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THE DETERMINANTS OF TECHNOLOGICAL INNOVATION ADOPTION AMONG *BUMIPUTERA* SMALL SCALE FOOD PROCESSING INDUSTRIES IN MALAYSIA

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SUMMARY

Bumiputera Small scale Food Processing Industry (FPI) need to modernise and adopt technological innovation to stay competitive. This will increase their efficiency, improve productivity and allow for the introduction of new products and services to satisfy existing market demand or expanding market share. By adopting new technology, *Bumiputera* small scale FPI will not only decrease cost and increase productivity, but they will also be enabled to increase their share in the domestic market and even export their products. The development of FPI is to ensure that Malaysia can produce adequate food and help to provide much needed employment and contribute to national income. Being small scale there are various factors that inhibit or influence *Bumiputera* small scale FPI ability to adopt a technological innovation. Hence, the main aim of this study is to identify the determinants of technological innovativeness among small-scale *Bumiputera* entrepreneurs in the food processing industry in Malaysia. The pertinent questions are: Why do some *Bumiputera* small scale FPI adopt technological innovation while others do not; do the *Bumiputera* small scale FPI have the capabilities to introduce new technology; how does institutional support shape SSIs' response to technology adoption?

The theoretical model developed in this study used five main theoretical approaches - adoption decision process, organisational buying behaviour, decision theory of firms, small firms decision process and the personality of entrepreneurs.

From this model the key factors influencing technology innovation decisions among *Bumiputera* small scale food processing firms were identified. Based on this model, we can show and quantify the inter-relationship between the various factors influencing technology adoption decisions. The researcher used a survey method to collect information from 197 *Bumiputera* entrepreneurs in small scale FPI. In the statistical analysis, as a way of solving the problem of multicollinearity among hypothesised factors, based on firms' size, the researcher stratified the respondents into two groups - tiny and small firms.

Findings of this study showed that *Bumiputera* small scale FPI has a greater tendency to adopt an incremental type of innovation. The entrepreneurs' characteristics, communication, their perception of the buying situation, the objective characteristic of the innovation, institutional involvement and their firms' characteristics significantly influenced entrepreneurs in small and tiny firms to innovate. The entrepreneurs' perception of the innovation only influenced the decision to innovate of the entrepreneurs in tiny firms.

In tiny and small firms, among the entrepreneurs' characteristics that influence the innovativeness are their personal demographics, personality traits and skill upgrading. Firms' performance and their financing problem are the characteristics of their firms that had significant influence on firms' innovativeness. Firms' age only has significant influence on tiny firms, while firms' size and structure have significant influence on small firms' decision to innovate.

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ASEAN	-	Association of South East Asia Nations
BPMB	-	Malaysian Development Bank
CCDSI	-	the Coordinating Council for Development of Small and Medium Industries
CGC	-	Credit Guarantee Corporation,
CIAST	-	Centre for Instruction and Advanced Skill Training
FPI	-	Food Processing Industry
GDP	-	Gross Domestic Products
IMP	-	Industrial Master Plan
IRPA	-	Research in Priority Area
IS	-	Import Substitution
ITAF	-	Industrial Technical Assistance Fund
IFCT	-	The Industrial Co-operation in Thailand
ITI	-	Industrial Training Institute
JETRO	-	Japan External Trade Office
KEMAS	-	*Kemajuan Masyarakat* (Community Development)
LSIs	-	Large scale industries
LPP	-	*Lembaga Pertubuhan Peladang* (Farmers' Association Authority)
MARA	-	*Majlis Amanah Rakyat* (Council of Trust for Indigenous People)
MARDI	-	Malaysian Agricultural Research Development Institute
MIDA	-	Malaysian Industrial Development Authority
MIDF	-	Malaysian Industrial Development Finance
MITI	-	Ministry of Trade and Industry
MNCs	-	Multinational corporations
MSIs	-	Medium scale industries
NEP	-	New Economic Policies
MEXPO	-	Malaysian Export Trade Centre
NPC	-	National Productivity Centre
PERNAS	-	*Perbadanan National* (National Corperation)
PNB	-	Permodalan Nasional Berhad (National Investment Limited)
R&D	-	Research and Development
RIDA	-	Rural Industrial Development Authority
RM	-	Ringgit Malaysia
S&T	-	Science and Technology
SEDCs	-	State Economic Development Corporations
SIRIM	-	Standard Industrial Research Institute of Malaysia
SMI	-	Small Medium Industry
SSIs	-	Small Scale Industries
TSIs	-	Tiny scale industries
UKM	-	Universiti Kebangsaan Malaysia
UNIDO	-	United Nation Industrial Development Organisation

CHAPTER ONE

INTRODUCTION

1. Introduction

Food processing activities must increase to maintain the food supply for Malaysia's growing population. Improvement in crop yields alone will not solve the problem of excess demand for food; it needs to be accompanied by a concerted effort to increase the amount of food produced. The main reasons why Malaysia needs to increase the amount of food produced are to reduce its dependence on imports and to increase its exports.

Although Malaysia is a resource-rich and agriculture based economy, it still relies on imported food. For example, Malaysia imports RM64 million[1] (approximately £16 million) worth of fresh and processed fruits annually from Thailand, Australia and United States of America (MARDI 1991a:2). Malaysia consumes an average of 7 million litres or RM30 million[2] worth of fruit juice annually, which it imports from USA, France and Australia. Furthermore, there is a considerable potential in the world food trade. MARDI (1991b) estimated that the value of world trade in fruits and vegetables will increase from US$4,000 million in 1988 to US$8,000 million in the 1990s. The market share for tropical fruits is expected to increase from US$250 million in 1988 to US$1,200 million in 1990s. One of the most popular tropical fruit juices is pineapple of which the major exporters are the Philippines and Thailand. Malaysia, however, is one of the major exporters of canned pineapple. Malaysia could gain considerably by

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[1] RM1.00 = £0.25
[2] £7.5 million

exporting processed food. For example, the price of "single-strength" markisa fruit juice is from US$1,000 to US$1,400 per metric ton, while a frozen concentrated fruit juice can fetch between US$3,500 and US$4,000 per metric ton. For mango, guava and pineapple, the price is US$700, US$600 and US$2,400 per metric ton respectively.

Here lies the importance of the food processing industry (FPI): increasing food production and ensuring that consumers can obtain products of the desired quality, in sufficient quantity. The development of the FPI would not only ensure that Malaysia can produce adequate food, but it would also help to provide much needed employment, contribute to national income and most importantly, achieve the twin objectives of the New Economic Policies (NEP), namely poverty eradication and economic restructuring.

1.1 The Research Problem

The FPI is an important industry, contributing RM1,700 million[3] worth of exports and employing 29,080 workers in 1990 (Malaysia 1991:130-131). In 1986, the government identified FPI as one of the twelve industries to be developed under the Industrial Master Plan (IMP) to spearhead Malaysia's effort at "leap frogging into an industrialised country" (UNIDO 1985). As one of the twelve prioritised industries, FPI has an important role to play in Malaysia's scheme of planned industrial development. The government's effort in promoting FPI to spearhead Malaysia's industrialisation effort is commendable; however, we are concerned about the ability of the industry to play its role. This doubt regarding capability of the FPI pertains mainly to two key issues: **the size of the firms in the industry** and **its ability to adapt to a changing social and economic environment**.

[3] £425 million

The food processing industry is dominated by small scale firms, which are mostly operated as sole proprietorship or family businesses. They use low technology and their products are for the most part sold in the domestic market. Small scale industries (SSIs) are confronted with a variety of problems, such as limited market, unskilled labour, low technology and limited finance (Chee 1985, 1991a, 1991b; Ismail 1990; UKM 1990). All these problems prevent SSIs from realising their full potential and contributing to Malaysia's economic development. Another related problem is that of ethnic composition. A close examination of Malaysia's manufacturing sector reveals an imbalance in ethnic composition; with the majority of *Bumiputera*[4] dominating the less productive sectors such as the traditional food industries and handicraft industries. Even in the food industries, they are mostly concentrated in the highly competitive sectors such as spice production and sauce making. The share of *Bumiputera* in the more productive sectors, such as chemicals and chemical products, iron and steel, textiles, electrical machinery appliances and parts is still limited, due to high capital and skill requirement in these sub-sectors

Apart from the problems associated with size and ethnic composition, another problem which appears to be of serious concern is the inability of Malaysia's manufacturing industries to adapt to the changing social and economic environment resulting from two recent developments: (a) introduction of "new" technology, and (b) changes in local and international demand.

(a) <u>"New" Technology</u>

During the 1990s, one of the most critical issues confronting the domestic SSIs is the state of their technologies and their innovative capacity. Studies by UKM (1990, 1992) and MITI (1990) have shown that most SSIs lack skilled labour and

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[4] The term, *Bumiputera* refers to the Malays and other indigenous communities. The non-*Bumiputera* are the Chinese and Indians.

are constrained by their low technologies. Unless they make certain efforts to improve their technological base, the SSIs may be seriously affected by the rapid structural change that is currently shaping Malaysia's manufacturing sector, due in large part to the introduction and application of "new" technologies. Generally, one can classify these new technologies into five, namely, information, new materials, biotechnology, space and nuclear. These new technologies principally emanate from the industrialised countries, but have also affected the industrialisation and development process in developing countries like Malaysia (Anuwar 1992). UNIDO (1989:1-20) argued that these new technologies can create an economic imbalance and techno-structural gaps, in term of the varying speed of innovation for increasing competitiveness and changes in output and composition conforming to a changing demand structure. What is the implication of these new technologies for small scale firms in Malaysia? The immediate effect of new technologies is that a firm's competitiveness will be determined by the technology it utilises. The new technologies can alter the price relationships and the situation created by the comparative cost of factors such as labour and capital. According to Anuwar (1992:65), the wide application and dissemination of the new technologies have some effect on the basic structure of industrial production in terms of production cost, labour utilisation and productivity.

The technologies developed up to the early 1970s were designed for large scale industries (LSIs) involved in mass production. Today's technology, however, is more focused on software, multi-item and small-scale development, such as computer controlled equipment and programmable automation. In short, SSIs need to modernise and adopt technological innovation to stay competitive. This will increase their efficiency, improve productivity and allow for the introduction of new products and services to satisfy existing market demand or expanding market share. By adopting a technology, the SSIs will not only decrease cost and increase productivity, but they will also be enabled to increase

their share in the domestic market and even export their products. All these developments offer potential opportunities of fulfilling SSIs' needs. More importantly, technology will become a critical factor in the reorganisation and adjustment of the SSIs if they are to improve their competitiveness. For example, firms with electronic-based technologies and automation are able to market their products more quickly once they have been designed, and to respond rapidly and flexibly to their customers' needs and specifications. However, the rapidity of technological change and automation has created new problems of obsolescence and competition. Firms with the technology may be able to meet the changing demand, but technology tends to shorten the life-span of new products (Anuwar 1992:65). Small firms may find themselves in a difficult situation; they are under pressure to adopt technology and maximise returns from their new products as soon as possible, before their products become obsolete. Only through technology upgrading, can the SSIs exploit new business opportunities and adapt to the changing social and economic environment. Thus, the key element in a firm's competitiveness is **technology upgrading.**

(b) Changes in Demand

Malaysia is currently experiencing rapid economic growth. From 1985 to 1990 and from 1990 to 1995, its Gross Domestic Product experienced an average annual growth rate of 6.7 per cent and 8.7 per cent respectively (Bank Negara Malaysia 1992; Malaysia 1991; Ministry of Finance 1995). Such rapid economic growth is usually accompanied by an increase in the standard of living and changes in the pattern of consumption and purchasing behaviour. With increased income, consumer needs will be more diversified and "sophisticated" and the market for individual products and services will become more closely defined. For example, we see a growing demand for fast foods due to changes in work patterns with increases in income and in the

number of women leaving home to join the labour market. SSIs, compared with LSIs are more flexible, and are potentially able to respond more quickly to this changing consumer demand by expanding their activities into new areas or improving their product quality and services. However, in order to meet the increasingly sophisticated needs of the market, the SSIs need to improve their technology.

We have seen that in the face of change in technology and in demand, Malaysian SSIs will depend on the acquisition and diffusion of new technology to increase productivity, competitiveness and efficiency. The benefits derived from technology adoption and upgrading are unquestionable. What is, however, at issue, is the extent to which new technology **can** and **will** be adopted. Some manufacturers may respond and adopt new technology, while others may not. A common theme running through studies on SSIs in Malaysia is that while some SSIs have responded by introducing new technology such as computer-aided-design, many others continue to produce using "old" techniques. Previous studies (Chee 1985; Ismail 1990; Mohd and Shaari 1988; UKM 1990, 1992) have revealed that SSIs face many problems due to their use of obsolete machines, low level of technology and lack of access to technological information. A study by a Universiti Kebangsaan Malaysia (UKM) research team (UKM 1990:82) revealed that 30 per cent of small scale firms under study were using machines aged between 5 to 10 years, while 10 to 15 per cent were using machines aged 11 to 15 years. In fact more than 50 per cent of the entrepreneurs had not changed their production methods since they first began operating. These results suggest that small scale firms have responded differently, one manufacturer to another, depending on a variety of factors.

The usage of old and inefficient machines does not necessarily indicate that entrepreneurs are unaware of the availability of better alternatives or more up-to-date production technologies in the market. Some entrepreneurs are aware of better alternatives; however, there are numerous factors that they need to consider

in making their decision to shift or adopt new technology. The most commonly cited reason for the lack of technological adoption by SSIs is that they lack financial resources to finance new technology. These studies argue that the need to undertake fixed investment and the high cost involved may prevent SSIs from adopting new technology. Access to capital is necessary to finance the adoption of new technology. Assuming that this is true, then an increase in financial support to SSIs, would encourage them to adopt new technology.

A closer examination, however, reveals that financial constraints are more of a "myth" than a reality to the majority of the SSIs in UKM's (1990) study. Although the majority cited financial constraints as their major reasons for non-adoption of new technology, only 38 per cent of the sampled firms had made efforts to seek institutional funding for such purpose. This research finding was parallel to the finding in Chee's (Chee 1977: 34) earlier study which stated that many small establishments had never approached a bank when they were short of funds, mainly because they did not think they could get a bank loan. In fact, there are no less than 13 government ministries and thirty agencies (Chee 1991b; Ismail 1990) involved in promoting SSIs in Malaysia, suggesting that there is no lack of support for SSIs. In terms of financial support, *Bank Negara Malaysia* (Central Bank), the commercial and development banks have introduced various programmes and funds to provide financial assistance to SSIs. Agencies such as *Majlis Amanah Rakyat* (MARA) or Council of Trust for Indigenous People, *Bank Pembangunan Malaysia Berhad* (Development Bank of Malaysia), and Malaysian Industrial Development Finance (MIDF) have special schemes to assist the financing of machines and equipment for SSIs. Considering that the majority of SSIs' entrepreneurs have not made any attempt to obtain financing from these agencies to enable them to buy new machines and equipment, it is difficult for us to believe that lack of financial resources is the major constraint to their technological adoption.

Another commonly cited reason for the lack of technological adoption among SSIs is that they do not have information on the latest available technology (Asit and Siti 1988:52; UKM 1990). However, there is enough evidence to suggest that there are several government agencies involved in disseminating information on technology and providing technological support to SSIs. The government has also established agencies such as the Malaysian Agricultural Research Development Institute (MARDI) and Standard Industrial Research Institute of Malaysia (SIRIM) to provide technological support to the SSIs. Nevertheless, studies by Chee (1990), Ismail (1990), Mohd and Shaari (1988) and UKM (1990, 1992) revealed that only a small percentage of SSIs had used the facilities provided by these agencies, suggesting that SSIs have limited access to these agencies.

SSIs' abilities to adopt a new technology introduced by the above agencies reflect their level of innovativeness. This new technology is a process innovation, involving some new machinery, that is considered by these agencies as appropriate to be introduced to small firms to improve their performance. The abilities of some firms to introduce this technological innovation showed that they were able to search for information about the existence of such an innovation and their willingness to make changes in their firms which indicated their innovative behaviour[5].

It seems to us, that the problem associated with technological innovation is not one of lack of finance or institutional support as has often been perceived, but a combination of factors which are internal and external to the producers. Yes, technology will increase efficiency, improve product quality and strengthen SSIs' level of competitiveness. Adoption of a technological innovation seems to be the

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[5] In this study we define innovation as the adoption of a new machine by small firms to improve their performance. This is a type of process innovation (refer to Chapter Three and Chapter Four for the details).

near perfect solution to the problems of inefficiency, lack of market competitiveness and low quality of products faced by SSIs. However, despite government efforts to facilitate technology transfer, the SSIs do not innovate. Even if they do innovate, they undertake only incremental innovation and marginal adaptations to meet local needs, rather than the design and development of new products and processes. Assuming that technological innovation is good, then why is it that there is differential response by SSIs to the scope which expect for technology adoption? This brings us to the research question in this study: **Why do some small scale *Bumiputera* entrepreneurs in food processing industries in Malaysia adopt technological innovation while others do not?** Other related questions are: do the *Bumiputera* SSIs have the capabilities to introduce new technology? Is there a need for them to introduce new technology? How does institutional support shape SSIs' response to technology adoption? The answers to these questions will enable us to achieve the following:

(a) identify **who** adopted technology in the food processing industry, and what are the personal characteristics, demographic background, attitudinal factors, and experience of those who adopted and those who did not;

(b) explain **how** the above characteristics influence entrepreneurs' decision to innovate;

(c) examine **the characteristics of firms** which promote or constrain technological adoption in *Bumiputera* SSIs;

(d) discuss the **role of institutions** (government and private) in promoting *Bumiputera* small scale entrepreneurs' capabilities to adopt technology; and

(e) examine the effects of other factors such as competitive intensity and the characteristics of the innovation on the entrepreneurs' decision to innovate.

1.2 Purpose of the study

This study seeks to explore influences of technological innovativeness among small-scale *Bumiputera* entrepreneurs in the food processing industry in Malaysia. The study includes inquiries into:

(a) The general background of the food manufacturing industry in Malaysia, *for example, its role in Malaysia's economic development, potentials and constraints, and the effect of government policies on FPI;*

(b) *The characteristics of the entrepreneurs*, for example their demographic background, educational achievement, personality traits, level of knowledge on innovation and experience. What are the characteristics of innovative or non-innovative entrepreneurs?

(c) *The characteristics of firms*, for example size, age, economic performance including organisational structure. What is the process of technological acquisition?

(d) *The effect of institutional support, competitive intensity, the characteristics of the innovation, the entrepreneurs' perception of innovation and buying procedures* on technology adoption decisions.

1.3 Importance of the Study

Previous studies on Malaysian SSIs have tended to focus on their problems (Chee 1986, 1990; Ismail 1990; Mohd and Shaari 1988; UKM 1990, 1992). It seems to us,

that these studies lack a sectoral approach. These studies appears to treat all SSIs as alike, assuming that they have similar potential and face similar problems. This study differs from previous ones because it focuses on one particular sector, that is, the food processing industry. By doing so, we hope to identify the potentials and constraints which are pertinent to this particular sector.

This study hopes to improve existing knowledge on technology innovation studies in Malaysia. Previous studies on technology innovation tended to focus on the macro-level (regardless of the size of firms) with limited discussion of small scale industries. Both Anuwar (1992) and Fong (1986) have provided useful insights into Malaysia's industrialisation programme and the need for technological advancement. Our study complements Fong's and Anuwar's studies by discussing technological innovation at the micro-level.

The theoretical model developed in this study can identify the key factors influencing technology innovation decisions in *Bumiputera* small scale food processing firms. Based on this model, we can show and quantify the inter-relationship between the various factors influencing technology adoption decisions.

1.4 Scope of the Study

This study's scope is limited to small scale FPI. Before we provide our justification for limiting this study to a set of ethnic groups, we have to understand the background of the Malaysian population. The population of Malaysia comprises three main ethnic groups, namely Malays, Chinese and Indians. Malays, with other indigenous groups such as Iban, Melanau, Jakun and Kadazan, are called *Bumiputera*. Malays, Chinese and Indians have their own distinctive cultures, which influence their life styles. Before the 1970s, these main ethnic groups could be identified by their economic activities. For example,

Malays were involved in the agricultural sector in rural areas, Indians worked as agricultural labourers in rubber estates while the Chinese were involved in the industrial and commercial sectors in urban areas. However, there has been a rapid increase in the number of *Bumiputera* participating in FPI over the last twenty years. The increase in number of *Bumiputera* participating in FPI, the positive discrimination by government which helped to bring this about, and the distinctive culture of Malays with other major ethnic groups were the main reasons why we limit the scope of this study to *Bumiputera* in small scale FPI.

The main reason for the increase in *Bumiputera* small scale food processing firms was the launching of the New Economic Policy (NEP) in 1971 with its twin objectives of poverty eradication and economic restructuring. The second prong of this policy aims at accelerating the process of restructuring of economic imbalances, so as to reduce and eventually eliminate the identification of race with economic function. Hence, its strategy was to bring about greater participation of *Bumiputera* in manufacturing sector activities. The essential part of this strategy was the creation of the *Bumiputera* Entrepreneurs Commercial and Industrial Community (Malaysia 1971). In order to achieve this objective, a high proportion of public spending was used to set up conducive environments for such creation, such as setting up various institutions and public enterprises for training, providing physical facilities and financial assistance. By limiting the scope of this study to *Bumiputera* entrepreneurs, indirectly we could observe the role of some of these institutions in promoting technological innovation adoption among *Bumiputera* entrepreneurs.

Another reason for the emergence of small scale *Bumiputera* entrepreneurs in FPI was the increase in demand for *halal*[6] food. The increase in demand for *halal* food was due to Islamic resurgence and an increase in the number of

[6] Food prepared according to Muslim dietary laws.

Bumiputera women participating in the labour force in the 1970s. Islamic resurgence led to more inclination among *Bumiputera* to buy from *Bumiputera* firms which provided *halal* food. Hence, to some extent *Bumiputera* production was supplying some distinct segment within the market - for rural Malays and urban Malays who were inclined to buy from corner shops as opposed to supermarkets.

Bumiputera, about 90 per cent of which consist of Malay Muslims (the major ethnic group) have distinctive culture, quite different from Non-*Bumiputera* (Chinese and Indian). We believe that the distinction in culture to some extent influence their management style and performance of their firms. By limiting the scope of this study to *Bumiputera* entrepreneurs we were able to control the influence of culture in determining firms' innovativeness in the analysis.

We also have to recognised the constraints which would have been faced to operationalise the study if we had wanted to include small scale FPI of Chinese and Indian entrepreneurs. Since the study was conducted by the survey method, and we used interviews and questionnaires as our instruments of obtaining information, if we were to have included, Indian and Chinese entrepreneurs, we would have had to develop two more sampling frames, develop questionnaires in theses two languages and hire Indian and Chinese field workers to ease the process of collecting information. Limited funds and time does not permit us to study beyond the scope of *Bumiputera* small scale FPI.

1.5 Study Limitations

This study has several limitations. The first limitation arises due to use of the survey method. Our study is based on information gathered from small scale *Bumiputera* firms in the food processing industry. As a result of using a survey method, we are

unable to generalise our findings to firms beyond the survey area or those which differ in ethnic composition and size from the surveyed firms. This study uses cross-sectional data which do not take into account the process of change. By examining their innovation decisions at one particular period, we exclude the various innovations that may have been made previously (before 1989). Rather than discussing different types of innovation, our study only focuses on process innovation, particularly of automation and machine. Though we may improve our understanding of the factors involved in the adoption of process innovation, we have overlooked other innovations, such as those related to information technology.

1.6 Organisation of Thesis

Our thesis is organised into nine chapters. In **Chapter One** we introduce briefly the importance of the FPI and its role in Malaysia's economic development. We proceed to discuss the need for technology in Malaysian SSIs. Part of this need is due to the emerging trend in technological development and changes in demand today. SSIs need to respond to these changes in order to survive. Previous studies on SSIs show that there is differential response to technological innovation. The purpose of our study is to identify the factors which explain this differential response; why do some SSIs innovate while other do not? Besides outlining the purpose of this study, we also outline its importance and limitations.

In **Chapter Two**, we discuss the role of the New Economic Policy (NEP) and the growth of industrialisation, the nature of the food processing industry and the role of small scale industry in Malaysia. We also discuss the potential and constraints of SSIs and the role of government agencies in developing the industry.

In **Chapter Three** we begin by introducing what we mean by "innovation". This will then be followed by a discussion of some of the theoretical approaches used in this study, such as the adoption decision process, organisational buying behaviour, decision theory and small firms' decision process. From this theoretical discussion, we hope to identify the stages involved in the small firms' buying process including the factors affecting their buying behaviour. We use this theoretical discussion as a foundation for developing our theoretical framework in the next chapter.

In **Chapter Four,** we attempt to develop a conceptual framework to study the determinants of technological innovation in SSIs, focusing on *Bumiputera* entrepreneurs in the food processing industry. For the purpose of discussion, we also propose the hypothesis regarding the factors that influence technological innovation.

Chapter Five outlines the methodology of the study. It includes a discussion on the instruments, sampling techniques and statistical tools used in this study, which has adopted a survey method to collect information from 197 *Bumiputera* entrepreneurs in the food processing industry. We use a logistic regression function to identify the significant factors that determine technological innovation decisions.

Chapters **Six, Seven** and **Eight** contain analysis of research findings. In **Chapter Six** we identify the characteristics of entrepreneurs that influence their decision to innovate. We found that among the significant characteristics that influenced the entrepreneurs to innovate are their age, level of education, experience, skill upgrading, need for achievement and attitude towards risks. In **Chapter Seven,** we analyse the influence of communication, entrepreneurs' perception of the characteristics of the innovation and buying procedure. We also analyse the influence of institutional involvement and government agencies in

determining their innovative behaviour. **Chapter Eight** identifies the significance of firms' characteristics in relation to entrepreneurs' decision to innovate. We found that factors such as financing and economic performance have a significant influence on entrepreneurs' innovative behaviour.

Chapter Nine is the concluding chapter. In this chapter we discuss the inter-relationship of all the factors influencing technological innovation. We attempt to answer the research questions and summarise the research findings. In this chapter we also propose some policies that could be adopted to enhance technological innovation among small scale FPI in Malaysia. This chapter also includes some suggestions for future research.

CHAPTER TWO

SMALL SCALE FOOD PROCESSING INDUSTRY IN MALAYSIA: CURRENT ISSUES AND CHALLENGES

2. Introduction

This chapter contains a discussion on the role of the food processing industry (FPI) in the Malaysian economy. By way of introduction, it is useful to discuss Malaysia's New Economic Policy (NEP) and the growth of industrialisation in Malaysia. Our discussion will trace briefly the different stages in Malaysia's industrialisation. In this section, we shall also the discuss the role of industrialisation in achieving the twin objectives of the New Economic Policy (NEP). This will be followed by a discussion of critical issues in Malaysia's FPI, focusing on small-scale firms. Such a discussion is necessary to provide the context for explaining why the FPI industry is what it is today; the most "important" industry as reflected by the size of its contribution to Malaysia's Gross Domestic Product (Malaysia 1991) and number of establishments (UNIDO 1995).

We must emphasise that most of the information used in this chapter is based on secondary data, informal or unstructured interviews (with entrepreneurs and government officers), and the researcher's impression and understanding of the issues discussed. This chapter not only serves as a background, but it also

complements the information provided in the later chapters which are based on a survey using structured interviews.

2.1 Industrialisation and the New Economic Policy

A study of Malaysia's industrialisation effort is incomplete without discussing the role of the New Economic Policy (NEP). To understand the reasons behind Malaysia's introduction of the NEP, we must first understand its economic history. Malaysia[1] which was once a British colony achieved its independence in 1957. After independence, Malaysia pursued a laissez-faire approach to development. The government's role was mainly limited to its traditional role of maintaining law and order, and provision of education and basic utilities.

The government's limited role, however, changed with the implementation of the NEP in 1971. The NEP was implemented in reaction to the racial riots of 1969. The government realised that it could no longer play a passive role in development, for there were obvious signs of economic imbalances between races, regions and sectors in the economy. In terms of races, there is evidence that there is a clear identification of race with economic occupations. The *Bumiputera*[2] are mostly concentrated in the rural traditional sector (such as agriculture, fishing) while the non-*Bumiputera* are mostly concentrated in the modern industrial and commercial sector. There is a wide income inequality between the races resulting from the identification of race with economic activities. **Figure 2.1** shows the

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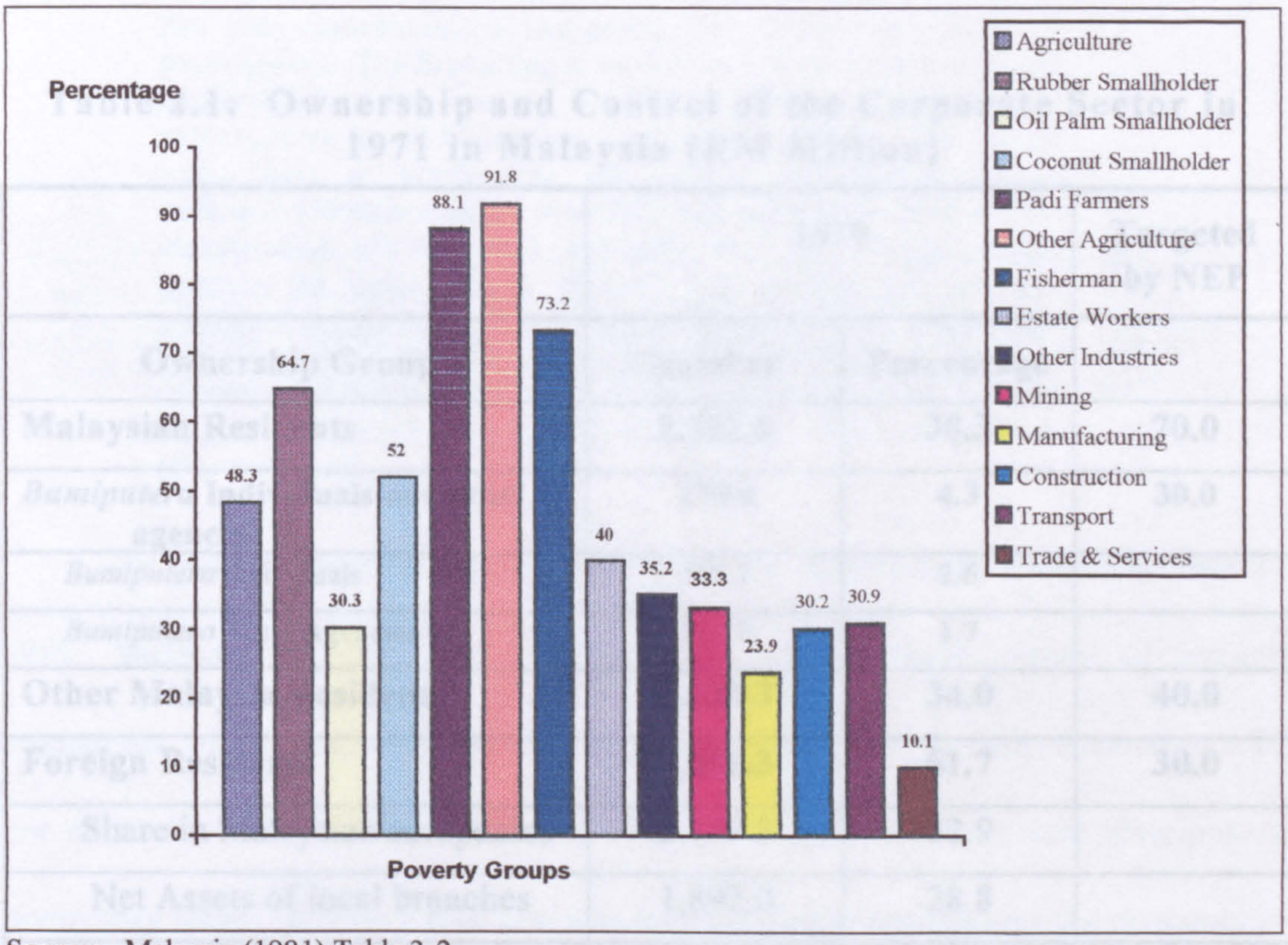
[1] The Federation of Malaya gained its independence in 1957. Sabah and Sarawak joined with the Federation of Malaya in 1963 to form Malaysia.

[2] The terms Bumiputera is literally translated as "sons of the soil". In Malaysia the Bumiputera comprises the indigenous people of Sabah, Sarawak and Peninsular Malaysia. It does not include the Chinese and Indians.

incidence of poverty by rural-urban strata in Peninsular Malaysia prior to the implementation of the NEP. It is evident from **Figure 2.1**, that the agricultural sector had the highest incidence of poverty; 64.7 per cent of rubber smallholders, 88.1 per cent for padi farmers and 91.8 for other agriculture. Of all the sectors, the trade and services had the lowest incidence of poverty (10.1 per cent).

Figure 2.1: Incidence of Poverty In Peninsular Malaysia in 1970



Source: Malaysia (1981) Table 3-2.

In 1970, the incidence of poverty in Malaysia was 49.3 per cent, with 65 per cent of total Malay households living below the poverty line. The Malays earned an average income of RM172.00[3], compared to RM394.00[4] for the Chinese

[3] £43.00

[4] £99.00

and RM304.00[5] for the Indians giving the non-Malays: Malay income ratio of 2:1 (Malaysia 1971).

There was also an imbalance in the ownership of equity capital as shown in **Table 2.1**. It is evident from this table that *Bumiputera* individuals and trust agencies controlled 4.3 per cent while the other non-*Bumiputera* Malaysians controlled 34.0 per cent of the corporate sector in 1971.

Table 2.1: Ownership and Control of the Corporate Sector in 1971 in Malaysia (RM Million)

	1970		Targeted by NEP
Ownership Groups	**Number**	**Percentage**	
Malaysian Residents	**2,512,8**	**38.3**	**70.0**
***Bumiputera* Individuals and trust agencies**	**279.6**	**4.3**	**30.0**
Bumiputera individuals	168.7	2.6	
Bumiputera Trust Agencies	110.9	1.7	
Other Malaysia Residents	**2,233.3**	**34.0**	**40.0**
Foreign Residents	**4,051.3**	**61.7**	**30.0**
Share in Malaysian companies	2,159.3	32.9	
Net Assets of local branches	1,892.0	28.8	
TOTAL	**6,564.1**	**100.0**	**100.0**

Source: Malaysia (1981) Table 3-12

Available data also shows wide economic disparities between regions in the country; the western coast states (such as Malacca, Selangor, Penang, Johore, Negri Sembilan, Perak) were more developed than the east coast states of Kedah,

[5] £76.00

Kelantan, Trengganu and Pahang in Peninsular Malaysia. There was also economic disparity between Peninsular Malaysia, and the two states in Borneo, namely Sabah and Sarawak.

In response to this situation, the government introduced the NEP[6] with its twin objectives of poverty eradication and economic restructuring.

> The Plan incorporates a two-prong New Economic Policy for development. The first prong is to reduce and eventually eradicate poverty, by raising income levels and increasing employment opportunities for all Malaysians, irrespective of race. The second prong aims at accelerating the process of restructuring of economic imbalance, so as to reduce and eventually eliminate the identification of race with economic function. This process involves the modernisation of rural life, a rapid and balanced growth of urban activities and the creation of a Malay commercial and industrial community in all categories and at all levels of operation, so that Malays and other indigenous people will become full partners in all aspects of economic life. (Malaysia 1971:1) (Our emphasis)

To achieve its restructuring objectives, the government announced that by 1990, Malaysians would own 70 per cent of total share capital of limited companies with *Bumiputera* owning at least 30 per cent, the non-*Bumiputera* 40 per cent and foreign interests 30 per cent. In fact, the 30 per cent *Bumiputera* ownership target became a rule that was applied almost throughout the economy.

As we can see from **Table 2.1**, the NEP laid down that the *Bumiputera* equity share had to increase from 4.3 per cent in 1970 to 30 per cent in 1990. The non-*Bumiputera* share had to increase from 34 per cent to 40 per cent, while the foreign interest had to reduce from 61.7 per cent to 30 percent. The government realised that total reliance on market forces and the private sector to uplift the economic status of the Malays in commerce and industry would be

[6] The NEP period spans from 1970-1990.

slow, uncertain and probably not feasible. The implementation of the NEP saw a shift in government's role in development; from a passive to an active one. It was argued that government assistance or "intervention" was required to assist rapid *Bumiputera* entry into and increased involvement in the modern industrial sector.

In the Malaysian case, economic restructuring was achieved through corporate growth rather than asset redistribution. The government created specialised or "trust" agencies, such as Council of Trust for Indigenous People (MARA), State Economic Development Corporations (SEDCs), Bank Bumiputra, and *Permodalan Nasional Berhad* (PNB) or National Investment Limited, to ensure the rapid growth of *Bumiputera* commercial and industrial community. One of the responsibilities of these agencies was to provide support (marketing, financial, technical, consultancy services) to the *Bumiputera*. The government also introduced guidelines for lending by commercial and financial institutions to the *Bumiputera*.

Active *Bumiputera* involvement in the non-agricultural sectors, particularly manufacturing, became a major element in the strategy of the NEP. By encouraging the *Bumiputera* to participate in the non-agricultural sectors, the government hopes to help move the *Bumiputera* from the low productivity and income activities to higher productivity and income activities.

Though it is not within the scope of this study, however, it is also useful to evaluate the criticisms of the NEP. Many non-*Bumiputera* have voiced their serious concern over the implementation of the NEP. One of the strongest voices

came from the Kuala Lumpur and Selangor Chinese Chamber of Commerce (*Dewan Perniangaan dan Perindustrian Cina Kuala Lumpur dan Selangor).* In their memorandum to the Ministry of Trade, they wrote:

> Over the last 15 years, since the promulgation of the NEP, the environment for industrial development has become increasingly regulated.....The result is a highly over-regulated industrial environment that suffers from significant market distortions, and inefficiencies...A large part of the blame for this state of affair must be put on the abuses and excesses in the implementation of the New Economic Policy (NEP) in the past. (KLSCCI, 1986:7) (Our emphasis)

To the Chinese communities, the NEP has been subject to "biases" and "abuses". Among their areas of discontent are the government's contract award system and the bias in the government's support programmes.

> The government contract award system for supplies and public work has shown consistent bias in favour of [B]umiput[e]ra contractors. Instead of an open tender system, many contracts are awarded based purely on NEP criteria with little regard for cost competitiveness (KLSCCCI, 1986:9)

> The government has shown consistent bias in its Small Scale Industry (SSI) assistance/support programs and in its manpower/entrepreneurial training programs. For example, practically all the government operated entrepreneurial training programs catered exclusively to [B]umiput[e]ra businessmen. (KLSCCCI, 1986:10)

Their criticism is not without basis. A close examination of the participants in government (or trust agencies) sponsored entrepreneurial programmes, shows that there is obvious bias against the non-*Bumiputera.* **Table 2.2**. It appears to us that the non-*Bumiputeras* have limited access to government support.

Undoubtedly, the government has accorded "preferential treatment" to the *Bumiputera* communities, as reflected by the number of *Bumiputera* participants in its training programmes, the types of support it extended to *Bumiputera* businesses, and the number of agencies it created to develop *Bumiputera* commercial and industrial communities. However, we must also recognise that the non-*Bumiputera*s have not been totally excluded from the government's support programmes. In our opinion, the critics by non-*Bumiputeras* place too much emphasis on the 30 per cent equity share that should be allocated to *Bumiputera*. As we have discussed earlier, the economic restructuring does not involve reducing non-*Bumiputera* equity share or ownership of the corporate sector; in fact, their share is to increase - albeit marginally - from 34 per cent to 40 percent.

Figure 2.2: *Bumiputera* and Non-*Bumiputera* Participants in Entrepreneurial Training Programmes Organised by Various Instituions

Institutions	1981				1985			
	Bumiputera		Non-Bumi		Bumiputera		Non-Bumi	
	No.	%	No.	%	No.	%	No.	%
National Productivity Centre (NPC)	4,940	99.6	15	0.4	2,901	99.6	11	0.4
Public Works Department	222	100.0	-	-	398	100.0	-	-
Bank Pembangunan Malaysia Berhad	134	100.0	-	-	342	100.0	-	-
Bank Bumiputra Malaysia Berhad	14,614	100.0	-	-	15,000	100.0	-	-
National Corporation (PERNAS Edar)	1,447	100.0	-	-	1,000	100.0	-	-

Source: Malaysia (1986), Table 3.12

Having briefly discussed the NEP, we shall now analyse the growth of industrialisation in Malaysia. Most studies have traced the growth of industrialisation in Malaysia in three phases: import substitution, export

orientation and export-led growth based on heavy industries (Anuwar 1992; Fong 1986). The import substitution stage covers the period immediately after independence in 1957, up to 1968. The export orientation phase started in 1968, with the launching of the Investment Incentive Act of that year. The third phase, which began in 1980, continues to the present.

The first phase in Malaysia's industrialisation programme was characterised by a strong emphasis on import substitution. Like many newly independent countries at that time, Malaysia saw industrialisation as the key to rapid economic growth. Industrialisation was also pursued as a form of economic diversification and a way to absorb the increase in the labour force which could not be absorbed by the agricultural sector. To promote industrialisation, the government introduced the Pioneer Industries Ordinance of 1958. During this phase, the emphasis was on industrial development, with the private sector and foreign investment playing the key role. Foreign companies were producing consumer durables using technology imported from their parent companies. Local companies were indirectly encouraged to import foreign technology by the duty exemption given to imported technology and capital equipment. Furthermore, government incentives tended to favour large-scale and capital intensive manufacturing industries over small ones. Not only did government policies neglect small scale industries, they also failed to promote industrial linkages and develop indigenous technological capability. Undeniably, import-substitution succeeded in promoting industrial development and increasing manufacturing contribution to GDP. However, it did not promote manufactured exports or encourage industries to make full use of domestic raw materials. In fact, the value

of Malaysia's import of manufactured products increased more rapidly than its exports. By the 1970s, many of the Malaysian industries were unable to market their products due to market saturation. The government realised that the solution to this problem was to adopt an industrial policy which encouraged export promotion.

The second phase in the growth of industrialisation which started in 1968 and continued up to 1980, marked the beginning of Malaysia's effort at industrialisation based on export expansion. The government introduced the Investment Incentive Act of 1968 to promote export-oriented industrialisation. The major instruments in this regard were the granting of pioneer status, tax holidays based on the nature of product, the location of the firm, and the content of local raw materials, and export incentives to new industries (Anuwar 1992:9; Fong 1986:33).

The export-oriented industrialisation continued to emphasise foreign investment, particularly multinational corporations (MNCs). The MNCs were expected to play important roles such as providing capital, industrial technology and access to foreign markets. In this phase, the emphasis was on the development of labour-intensive industries, particularly electronics and textiles. Towards the end of this phase, we saw a shift away from labour-intensive industries to more capital- and technology-intensive industries, and resource based industries.

The third phase continues to emphasise the production of export manufactures and the manufacturing sector continues to be the leading growth sector. Besides emphasising the export-orientation, the government began to

promote the development of heavy industries. Under the Fourth Malaysia Plan (1981-85), the development of heavy industries (such as chemical complexes, fertiliser, automobiles, cement integrated steel mills) was also part of the government's effort to develop the underdeveloped regions in Malaysia. The government hopes that by setting these heavy industries in underdeveloped regions, the linkage effects will be felt in these regions, leading to the development of other ancillary industries (Fong 1986:42). One of the drawbacks is that the growth of these heavy industries has not been complemented by the expansion of indigenous technological capacity (Anuwar 1989, 1992).

Also; in the third phase, we have seen the implementation of the Industrial Master Plan (IMP). The IMP was launched in 1986, with the principal objectives of: (a) accelerating the growth of manufacturing to ensure a continued rapid growth in the Malaysian economy consistent with the objectives of the New Economic Policy, (b) promoting opportunities for the maximum and efficient utilisation of the nation's natural resources, and (c) building up the foundation for leap-frogging towards an advanced industrial country by increasing competitiveness and upgrading skills and technologies (UNIDO 1985:52).

The IMP identified twelve major industrial sectors which would spearhead Malaysia's industrialisation programme during the IMP period (1986-1995). The twelve sectors were rubber products, palm oil products, food processing industry, wood-based industry, chemical industry, electronics and electrical industry, transport equipment industry, machinery and engineering industry, iron and steel, and textile and apparel industry.

We have discussed briefly the development of industrialisation and the NEP in Malaysia. In the following section we shall discuss some of the critical issues in the development of Malaysia's food processing industry.

2.2 Food Processing Industry In Malaysia: Its Economic Role

In Malaysia, the food processing industry (FPI) is often classified according to its products and structure. **Table 2.2** shows the classification of FPI in Malaysia according to its products.

Table 2.2: Classification of Food Processing Industry in Malaysia

No.	Sub-industry	Types of Activities
1.	Meat processing	Slaughtering, preparing, preserving and storage of meat
2.	Dairy products	Ice-cream, cream and milk products
3.	Fish products	Canning, preserving and other related fish processing products
4.	Cooking oil and fat	Coconut oil, palm oil, palm kernel oil, animal shortening
5.	Grain or grain products	Rice milling, Flour milling, biscuit noodles and grain related products
6.	Vegetable and fruit processing	Fruit and vegetable canning, fruit and vegetable preserving
7.	Sugar confectionery	Sugar factories and refining
8.	Coffee, cocoa, tea and spices	Coffee products, tea products, cocoa products, spices
9.	Animal feed	Animal feed processing factories
10.	Other food product	Sauces, stocks and coconut product
11.	Beverages	Soft and carbonated drinks, beer and mineral water

Source: UNIDO (1985)

The food industry has two important roles to play in Malaysia's economic development; it provides the country with export earnings and food. In 1985, the food industry contributed RM755.5 million[7] worth of export earnings; and, with its annual growth rate of 17.6 per cent, by 1990 the amount had increased to RM1,700 million[8] (Malaysia 1990:130). Between 1985 and 1990, the sector registered an average annual production growth rate of 9.1 per cent which enables it to contribute to employment creation, but only to a small extent[9]. In 1990, this sector employed 29,080 workers, or 6.3 per cent of the total labour force. Though the sector does not contribute significantly to employment creation, compared to other sectors like electrical machinery and appliances[10], it is still an important sector because of its role in providing food and reducing Malaysia's dependence on imported food. For example in 1986, food alone constituted 6.1 per cent (RM1,675 million[11]) of Malaysia's total imports (Bank Negara Malaysia 1986). In 1992, food constituted 3.4 per cent (RM3,447 million[12]) of the total import (Bank Negara Malaysia 1992). It may seem that the percentage of food imported decreased between these two years, but the actual value of food imported increased. For a country which is agricultural and resource-based the value of imported food is considered high. This suggests that Malaysia continues to spend much of its income on imported food.

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[7] £189 million

[8] £425 million

[9]Between 1986 and 1990, the average annual employment growth rate for food industry is 2.5 per cent (Malaysia 1990:131)

[10] Between 1986 and 1990, the average annual employment growth rate for electrical machinery and appliances sub-sector is 20.6 per cent (Malaysia 1990:131)

[11] £419 million

[12] £862 million

We can trace the history of the Malaysian FPI to the 1950s. During that period, production techniques were simple, the sizes of firms were small and they were geared towards the production of basic food such as biscuits, bread and sauces. The majority of firms catered only for local markets, suggesting the limited capabilities of the Malaysian FPI to penetrate the international market. The 1960s and 1970s saw a new trend in the Malaysian FPI with the development of large-scale firms. Many of these firms used modern techniques, and some even managed to penetrate the international market. Two firms even managed to market their chilli sauces using the "Linggam" and "Aminah Hassan" brand. Foreign multinationals such as NESTLE and MAGGI built up production in Malaysia. Both these firms used advanced technology and were highly capital intensive.

Now, we can differentiate the food manufacturing firms into two categories; those in the first use traditional or semi-traditional methods of production, rely on local raw materials and cater for the local market. They are mostly small-scale firms. On the other hand, there are the medium- and large-scale firms, which are located in the urban areas, use modern technology, are capital intensive, and cater for national and even international markets.

2.3 Role of FPI in Economic Development

In Malaysia's Industrial Master Plan (1986), the FPI was identified as a resource-based industry with strong forward and backward linkages to the agricultural sector, refrigeration and machine industry. FPI increased its contribution to GNP

from RM2 million to 11 million between 1975 and1985. During the same period, the industry's contribution to total output in the manufacturing sector were up from 22 per cent to 27 per cent. Of the whole food industry, the highest contributor to GNP is edible oils and fats (63.4%).

FPI also plays an important role in terms of employment. According to Malaysia's Industrial Survey 1985 and Annual Digest of Statistics 1985, the industry employed 68,089 workers which formed 14.3 per cent of the total labour force in manufacturing industry (Department of Statistics, 1986a, 1986b).

Having discussed the role of FPI in the Malaysian economy, it is also useful for us to discuss the nature of the industry.

2.4 Nature of Small Scale Food Processing Industry

In this section, we shall introduce the nature of the food processing industry (FPI) in Malaysia. For this discussion, we rely on information obtained from secondary sources, particularly Annual Statistics Report and research results. According to a study by UKM (1990), 83.9 per cent of their sample of food processing firms employed less than 20 full time workers, 14.1 per cent employed 20 to 100 workers, and 3.5 per cent employed more than 100 workers. UKM's research also shows that the majority of the sampled bakery (67.5%) and sauce (86.7%) firms reported having capital valued less than RM50,000 (about £12,500). Unlike the larger firms which are highly mechanised and capital intensive, the small-scale firms tend to produce using manual or semi-mechanised techniques.

The majority (79.8%) of the entrepreneurs were aged between 35 to 45 years. In terms of experience, 49.3 per cent had less than ten years of experience in the FPI. That the majority were mostly middle-aged and with relatively short experience in FPI suggests that they have been involved in other forms of occupation or economic activities before setting up their food processing business. Being small, the majority of the small-scale firms were owner-operated.

Our study in 1993 confirms the observation made by the UKM (1990) study. We found that about 60.0 per cent of our respondents had previously worked in other economic activities, such as petty trading, waged employment, farming, and fishing before their involvement in the FPI. Some even had worked as factory workers in food processing firms. Our research also confirms the findings of earlier studies (UKM 1990; Chee 1990,1986) which shows that the majority of the small scale entrepreneurs had limited education. In our study, we found that 61.9 per cent of our respondents only had lower secondary education or lower. The larger firms, however, have different backgrounds to that of the smaller firms. Compared to their smaller counterparts, the majority of their workers are relatively skilled and educated.

Regarding processing, we found that FPI either directly process perishable commodities (such as fruits and vegetables, meat and fish) or use non-perishable materials as intermediate materials in the processing of final products such as bakery and cereal products, snack foods, vegetable-oil products. Firms which directly process perishable commodities tend to rely on close proximity to sources of raw materials, while those which rely on non-perishable materials depend on the market. Not only do they differ in their terms of their success factors, but also

in terms of techniques and equipment used. These differences reflect the diversity and complexity of the FPI in Malaysia.

Theoretically, the location of a food plant is often determined by the nature of the raw material, the finished product or the market, and availability of basic infrastructure. Firms producing highly perishable products, such as tomato ketchup, must be close enough to the fields so that tomatoes can be transported immediately to the plants after harvesting. The proximity to the market is another important locational determinant, particularly for bread bakeries, milk pasteurising and fresh meat.

In the case of Malaysia, the majority of firms locate their food plants near their market to make delivery economic. Previous studies (Mohd and Shaari 1988; UKM 1990) showed that the majority of firms producing perishable items, such as tomato ketchup, fresh noodles, beancurd and chilli paste, do not locate their plants near the source of supply of raw materials. One of the main reason for this is that these firms used imported raw materials or processed products such as flour, canned tomatoes, dried chillies and soya flour. For these firms, it is the market rather than the source of raw materials that determines their location. For those firms which are located near the source of supply of raw materials, the majority are producing traditional snacks and *keropok* (fish crackers). Unlike other firms, they use raw materials which are available locally. For example traditional snacks used tapioca flour, sugar-cane, palm-sugar, coconut milk, rice flour or bananas, while *keropok* use fresh fish, prawns and cuttlefish. These firms are mostly located in the rural areas and are usually tiny in size. Some of these rural food-

processing firms have a close economic relationship with local producers of raw materials, such as farmers and fisherman. Ishak and Chang (1993), study showed that *keropok* manufacturers purchase raw materials from *peraih sungei* (beach dealers).[13] Some of these firms even have contracts to buy raw materials from the local producers. This type of arrangement has some advantages, for both the suppliers and the food manufacturers; the firms will have a constant supply of raw materials, while the suppliers have a ready market for their products. Firms which use processed or imported raw materials usually purchase their raw materials in bulk and stored them in warehouses.

In Malaysia, a typical food process consists of five stages. In the first stage, raw materials are received, inspected, cleaned and graded. In the second stage, the raw materials are cut up or mixed with other food ingredients and chemical additives. In the next stage, they are then subjected to heat, refrigeration, de-aeration, pasteurisation, sterilisation, sometimes are coated and then are packed. Some firms may also employ fermentation, smoking and extraction at this stage. In the final stage, the packaged products are ready for marketing. Below we have outlined some of the steps involved in the processing of food in some of our sampled firms.

Firm A produces *serbuk perencah segera* (food spices), such as meat and chicken *rendang, assam pedas,* and *lemak cilli api,* **Figure 2.3** shows Firm A's production flow-chart.

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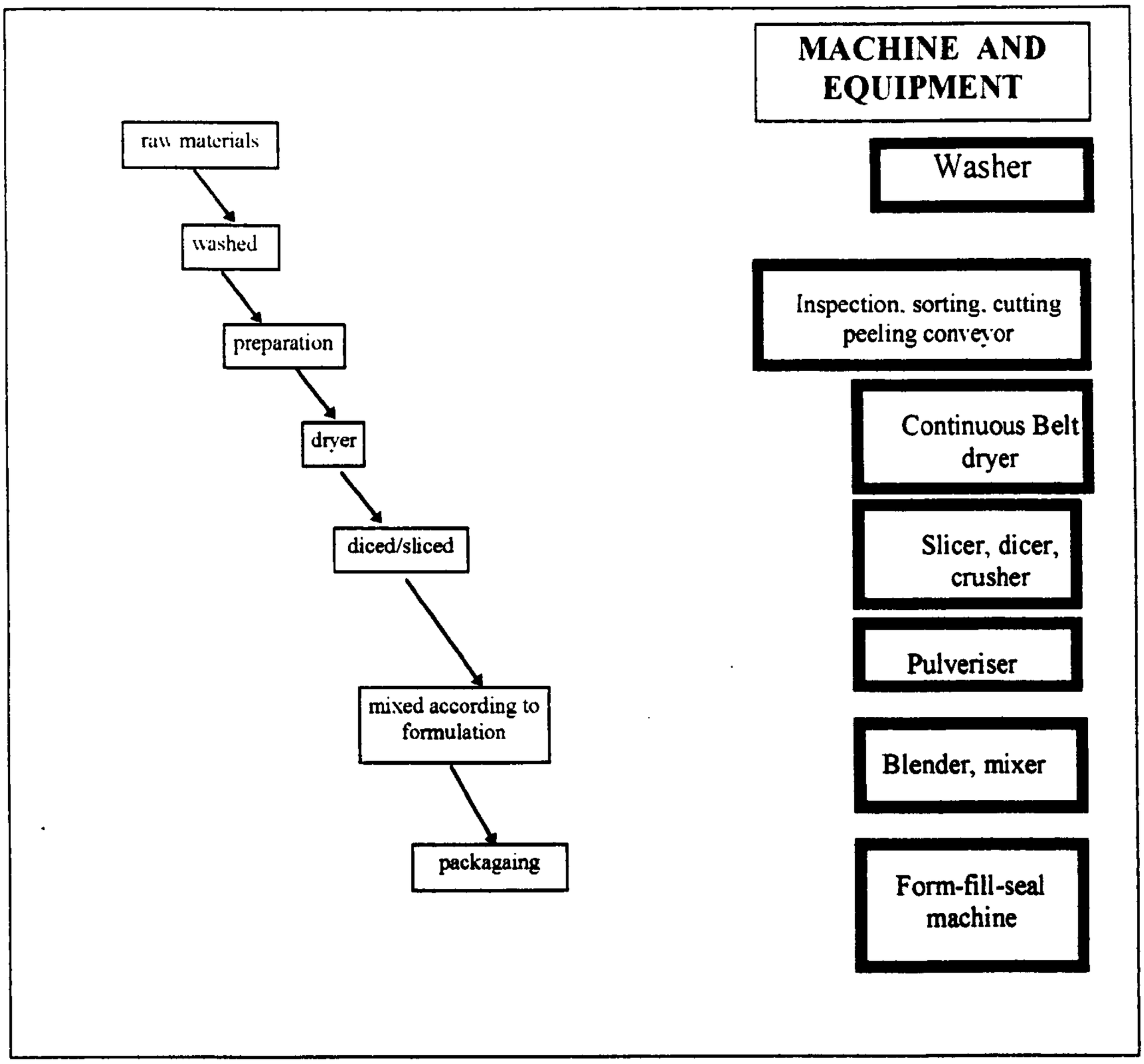
[13] In their study of the marketing structure of Kuala Besut fishing industry, Ishak and Chang (1993:58) found that the *taukeh* or boat-owners market their fish in three ways, that is to distribute through the *peraih sungai* (beach dealers), local wholesalers and in-state retailers. The *peraih sungai* in turn sell fish to local distributors (*peraih basikal* or *peraih motosikal*) or to owners of *keropok* busines.

Figure 2.3: Flow-chart and Machines Used in the Processing of Food Spices



Source: Factory Visit 1993

From our research we found that a wide range of technologies and degrees of technological sophistication currently exists in food processing firms in Malaysia. The majority of small scale firms have started as an informal food business suggesting that they have scaled up their kitchen-process. Take the case of the fish-cracker (*keropok*) industry: their technology means using larger cooking vessels and bottled gas as heat source, and finishing by sun drying. For

others they have adapted simple electrical equipment or developed ingenious designs to cope with difficult operations for example by using electric knife rather than. a dough slicing machine. We also found that some firms used specialised machines to perform certain operations. For example while rice steamers are used only in the processing of rice-noodles, a fruit-extractor is used for almost any processing of fruits.

In **Table 2.3,** we provide a list of some of the common machines and their estimated cost, and raw materials used by small scale Malaysia's food processing firms.

Table 2.3: Raw Materials and Major Types of Machine/Equipment Used by Selected Food Processing Firms in Malaysia

Food Products	Raw Materials	Major Types of Machine and Equipment Used	Estimated Cost
Food spices	chilies, ginger, cardamom seeds, pepper, cinnamon, anise, fennel, cumin, etc.	washer; slicer; dicer; inspection, sorting, cutting and peeler conveyor; continuos belt conveyor; pulverizer; blender; mixer; form-fill-seal machine	RM1,000,000 (≈ £250,000)
Concentrated Fruit Juice	Fresh fruits, sugar, etc.	fruit washer; inspection, sorting, cutting, peeling conveyor; elevator; fruit extractor; fruit chopper; decanter; enzyme reaction tanks; preheating, de-aeration, pasteurisation, sterilization, after-cooling spiraflo; holding tank; counter-pressure filler and capper; sterile holding tank; carbonation plant.	RM8,500,000 (≈£2,125,000)
Fruit Cordial	Fruits	fruit washer; inspection, sorting, cutting, peeling conveyor; elevator; fruit extractor; fruit chopper; PHE pasteuriser group machine; de-aerator and blending tanks; destoner, pulper, finisher; rinser; filler; capper; labeller.	RM1,500.000 (≈£375,000)

...continue

Fast food (such as tomato rice, fruit condiments, meat dishes)	chilies, ginger, cardamom seeds, pepper, cinnamon, anise, fennel, cumin, salt, colouring, tomato paste.	nitrogen tank; cryogenic chamber; racks; rice cookers; multipurpose cookers; tables.	RM500,000 (≈£125,000)
Traditional cakes	rice flour, starch flour, glutinous rice flour, coconut, spices, salt, food conditioner, oil palm, etc.	preparation tables; dough mixer; coconut disintegrator; hydraulic press; soaking tank; autoclave; cooker; encrusting machine; proover; ovens; steamer; fryer; coating machine; racking table; sealing machine	RM500,000 (≈£125,000)
Instant coconut powder	fresh coconut	coconut container with parring machine; belt conveyor; soaking tank; tables; screw conveyor; disintegrator; screw press; centrifuge; mixing tank; pasteuriser; homogeniser; spray dryer; sealing machine; conveyor.	n.a
Noodles	rice, starch flour, salt, food conditioner, oil palm.	rice washing machine; siever; steamer;	100,000 (≈£25,000)
Bakery	flour, salt, vegetable oil, yeast, coconut, milk, sugar,	vertical mixer; spiral mixer; water chiller or cooler; dough divider; dough rounder; conveyor prover & cup escalator; moulder; bakery-steam prover; rack oven; oven; moulder; reversible sheeter; bread slicer; doughnut forming and fryer; flour sifter; rotating cake mixer; encrusting machine, oven.	RM450,000 (≈£135,000)
Fruits Canning	Fruits, syrups	Fruit washer, belt conveyor, soaking tank, skin peeler, washer, slicer, filling conveyor, canned delivery system, syruper, can steamer, rotary cooker, cooler, can dryer, can polletizer, labeller, non-shock caser, case sealer, case palletizer.	RM1,200,000 (≈£300,000)

Source: Factory visit; Survey 1993; MARDI; KEMAS; MARA

Quality control is one of the most important aspects of food processing because it must be 100 per cent safe. The sampled firms used different techniques to control the physical, chemical and biological condition of their products. For example, Firm B controlled the quality of its product at three different stages; (a)

raw materials, (b) food additives, and (c) packaging. Being a rice-noodle producing firm, Firm B places great emphasis on the raw materials it uses, particularly rice. Being the main ingredient, the grade of rice used determines the quality of the rice-noodle. Though Firm B recognises that a high grade rice will result in a high quality product, it uses a lower grade rice - "broken Grade D1" - in its *kuetiau* production to reduce production cost. Like the majority of rice-noodle producer in the study, the entrepreneur of Firm B uses lower grade rice as long as it is clean, standardised, white and new. Some firms used food conditioners such as sodium metabisulphate to prevent "*browning*" of raw materials and to ensure that rice has a white colour.

Besides using "safe" additives, Malaysian firms also use machine to control product quality. For example, in fruit juices processing plants, they have to use machine for pasteurisation, sterilisation and other automatic time-temperature control machine for thermal killing of micro-organisms.

Besides controlling raw materials, firms also control the quality of their products during processing and packaging. Firms used machine not only to produce but also to ensure their products achieve the desired quality. Rice-noodles may be cut and packed manually, but many firms have introduced machines to ensure that the rice-noodles have the same thickness (approximately 1 centimetre) and are well-packed.

Packaging is an important aspect of food processing operations. Foods are packed in order to measure out a suitable quantity, to protect against contamination, to make them easy to handle, to identify the product and its

ingredients, and to promote the sale of the product. A casual examination of the type of machine and materials used in packaging reveals that innovations are continuously being introduced. Now we find that wet foods are not only stored in jars, bottles and cans, but also packed in heat-sealed flexible containers which are lighter in weight and more flexible to handle. We also find that flexible plastic films (such as high density polyethylene) and aluminium foil are slowly replacing paperboard cartoon to store dry food (MARDI 1993a: 8). Given the importance of packaging in the marketing of food, firms have little choice but to give some consideration to this aspect.

Packaging operation are performed differently according to firms' capacity. High capacity firms use high speed machines, including casing. In our visit to a fruit canning firm, we found that the firm even used palletizers to assemble cases of products (Survey 1993). Low capacity firms, however, use manual labour or semi-automated techniques for packaging. The majority of the tiny firms used simple manual methods to pack their products. To illustrate the simplicity of the technique used, let us cite an example of the packaging technique used by **Firm C** in our sample. It is a vermicelli (*bee hoon*) producing firm. Packing was done by four female workers using only three pieces of equipment; a table (with a large hole in the middle), a portable weighing machine and a portable electric plastic-sealer. Two of the workers were sitting on top of a table; one of them would weigh the required amount of vermicelli which she passed to the second worker. The second worker then tied the vermicelli and lowered it through the hole in the table to the third worker who waited under the table with a plastic package. She then sealed the package and passed it to the fourth worker who packed it in a

cardboard case. There are, however, firms which do not pack their products. Instead they contract out this process to a packaging company or individuals (such as housewives).

It appears to us that the processes used by the majority of Malaysian food processing firms are a mixture of traditional and modern methods. In our visit to a traditional-cake manufacturer, we found that a encrusting machine operates alongside a gas cooker.

2.5 Critical Issues in the Development of the Food Processing Industry

As we have discussed in an earlier section, the FPI has been identified as one of the twelve industries to be developed under the IMP. Malaysia's attempt at "leap-frogging" into an industrialised economy hinges on **technological upgrading**. The IMP envisaged that industrial development will be based on the development and use of "new" technologies, such as process control, automation, automated processing, computer-based communications and communications-linked information processing systems. This suggests the critical role of technology in Malaysia's industrial development. Malaysia's attempt at catching up with the industrialised countries is also dependent on the ability of its industry to maximise the efficient utilisation of Malaysia's natural resources and development of intersectoral linkages. Explicitly, the IMP calls for the FPI to develop its technological capability and utilise efficiently Malaysia's natural resources.

There are several critical issues in the development of the FPI in Malaysia, of which the pertinent ones are: (a) low levels of indigenous technology, (b) delayed industrialisation, (c) weakness in interindustry structure, (d) raw materials, (e) market structure and (f) small scale.

(a) Low Levels of Indigenous Technology

One of the major problems confronting the Malaysian FPI is the low level and limited adaptive capability of its technology. Many of those industries which are high-tech, are either foreign-owned or are owned jointly with foreign firms. Like many other Malaysian manufacturing industries, FPI has tended to rely heavily on foreign technology making it difficult for such firms to exercise leadership in marketing and new product strategies.

Part of the explanation for the FPI is low level of technological capacity lies in its relative lack of an industrial base, underdeveloped intersectoral and inter-industry linkages, economies of scale due to small market size, as well as foreign dominance. Furthermore, the government's policies in the 1960s and 1970s which gave tariff protection to import-substitution industries tended to make the FPI complacent and less competitive. Typical of Malaysia's manufacturing industries, the FPI has a relatively slow pace of technology acquisition and adaptation due to the absence of strong R&D personnel and facilities (UNIDO 1985). It was only with the launching of the Fifth Malaysia Plan (1986-90) and the IMP that Malaysia started to focus on the development of industrial technology. The government may have realised the importance of technological development; however, the rapid pace of technological changes at

the international level and the increasing complexities of science and technology (S & T), make it difficult to manage technological change. For a resource-rich country, Malaysia faces difficulties in fostering technological effort that leads to the most efficient use of available domestic resources. Since most of the technologies developed in industrialised countries are capital intensive, it is reasonable that these technologies may be inappropriate to a labour-abundant country like Malaysia. As we have mentioned, Malaysia is heavily dependent on foreign investment in its manufacturing activities. This makes it difficult for Malaysia to develop indigenous technology and manage technological change.

Malaysia's earlier emphasis on foreign investment and MNCs also hinders indigenous technology development. The MNCs tended to rely on technologies developed in their parent firms, suggesting a lack of technological creativity and heavy reliance on foreign technologies. There is reason to believe that Malaysia's private sectors do not have a tradition of industrial technology development; they still lack the capability to develop industrial technology.

(b) <u>Delayed Industrialisation</u>

In Malaysia, the FPI as we know it today is a recent development. However, food processing activity has always been part of Malaysian life. Before the industry was fully developed in the early twentieth century, the people processed their food using the techniques they knew best; simple, labour intensive and effective. In the absence of effective demand for manufactured food, the food processing industry did not extend beyond pineapple canning until the last twenty years. For an agricultural producing country, Malaysia was a late starter in food manufacturing;

the first food processing plant (pineapple) was only established in the early twentieth century.

It appears to us, that there was a lack of attention to the food manufacturing industries in the early period of Malaysia's economic development. When Malaya became independent in 1957, it inherited an economy that was heavily dependent on two products; rubber and tin. Malaysia's early development efforts were geared towards the development of these sectors, suggesting a neglect of other industries, including food processing. Not surprisingly, the food processing industry was hardly mentioned in Malaysia's early development plans.

In the 1960s, we saw a shift in Malaysia's industrial strategy aimed at promoting industrialisation through import substitution (IS). The government introduced the Pioneer Industries Ordinance of 1958 to encourage foreign direct investment. The food processing industry, however, benefited little from the fiscal incentives provided under the ordinance, because the incentives were biased towards the development of large scale industries which manufactured consumer non-durables to replace imports. It was only with the enactment of the Investment Incentives Act of 1968 that we saw a major emphasis on investment promotion of export-industries. The pineapple processing industry, grew rapidly behind the safety of the government's protectionist policy. The incentives also encouraged the development of new industries such as dairy products, flour milling, animal feeds and sugar refining. However, they were still based on imported raw materials. It was only with the implementation of the IMP in 1986, that we see the emergence of industries based on local raw material (UNIDO 1985). The FPI may

have been prioritised as one of the industries to spearhead Malaysia's industrial development in the 1990s, but the three leading industries are electronics, machinery and textile industries.

(c) Weakness in Inter-Industry Structure

The FPI, like many manufacturing industries in Malaysia, tends to have weak interindustry linkages. As a resource-based industry, the FPI has largely concentrated on primary processing and has done little to exploit the potential in downstream processing. Furthermore, the industry has a low industrial linkage, as reflected by its relatively high leakage ratio; 20.2 per cent for backward linkage and 22.4 per cent for its forward linkage (UNIDO 1985). Its inability to generate linkage is strongly linked to the fact that the majority of the industries are relying on imported raw materials. Moreover, the sector is also dependent on foreign investments.

(d) Raw Materials

Malaysia's economy may be resource-based; but 70 per cent of FPI raw materials are imported. This heavy reliance on foreign imports such as flour, sugar, dairy products and beverages suggest that the industry has yet to establish comparative advantages in its import-substituting sector.

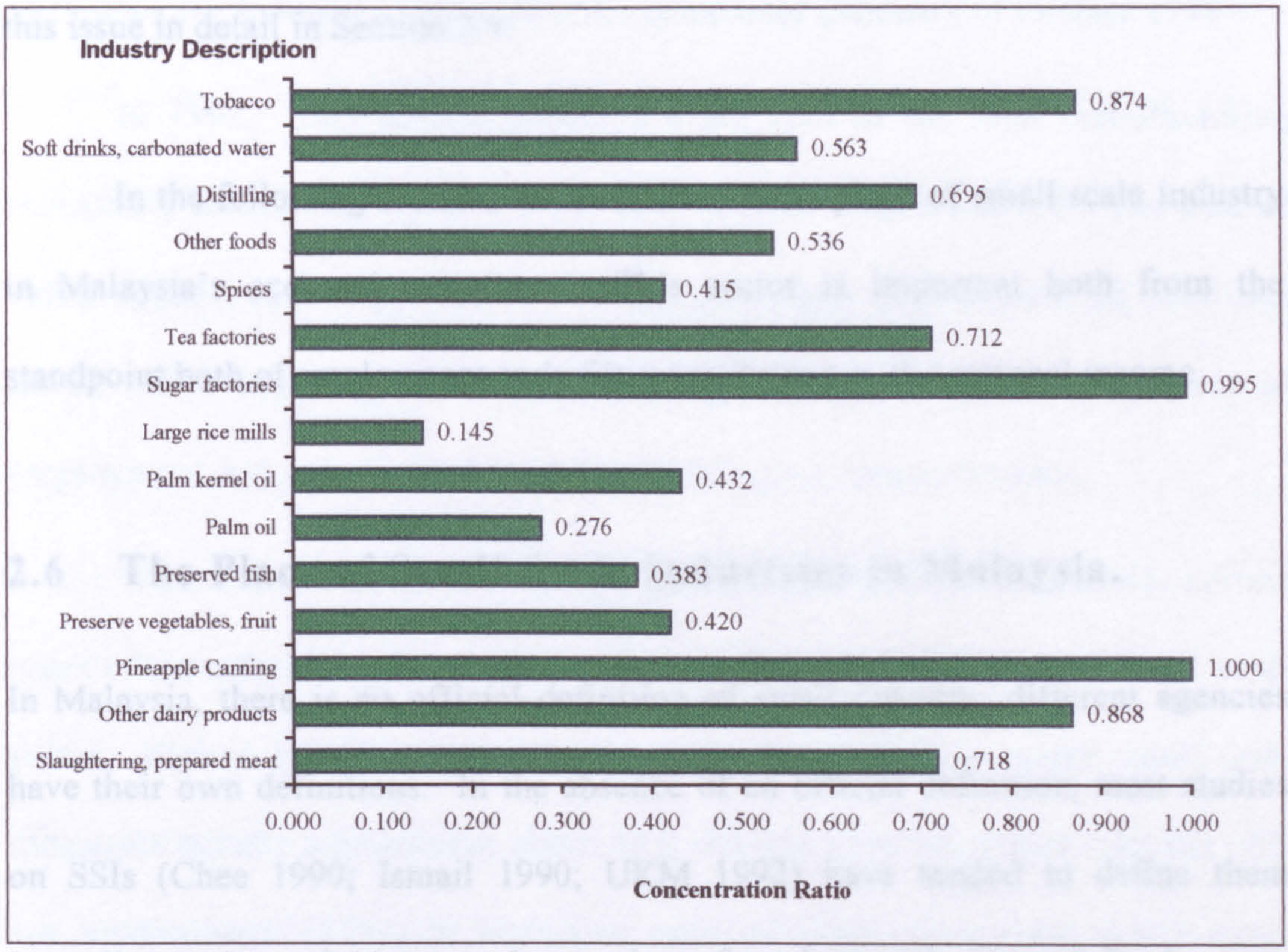
(e) Market Structure

Market structure refers to the number and size distribution of firms, as well as the height of barriers and entry in an industry. An industry which has a high entry

barrier is one where it is difficult for new entrants to establish a presence in the market. Market structure is an important factor because it influences an industry's ability to charge high prices and earn supernormal profits. Markets can be characterised by the level of concentration. The more concentrated an industry, the more it approaches the monopolistic situation and the higher its profits are. Our study shows that the overall market concentration[14] in the food industry is generally low. Many of them have a concentration ratio of between 30 per cent to 40 per cent. The results suggest that the industry is highly competitive which means that profit is relatively low. However, concentration is relatively high in certain sub-sectors such as pineapple canning (1.000), slaughtering and preserving meat (0.718), other dairy products (0.868) and sugar refineries (0.995). The high concentration ratio in this four sub-sectors suggests that they are highly concentrated and controlled by a few large firms. Our study shows that the majority of *Bumiputera* firms are concentrated in the production of spices, canning and preserving and processing of fish, and preserving of fruits and vegetables. As we can see, these sub-sectors are highly competitive, as reflected by their low market concentration. It appears that the *Bumiputera* tend to be involved in sub-sectors where competition is high and profit is low.

[14] Market concentration has three dimensions, namely the number of firms, their relative share in the market and the viability of collusion by the leading firms. A four-firm concentration ratio (CR4) measures the contribution of the largest four firms to total industry output. By this criterion, an industry with a CR4 of at least 40% is considered an oligopolistic. An industry with a CR4 of at least 70% is considered to have a high degree of concentration.

Figure 2.4: Four-Firm Concentration Ratio by Food Processing Industry



Source: Adapted from Table H2 Bank Negara Annual Report 1992

Among the factors which encourage or discourage market concentration are scale economies, capital intensity and presence of foreign firms. An industry will have a high market concentration if other firms face difficulties entering the market. That the *Bumiputera* are mostly involved in low concentration sub-sectors suggests that they have low capital. There is reason to believe that the large firms are either foreign owned or owned by *non-Bumiputera,* particularly the Chinese.

(f) <u>Small Scale</u>

One of the basic characteristics of the industry is that it is predominantly small-scale and with low value-added. This suggests that the FPI is labour intensive and traditional. One explanation for its low value-added is there has been biased

implementation of government assistance programmes for SSIs. We shall discuss this issue in detail in Section 2.9.

In the following section, we shall discuss the place of small scale industry in Malaysia's economic structure. This sector is important both from the standpoint both of employment and of its contribution to the national income.

2.6 The Place of Small-Scale Industries in Malaysia.

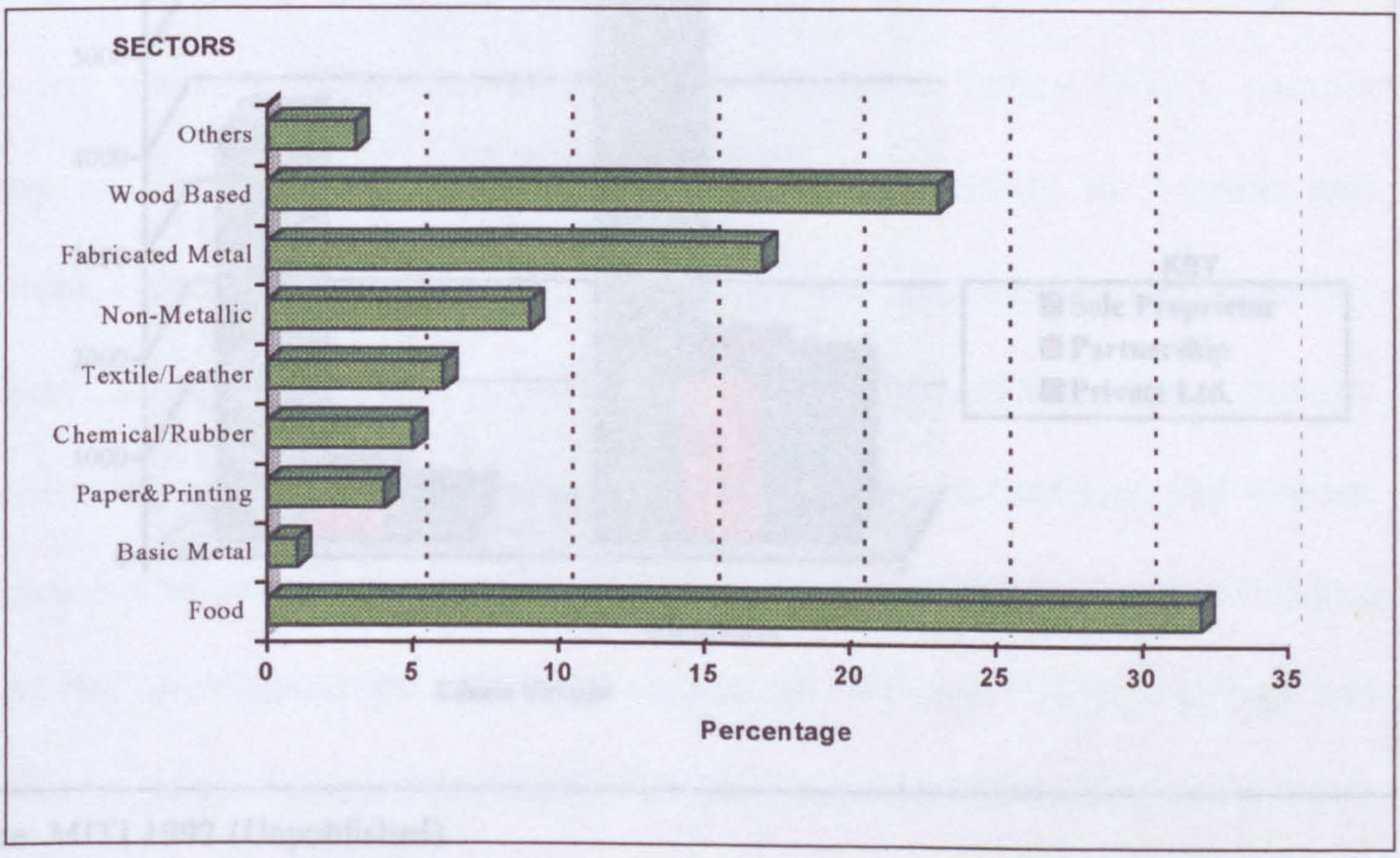
In Malaysia, there is no official definition of small industry; different agencies have their own definitions. In the absence of an official definition, most studies on SSIs (Chee 1990; Ismail 1990; UKM 1992) have tended to define them according to two criteria, namely, number of workers and value of fixed assets. Ismail (1990) classified industries into four main categories, namely tiny, small, medium and large scale industries. Tiny scale industries (TSIs) are firms employing 4 persons or less, while small scale industries (SSIs) are those employing between 5 and 49 workers. Medium scale industries (MSIs) are firms employing between 50 and 199 workers, while large scale industries (LSIs) are firms employing 200 workers or more. The Co-ordinating Council of Small Scale Industries defined SSIs as those with fixed assets less than RM250,000 (about £62,000). These two definitions are the most commonly adopted by researchers. Bank Negara Malaysia defined firms' size based on definitions as identified under the Industrial Co-ordination Act 1975 (amendment 1986) and the Promotion of Investment Act 1986 as its lending guidelines SSIs are defined as manufacturing companies with shareholders' funds of less than RM500,000 (about £125,000);

while those with shareholders' fund of RM500,000 to RM2.5 million (about £625,000) are regarded as medium scale companies (Ministry of Finance 1988).

In 1992, SSIs formed about 56.8 per cent of the total manufacturing industries, contributed about 9.3 per cent of total employment, 6.9 per cent of value added and 5.6 per cent of total fixed asset (Department of Statistics 1992). This data suggests that the SSIs accounted for a small proportion of employment and value added for all manufacturing establishments.

What are the basic features of SSIs in Malaysia? In Malaysia, certain types of manufacturing industries are particularly prominent in the small scale sector. **Figure 2.5** throws light on the type of industries in which small scale industries occupy a prominent place. It is obvious from the figure that the SSIs are predominant (81%) in activities such as food processing, wood based (furniture), fabricated metal and non-metallic mineral industries.

Figure 2.5: Percentage Distribution of Small Scale Industries By Sectors in Malaysia (1990)

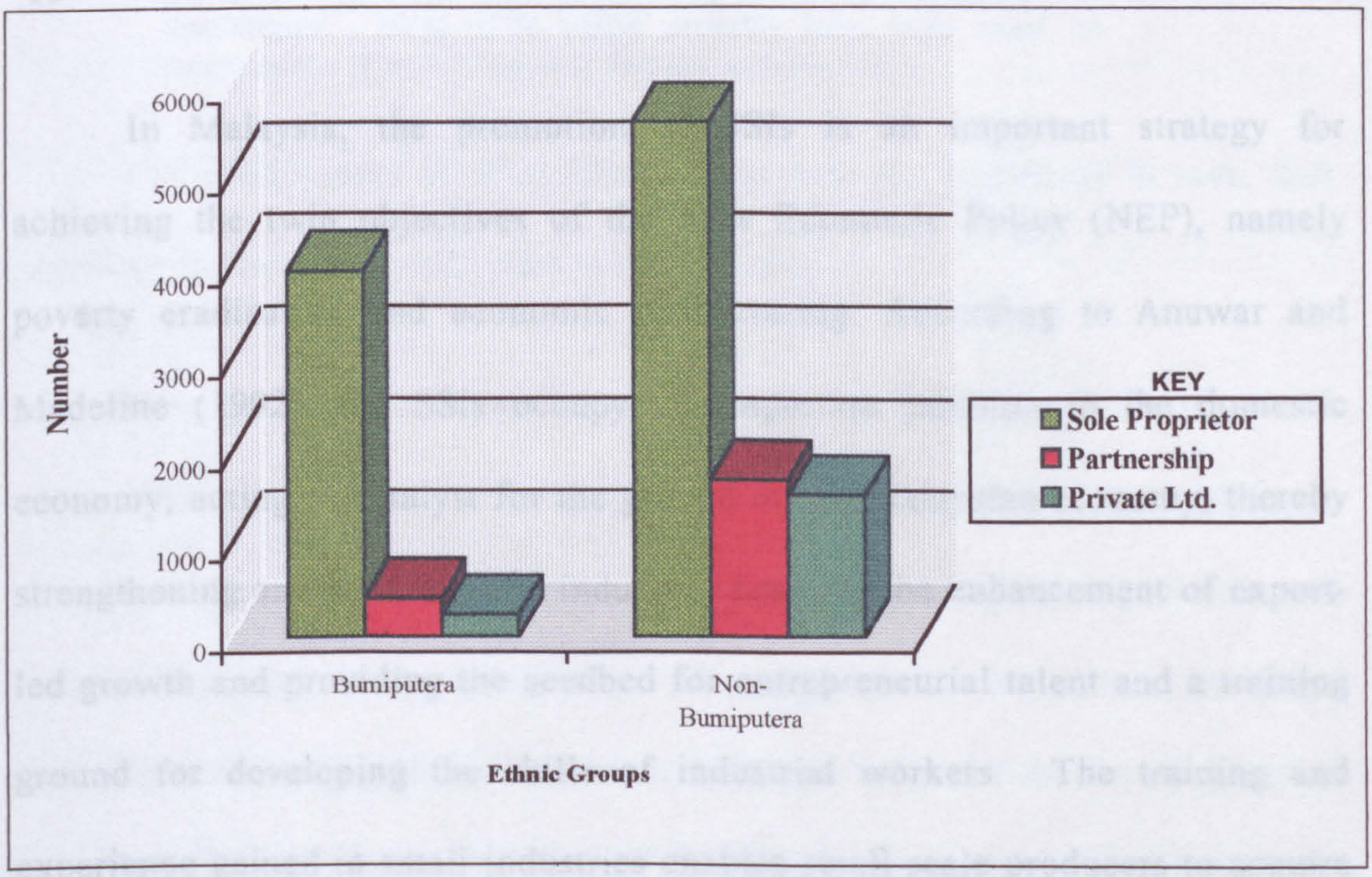


Source: MITI 1992 (Unpublished)

One of the basic characteristics which distinguishes SSIs from large industries is that the majority (69%) are organised as sole or family proprietorships (MITI, 1992) Another distinguishing feature of Malaysia SSIs is that they are mostly owned by non-*Bumiputera* as shown in **Figure 2.6**.

Another feature of Malaysia's SSIs is that they are labour-intensive, using simple technologies. MITI (1992) reported that 77.0 per cent of the small scale firms in Malaysia used capital less than RM50,000 (about £12,5000). MITI also reported that 70 per cent of SSIs used semi-mechanised and the remainder used non-mechanised technology, confirming the labour intensiveness of small scale industries in Malaysia. In terms of market, we find that the Malaysian SSIs mainly cater for local markets. Even then only 11.0 per cent are able to serve the local market effectively (MITI 1992), let alone penetrate the foreign market.

Figure 2.6: Type of Business Organisation By Ethnic Ownership



Source: MITI 1992 (Unpublished)

Having discussed the basic characteristics of the SSIs, we shall now discuss their potentials and constraints. In the following sections, we hope to answer the following questions: what is the potential role of SSIs in the Malaysian economy. What are the problems that SSIs have to contend with?

2.7 Potential of Small Scale Industries

Many studies on SSIs in developing countries have highlighted the potential role of SSIs. (Chee 1986, 1990, 1991a; Ismail 1990) The two most commonly cited contributions of SSIs are their role in creating employment and national income. Studies by Chee (1990), Ismail (1990), Mohd Asri (1996) and UKM (1992), claimed that small industries generally employ more workers per unit of capital. The development of small industries helps to create substantial employment opportunities.

In Malaysia, the promotion of SSIs is an important strategy for achieving the twin objectives of the New Economic Policy (NEP), namely poverty eradication and economic restructuring. According to Anuwar and Madeline (1992), the SSIs occupy an important position in the domestic economy; acting as catalyst for the growth of the Malaysian economy, thereby strengthening and widening the industrial base for the enhancement of export-led growth and providing the seedbed for entrepreneurial talent and a training ground for developing the skills of industrial workers. The training and experience gained in small industries enables small scale producers to acquire experience and develop their abilities with the growth of their business. The

development of SSIs is one way of increasing *Bumiputera* participation in manufacturing.

The third argument favouring SSIs is that they help to mobilise local savings. Small firms tend to rely on their owners' own family, friends and relatives for finance. In our study we found that the majority of small firms in the food processing industry used these informal sources to finance their innovation. The lack of outside financial support, force the SSIs to rely on personal resources for further improvement and expansion in production. The unreliability of external support encourage SSIs to increase their personal savings or use resources, which otherwise would have been spent on consumption. In discussing the contribution of SSIs, Chee (1990:30) wrote:

> It is likely that a large proportion of the capital mobilised for investment in small industries would not have otherwise been available - to large establishments or to the government - for investments. Most of it would probably have been spent on consumption if small industries had not mobilised it.

The development of SSIs helped to increase the propensity to save, thus increasing the overall savings ratio in the economy.

The experiences of Japan, South Korea and Taiwan illustrate the important role of SSIs as a supplier of components to large firms (Hasnah and Rahmah 1989; Madeline and Faridah 1989; Rogayah and Ahmad 1989). Studies in Malaysia (UKM 1992, 1990) have also highlighted the pattern of inter-dependence of the large-scale and small industrial unit, and the development of the latter as ancillary to the former. The SSIs can supply components and intermediate products to larger firms and create a process generally known as

subcontracting. The sub-contracting relationship is a prelude to the enhancement of greater inter-industry linkage. There are several advantages of subcontracting, of which the most common ones are:

(a) the small industries obtain a ready market for their product by supplying parts and components to the "parent" firms (large firms with which they establish a sub-contracting relationship);

(b) the subcontracting system enables large industries to operate at a relatively lower cost, since the cost of manufacture is relatively lower in small industries; and

(c) the "parent" firms provide assistance (technology, finance, skilled labour) to small firms thus ensuring their economic survival.

Another argument favouring SSIs in Malaysia is the issue of equity; their impact on income distribution. SSIs tend to employ more workers and manufacture products which are consumed by the lower income groups. The low cost of setting up small firms enables entrepreneurs with limited finance to gain entry into the industrial sector (Chee 1990; Ismail 1990).

2.8 Problems of Small Scale Industries

In this study it is also useful to examine some of the critical issues in the development of small scale food processing industries, because the problems they face are different from those of large industries. In this section, we shall discuss some of the major problems confronting small scale food processing firms in

Malaysia, focusing on such aspects as market, competition, finance and credit, labour, raw materials and technology. The problems confronting small scale industries differ in detail from one sub-sector to another and between units in the same sub-sector. However, these problems can be broadly classified as applicable to small scale industries in the FPI.

2.8.1 Marketing and Competition

There are two categories of market constraints confronting SSIs, namely demand and supply. Generally, the demand constraints are related to the restrictions on the size and pattern of the markets, including factors that account for the lack of demand or a fall in the demand for a certain kind of food. The supply constraints are related to restrictions on the market for inputs.

Among the problems of marketing the following appear to be pressing: (a) sales (b) competition (c) credit sales, (d) indebtedness and credit. One of the common problems perceived by small firms is their inability to sell their products well to attain a reasonable profit (Mohd and Shaari 1988; UKM 1990). Unlike large firms, tiny and small firms seldom conduct market research to enable them to plan their marketing strategies and programmes adequately. Part of the reason lies with their limited financial and human resources.

As we have mentioned earlier, tiny and small firms mainly cater for the local market. Even in the local market, only a small percentage are able to market their products effectively. Their inability to penetrate the overseas market or compete in the local market is mainly due to the non-competitiveness of their

products with regard to price, quality and after-sales service. Their products are not only poor in quality and after-sales service, but they are not backed by attractive packaging and labelling, elaborate sales promotion apparatus such as publicity and advertisement campaigns, salespersons, posters and press. The problems are due to a combination of factors including lack of funds and inability to initiate R&D. SSIs also lack information on trade and banking practices, knowledge of the demand patterns and the need to cope with administrative procedures. Large and well-established firms usually have patented brand-names (such as *Maggi* chilli sauce and noodles, *Ramly* beef-burgers, *Peladang* curry powder, *Yeos* drinks, *Kipas Udang* soya sauce, *Lingham* chilli sauce). Without the backing of sales promotion, small scale food producers have to rely on the local market and the persuasive capacity of their local dealers. The dealers demand and the producers are obliged to pay a higher rate of commission than those allowed by large scale firms. This not only increases small scale food producers' unit cost and affects their working capital but also impinges on their competitive ability.

Another serious constraint to growth of rural firms is the limitation of demand for their products. Small firms face competition not only from large but also from small and tiny industries in their effort to market their products. Small firms located in a particular area face competition not only from outside the region, but also from local producers (within the immediate locality). There is also a lack of product development and improvement in the quality of product. Lately, rural small scale food producers are finding that their potential markets are slowly disappearing in the face of competition from large, urban enterprises operating in the same product market. Large scale urban industries are often able

to supply lower priced goods in rural markets compared to the rural enterprises. Small and tiny firms are often denied the economic advantages of bulk purchasing and efficient production. Large firms are able to sell their products at competitive prices because of their low cost of production due to bulk purchase of raw materials and efficient machinery. Our study shows that the majority of firms are using manual operations, suggesting that production is less efficient. Small and tiny firms have limited finance to enable them to purchase raw materials in bulk and at seasons when such materials are readily available. In the case of food processing where the raw materials involved are not obtainable throughout the year, much economic benefit could be achieved by making bulk purchases. The inability to purchase in bulk necessitates that small scale food producers purchase their raw materials at frequent intervals and at higher cost.

A study by UKM (1990) showed that a high proportion of SSIs sold their products on credit. The duration of their credit was also comparatively high. The study reported that credit sales have a negative effect on the insufficient working capital resources of small firms. This problem has been responsible for keeping some firms idle and inhibiting their competitive ability.

Another marketing problem confronting small scale food producers in Malaysia is that of indebtedness and credit. As we are aware, the financial position of these producers condition their day-to-day performance and reflect their success. Small scale producers are indebted to suppliers, intermediary agencies, financial institutions, and friends and relatives. The most important reason for this indebtedness was for fixed capital.

Recall **Table 2.3** which shows some the characteristics of popular machines and equipment and the average cost of machines for selected food processing industries available in the market. The majority of the machines are imported. A casual glance at these machines and their cost, reveals that they are far beyond the financial capabilities of the majority of tiny and small scale firms, particularly *Bumiputera* firms.

2.8.2 Financial Constraints

The problem of indebtedness reflects the financial constraints facing small scale food producers. It may be observed from our survey, that the majority of respondents purchased new equipment using finance borrowed from personal resources, friends, relatives and government agencies. Small scale producers' dependence upon these sources of credit for operating needs is a point of interest, because it has some bearing on the adequacy and cost of credit, their ability to expand and their freedom of purchase. The fact that the resources were from informal sources suggests that the amount of credit may be inadequate. Our study shows that entrepreneurs from small firms spend an average of RM7,000 (about £1,750) and RM23,000 (about £5,750) to replace old machines and introduce new products respectively. By relying on friends and relatives, the small scale producers may have difficulties financing the full amount of loan that the producer would like to obtain. Without adequate funds the small firms may be prevented from expanding production, thus reducing their competitive ability. The other point to be noted is the influence of dependence upon credit, on the freedom of

purchase by small scale food producers. They are denied the benefits of bargaining in the market that are open to payers in cash.

The small scale food producers also face problems securing credit. These problems take different forms, such as high interest rate and lack of collateral, including unavailability of credit facilities (Chee 1986; Faridah and Madeline 1992; Ismail 1990; UKM 1990). Small scale producers who succeed in securing loans from commercial banks have to pay excessive rates of interest on their loans, which imposes upon them a heavy financial burden. Small and tiny firms also face difficulties providing adequate collateral as security for procuring financial assistance. Though there are no less than 30 agencies involved in promoting small scale industries in Malaysia (**Appendix I**) the number of small scale producers who can actually have access to these agencies is still limited (Chee 1986; Faridah and Madeline 1992; Ismail 1990; UKM 1992). The access of such entrepreneurs to credit is often limited by stringent collateral and administrative requirements of the organised financial sector. It is claimed that urban financial institutions have been `reluctant' in giving out loans to small scale industries because of the high risk involved. Commercial banks find it more profitable and less risky to extend loans to large industries because of their high credit ratings. Moreover, these agencies are often located in the urban areas creating locational disadvantages for firms located in the rural areas. All this demonstrates the insignificant role played by the commercial banks in the provision of industrial finance to SSIs.

2.8.3 Production

Small and tiny firms also face production problems which are related to excess capacity and finance. A study by UKM (1990) showed that small scale firms in Malaysia face excess capacity in machine and workers. The problem of excess capacity arises because of problems related to lack of finance, raw materials, labour and lack of demand.

As we have discussed earlier, the small firms have limited finance, which create an obstacle in raising production to full capacity. This problem is prevalent among those who lack operating funds for the purchase of raw materials, for the payment of wage bills and rent. Without adequate funds, the small scale food producers may not be able to keep their units in continuous operation for a certain period.

The small scale food producers also face difficulties in obtaining raw materials. As we have discussed, Malaysia's food processing is still dependent upon imported raw materials. Seventy per cent of raw material required by the food processing industry in Malaysia is imported (UNIDO 1985). Some examples of sub-industries that use imported raw materials are flour milling, sugar refining, dairy product processing and animal feed preparation. In the case of sugar refining, although various attempts have been made to produce raw materials locally, problems such as susceptibility to pests and disease and low sugar contents made the production of quality raw materials less viable. Wheat flour milling, of course has to depend entirely on imported raw materials as the Malaysian climate does not permit the production of wheat. Except for wheat,

considerable effort is being made to commercialise or further improve the current local production of raw material such as cane sugar, maize, tomatoes and chillies (Tasir 1991).

The problem of the supply of raw materials are due to various reasons. One reason is lack of suitable land and know-how of commercial production. With the exception of oil palm and pineapple, the raw material plantations are small and uneconomic for commercialisation. For example the majority of farms currently producing tomatoes and chillies for the sauce production subsector are small in size, disorganised and consequently achieving poor returns. Small holders prefer to plant cash crops such as rubber and oil palm because of stability in economic return (Tasir 1991).

Sometimes, the quality of material required may not be available in the market. The problem is most prevalent among those who rely on local raw material. With the few exceptions of poultry, pigs, pineapple, palm oil and cocoa, producers often face inconsistent quality of raw materials due among other reasons to their perishable nature and the seasonality of production. For example, the majority of ricemillers have difficulties of obtaining *paddy* (unprocessed rice) during off seasons (Tasir 1991). Large firms have storage and transportation facilities and adequate financial resources; their production capacity is not heavily influenced by the availability and cost of raw materials. Without adequate finance, storage and transportation facilities, small firms may have to wait for the prices of raw materials to go down in cases where there are fluctuations as in the case of the fish for *keropok* or chillis for chilli sauce.

A problem of under-capacity in small and tiny firms also arises because of lack of demand. This problem is related to the location, age and enthusiasm of the entrepreneurs. In rural Malaysia, it is common to find small firms or a group of producers producing almost similar products. For example, in the East Coast States of Malaysia where *keropok* making is popular, the close clustering of too many producers in certain areas might force some to produce below capacity. Comparatively newer units may find it difficult to penetrate the existing market. In the food processing industry, the problems faced by newer firms are much more serious. Our informal discussion with some entrepreneurs revealed that they face serious difficulties capturing demand at their initial inception. Because they are new, their products are unknown or viewed with suspicion by consumers. They claimed that established firms even "bad-mouth" their products through gossip and rumours. Without adequate finance, they are unable to advertise their products and establish goodwill. Until there is sufficient demand for their products, these new firms may have to produce below capacity.

Some firms also face problems of under-capacity due to lack of demand in the industry as a whole. In the Malaysian food processing industry, there has been a gradual switching of demand for *halal*[15] and health food which seems to be permanent in character. Firms which are unable to keep abreast of these changes may find themselves producing in excess, due to lack of demand. The ability of a firm to exploit these changes in demand is dependent on their financial resources which in turn affects their capacity to introduce new products or techniques of production. Small scale food producers also face excess capacity due to seasonal

[15] Food prepared according to Muslim dietary laws

demand in their products. The demand for food tends to be relatively high during festive seasons. Some firms may face excess capacity after these festive seasons due to lack of demand. These situations suggest that small firms have poor inventory control and lack production planning and control which is related to the lack of skilled workers or professional manpower in manufacturing management.

2.8.4 Personnel

Small firms experience significantly greater difficulty than larger firms in recruiting both skilled and technical workers, managers and professionals. Skilled worker shortages represent a problem for small firms as indicated by a small percentage of firms which employ skilled workers reveals the low level of skill among small and tiny industries in the study area. One reason for difficulty in attracting and retaining skilled workers is that SSIs, which lack working capital, are generally unable to offer attractive salaries and benefits to their workers to handle highly technical production operations, set up orderly accounting systems or conduct research and development. Without skilled manpower, this could slow down the pace of technology adoption in small firms.

In small and tiny firms, skill-upgrading is often made difficult by a high rate of labour turnover. In some cases, the high rate of labour turnover, particularly in rural firms, arises from seasonality in employment and rural urban migration among rural youths.

The problems connected with the acquisition of skill relate essentially to the lack of training facilities suited to the trade, particularly in rural areas. The

majority of Malaysia's training institutes and facilities are located in Kuala Lumpur or other major towns. Many rural producers, particularly women, are unable to avail themselves of these facilities. The problem is exacerbated by the high cost (time and money) involved in training. Though the majority of the short-courses organised by government agencies are free or subsidised, course participants may have to incur travelling and living expenses during the course. For small and tiny firms, this will be an extra financial burden which, with their meagre working capital they can ill afford. From **Table 2.4** we can see that some of the courses incur high fees. The cost of training in private institutions is relatively more expensive; courses such as those offered by the Penang Skills Development Centre are not within reach of small and tiny firms.

Apart from the high training cost, time is another factor constraining small scale producers from undergoing technical training. Since the majority of the research institutes are located in the major towns, the rural producers will have to stay at the training centres for the duration of their training course. In tiny firms with an average workforce of only five members, the entrepreneurs' absence is bound to have an adverse effect on production.

Table 2.4: Selected Courses for Small Scale Firms in Malaysia

Institutes	Courses	Duration	Qualifications	Cost
Centre for Instruction and Advanced Skill Training (CIAST)	***Instructor Training Course***	22 weeks	Trainee Instructors and Trade Instructors	
	Basic training Including skill analysis, written instruction materials, training administration, post basic training methodology, basic instructional techniques, module training system design	1-2 weeks	Vocational Training Instructors, Supervisors and Experienced workers who have been given instructing responsibilities	Tuition Fee = RM60.00 per week Hostel Fee = RM25.00 per week Hostel Deposit=RM50.00 Workshop Deposit=RM50.00
	Supervisory Skill Training	1-2 weeks	Supervisors and Vocational Training Instructors	
	Advanced Skill Training Sub-Module Module 2 - 3 All Modules	 2-3 weeks 5-8 weeks 30-50 weeks	Supervisors, Skilled workers and vocational training instructors who posses Intermediate Certificates or equivalent plus two years of working experience Sponsored by employer.	
Industrial Training Institute (IT)	***National Apprenticeship Scheme***	3 years	Sponsored by employers Passed MCE/SPM Certificates Employer provide in-plant training.	No tuition fees, but an apprentice who resides in the institutes' hostels is required to pay for food.
	Trade Skill Certificate course	2 years		
Malaysian Agricultural Research and Development Institute (MARDI)	***Training on Processing Technology and Quality Control***	- na -	- na -	- na -

..... cont.

Institutes	Courses	Duration	Qualifications	Cost
Majlis Amanah Rakyat Malaysia (MARA)	***Entrepreneurship Development***	14 days	Bumiputera entrepreneurs only	RM10.00 for every course
	Improvement Courses			
	Basic account-keeping, -Advanced account-keeping	3 days 3 days		
	Company secretarial course	1 day		
	Marketing	3 days		
	Distribution	3 days		
	Sales	2 days		
	Import-Export	3 days		
	Production Management	3 days		
	Administration	2 days		
	Computer application	2 days		
	Consumer relation	1 day		
	Preparation of working papers	2 days		
	Income tax and audit	2 days		
	Support programmes	- na -		
Penang Skills Development Centre *	Certificate in Training and Development	6 months	Trainers and Executives	RM2,780
	Certificate in Personnel Management	7 months	Executives	RM1,950
	Certificate in Purchasing and Materials Management	12 months	Buyers, supervisors, store personnel	RM800
	Diploma in Supervisory Management	12 months	Supervisors	-
	Diploma in Management Programme	2 years	Supervisors, executives	RM4,600
	White collar productivity	2 days	Engineers, supervisor	RM500
	Time management	2 days	Supervisors, managers	RM1,500
	Effective Supervisory Skills	3 days	Supervisors, line leaders	RM550

Source: FMM (1990), Handbook for small and medium sized industries (Unpublished)
Note: * The fees are for non-members

There is also the problem of the lack of awareness on the part of some small scale food producers about the need for undergoing technical training. A casual discussion with some of the producers revealed that they recognised the need for improvements in the quality of their products as well as a general rise in their productivity. However, many of them believed that these could be brought about by other means without actually undergoing technical training. Some of them even claimed they had "more knowledge" or "more first hand experience" about what was being taught in the institutes.

2.8.5 Technical

Many small scale firms have low capital and labour productivity suggesting that they have lower technical capabilities. Many of these problems are related to lack of information and knowledge of existing technical and advisory facilities for small scale industries. The size and characteristics of a technology available to the small scale producers depend on the nature of the particular industry, as well as the channels of information available to them. Often they face problems in relation to the availability of technological alternatives existing in the industry and the capacity of the entrepreneur to collect and assimilate the information. Differences also exist in technology and equipment used in the production processes, thus creating differences in the quality of products. In this study, a large percentage of the firms were found to be using simple tools and equipment in their production. In addition, small firms lack inter-sectoral links with machine workshops, repair or service facilities for some of their machines, often making it difficult for them to use sophisticated or non-readily available machines.

2.8.6 Discriminatory Government Policies

A close examination of government policies reveals a picture of bias against SSIs. These policies do not deliberately discriminate against SSIs, however their impact and the way they are implemented tends to do so. Chee (1990:37) argued:

> [*T*]he fiscal incentive system in Malaysia, as in many other countries, generally links the value of such incentives to the level of investment, implying that larger enterprises (in terms of investment) receive greater benefits.

There is an inherent capital bias in many government incentive schemes. SSIs are sometimes unaware of the incentives available.

Another form of indirect discrimination faced by the SSIs relates to government procurement policies. The SSIs are often left out of the lucrative government procurement business. Part of the explanation lies with the fact that government bulk purchase and tender tend to favour large scale industries because of their competitive prices and higher quality products.

2.8.7 Access to Business Service

Small and tiny firms, particularly those in rural areas, are widely seen as having relatively less access to business services such as banks, accountants, management, marketing, advertising and market research agencies, given that most of these services are located in towns. The frequency of use of external advice by rural small firms is fairly low. Government agencies such as MARA and MARDI lead the list of agencies providing advice to rural firms. These points seem to support the notion of rural isolation and its effects; firms in rural

Malaysia are relatively disadvantaged in terms of frequency of business service advice used by them.

2.9 Institutional Framework for Small Scale Industries

The government's involvement in small industries mainly developed after the launching of the New Economic Policy in 1971. The government may have established the Rural Industrial Development Authority (RIDA) in 1960 to promote industrial development, but at that time, there was no serious effort to develop SSIs. Malaysia's early development programmes focused to a large extent on the development of large scale industries. Such a strategy may have succeeded in accelerating economic growth, but it failed to address the social and economic imbalances prevailing in Malaysian society; a wide gap between the rich and the poor, between regions (rural and urban, West coast and East coast of Peninsular Malaysia), and most important, between ethnic groups (*Bumiputera* and non-*Bumiputera*. The NEP was implemented in 1971 with a commitment to eradicate poverty by raising income levels and employment opportunities and to restructure society so as to reduce and eventually eliminate the identification of race with economic function. (Malaysia 1971:154). The overriding concern of the NEP is to enhance *Bumiputera* participation in commercial, industrial and urban-based activities in which their participation has always been minimal. **Table 2.5** summarises some of the pertinent issues regarding the development of small and medium scale industries (SMIs) as highlighted in Malaysia's respective development plans.

Table 2.5: Malaysia's Development Plans and Pertinent Issues on the Development of Small and Medium Scale Industries.

Development Plans	Pertinent Issues On SMIs development
First Malaysia Plan (1965-70)	• No mention of SMIs
Second Malaysia Plan (1971-75)	• Implementation of the New Economic Policy. • Promotion of SMIs • Government provide technical, financial and management assistance Government established institutions such as Credit Guarantee Corporation (CGC), Malaysian Industrial Development Finance (MIDF) to assist SMIs
Third Malaysia Plan (1976-80)	• Development of SMIs as an integral part of Malaysia's industrial development • Focus on training of small entrepreneurs • National Productivity Centre (NPC), *Majlis Amanah Rakyat Malaysia*, Ministry of Culture, Youth and Sports conduct entrepreneurial development programmes
Fourth Malaysia Plan (1981-85)	• Development of entrepreneurship, • Creation of employment • Mobilisation of savings • broadening of industrial base of *Bumiputeras* • Providing inputs and support service • Government allocated RM318 million for development of SMIs • Established the Division of Small Enterprise in the Ministry of Trade and Industry
Fifth Malaysia Plan (1986-90)	• Expansion, improvement and modernisation of SMIs. • Improving of incentive system • Develop R&D activities by encouraging SMIs to establish links with research agencies. • Introduce a *Special Programme for the Development of Small Industries* involving total financial assistance of RM234 million undertaken with cooperation with World Bank
Sixth Malaysia Plan (1991-95)	• Foster inter-industry linkages • Focus on the supportive role of SMIs producing parts and components • Development of indigenous technology • Develop international marketing networks • Efforts to link SMIs with larger enterprise through subcontracting arrangements • Establishment of *Tabung BantuanTeknikal Perindustrian Kecil* (Industrial Technical Assistance Fund)

Source: Malaysia (1991, 1986, 1981, 1976, 1971)

It is evident from the table that much attention and support has been given to the development of small and medium industries in Malaysia. The government's commitment to SMIs development is reflected by the number of ministries and agencies providing assistance to SMIs. (See **Appendix I**). The

government has extended different types of programmes to assist SMIs. The government has adopted two approaches (a) promotional measures designed directly to help SMIs financially, technically and organisationally, and (b) protective measures to remove some of the problems in the day-to-day functioning of these units, by regulating the market for their products and reserving markets for SMIs. The major programmes that have been implemented to promote the development of SMIs are outlined in the following sub-sections.

2.9.1 Marketing Assistance

The government has designed an integrated marketing programme to assist SMIs to increase their market. Under the Sixth Malaysia Plan (1991-95:144) the government adopted the *konsep payung* (umbrella concept) which is a government purchasing scheme. Under this scheme, SMIs' products will be marketed through companies participating in the programme, such as *Besta Distributor Sendirian Berhad, PERNAS Edar Sendirian Berhad* including Guthrie Malaysia Trading Corporation. This umbrella concept was established to provide linkages through product sourcing and marketing in the food processing industry.

The government has also established the Sub-Contract Exchange Unit to assist SMIs to establish linkages. The unit serves as a meeting or a market place where buyers and sellers meet. Small scale entrepreneurs can also receive advisory services from this unit. Several private and public agencies, such as Malaysian Industrial Development Authority (MIDA), National Productivity Centre (NPC) Malaysian Development Bank (BPMB) participate in this scheme.

In 1980, the government established the Malaysian Export Trade Centre (MEXPO) to provide assistance such as information regarding trade opportunities and international marketing, maintaining database of local exporters and foreign buyers and provision of space for exporters to exhibit their products.

2.9.2 Finance

The financial problems faced by the SMIs point strongly towards the need to supplement their existing sources of financial help. There are several private and public institutions which have been established to provide financial assistance to SMIs. Among these institutions are: *Bank Industri Malaysia Berhad* (Bank of Industry), *Bank Pembangunan Malaysia Berhad* (Development Bank of Malaysia), Credit Guarantee Corporation (CGC), Malaysian Industrial Development Finance (MIDF) and MARA. These agencies provide financing for new fixed assets and factory building undertaking modernisation and expansion. The government has also initiated the *Tabung Bantuan Teknikal Industri* (Industrial Technical Assistance Fund or ITAF), *Skim Pembiayaan Usawan Kecil* (Small Entrepreneurs Finance Scheme), *Bumiputera* Entrepreneurs' Development Programme, New Entrepreneurs Fund, ASEAN Japan Development Fund Loan Scheme and *Tabung Usahawan Industri Kecil Sederhana* (Financing Fund for Entrepreneurs in Small and Medium Scale Industries) to provide grants and finance to help SMIs conduct R&D and upgrade their technological capacity.

Bank Industri Malaysia Berhad has initiated an engineering financing facility to assist SMIs in their new engineering projects and enable them to lease machinery and equipment. *Bank Pembangunan Malaysia Berhad* provides project

loans to *Bumiputera* firms for the purchase of land, factories, warehousing, office building, machinery and transport equipment. The ITAF was set up in 1990 with the purpose of providing grants to qualified SMIs to help them (a) engage consultants to conduct feasibility studies to modernise and upgrade their existing plants, and improve quality and productivity, (b) improve local product development and design, build up indigenous technological know-how to develop new products and improve existing products, (c) improve the quality of their product to meet the standard requirements as outlined by SIRIM, and (d) enter the export market and develop export marketing expertise. New or existing entrepreneurs who face financial difficulties can also apply to the New Entrepreneurs Fund to obtain loans to purchase fixed assets and for working capital. A nursery factory scheme has been provided to *Bumiputera* entrepreneurs under the *Bumiputera* Entrepreneur Development Programme. Under the scheme, *Bumiputera* entrepreneurs are provided with factory complexes for a specific period at a special rental rate. Another source of finance for *Bumiputera* entrepreneurs is the New Entrepreneurs Fund, which provides funds to new entrepreneurs to acquire fixed assets. SMIs can also obtain loans from the Malaysian Industrial Development Finance to finance new fixed assets, undertake new industrial ventures or undertake modernisation and expansion. Another source of finance for SMIs is the ASEAN Japan Development Fund Loan Scheme.

However, the majority of all these institutions require some forms of security such as fixed assets, life insurance, marketable securities, *Amanah Saham Bumiputera* shares, negotiable certificate of deposit, treasury bill, government securities, corporate guarantee, joint- and several directors/shareholders guarantee

or assignment of contract proceeds including debentures on fixed and floating assets. In most cases, tiny and small scale firms are prevented from benefiting from these sources of support, due to their inability to provide the required security or collateral.

2.9.3 Skill Upgrading and Technology

There are also a number of agencies involved in providing training to SMIs. Among the most common ones are the Centre for Instructor and Advanced Skill Training (CIAST), Industrial Training Institute (ITI), MARDI, MARA, National Productivity Centre (NPC), Forest Research Institute Malaysia and Penang Skills Development Centre. These agencies provided different types of courses to SMIs such as courses on technical aspects, improving management standards, efficiency and productivity in industrial operation, development of entrepreneurial skills, industrial training and food processing technology.

MARDI has one of the most comprehensive programmes on food technology, encompassing a variety of areas such as Food Information Development, Food Project Development, Food Industrial Development, Food Extension Services, Training for Food Industry and Food Quality Control Service. MARDI's Food Information Development programme documents information on Malaysia's food processing industry, food research information and food industry information systems. The purpose is to update information such as technology, manufacturing, trade, economy, policy and market relevant to the food processing industry. Small scale food producers can also obtain information regarding the

latest technology on food production under the MARDI Food Project Development which is a programme concerned with producing packaged technologies which has been tested.

Under its Food Project Development, MARDI designs and develops commercially viable systems for production of food products from research prototypes and other available machinery and equipment, design post-harvest handling systems for food, conduct commercial feasibility studies on food manufacturing projects and produce consumer acceptance reports on food products. This programme not only conducts technical and financial studies on all new products and technologies, but also is able to disseminate viable projects to interested producers.

Under its Food Industrial Development programme, MARDI provides technical and consultancy services to firms to develop new food manufacturing industries, or to existing industries to improve their quality and productivity, and to conduct research with selected industries in the development and testing of new ingredients, products, machinery and systems. MARDI also has special programmes for the development and improvement of SMIs in selected industries. MARDI assists potential entrepreneurs set up new small scale industries and transfer technologies and provides comprehensive guidance services on existing SMIs with respect to proper production technology, quality control systems and presentation of products. These programmes only focus on technical consultancy services and their purpose is to assist existing SMIs to operate efficiently, produce products of high quality and improve the marketing of products.

These programmes are complemented by MARDI's Food Extension Services which provide advisory and consultancy services to local food manufacturers including food technology, quality control, machinery layout, product diversification, labelling, packaging, food regulation and hygiene and sanitation. MARDI conducts training programmes not only for potential and existing entrepreneurs but also for extension officers from government agencies on aspects of food processing and quality control. It also organises seminars, forums, workshops and technical attachment training to assist food manufacturers.

Under its Food Quality Control Services, MARDI provides information on analytical services (chemical, nutritional, physical, microbiological and specialised services) and expertise on Muslim dietary laws to the food industry, either directly or through its extension programmes.

2.9.4 Institutional Support for Science and Technology

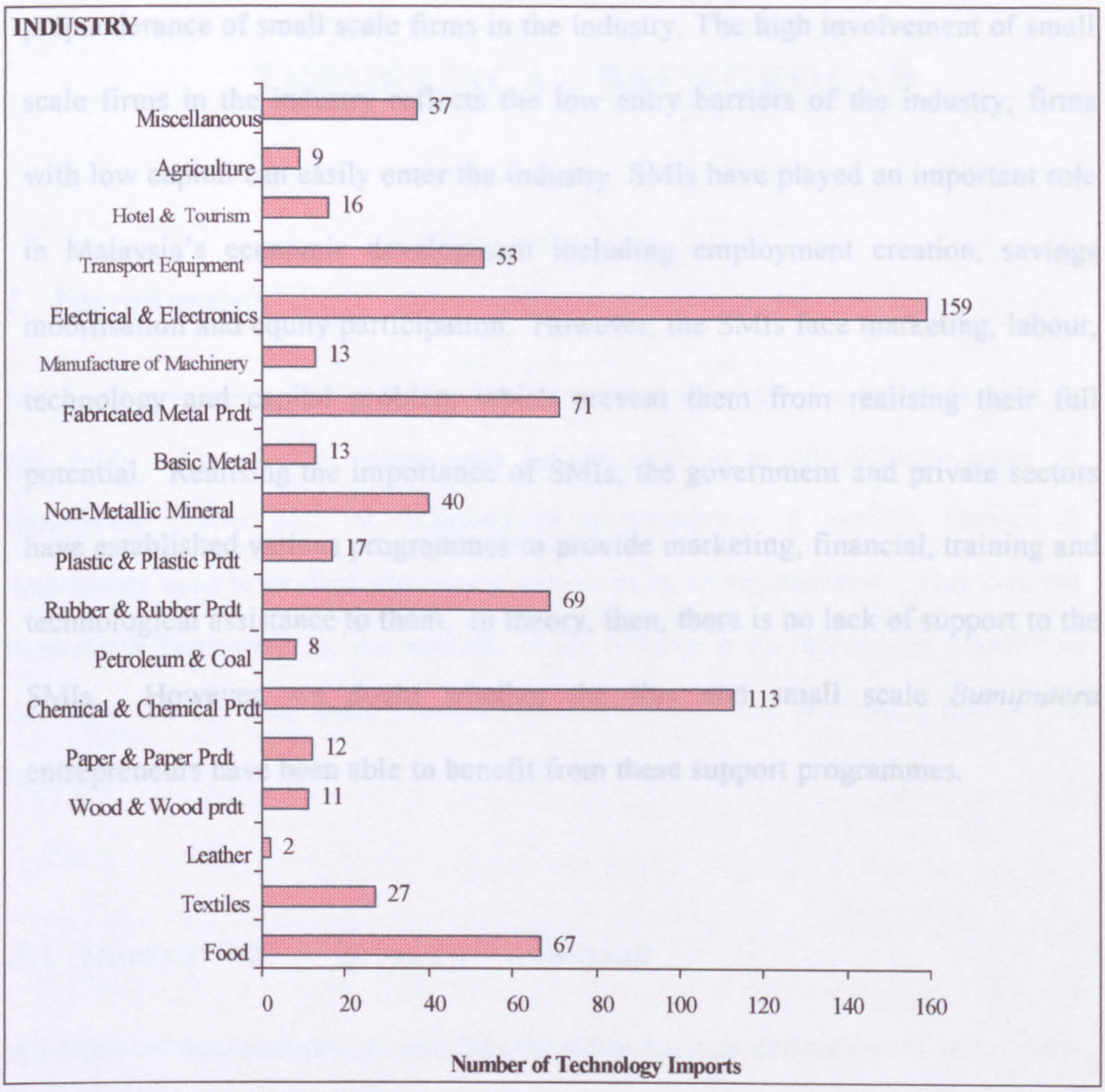
Besides these support programmes, the government has also introduced a comprehensive policy for the development of Science and Technology (S&T). Its strategies and programmes were aimed at widening and improving the S&T base through indigenous technological development with the acquisition of selective technology from abroad. To ensure the quality of R&D activities in the public sector, the government have implemented a programme entitled Intensification of Research in Priority Areas (IRPA). This is a more centralised and coordinated management system for R&D and technology development in the areas of agriculture, industry, medical and selected strategic areas. There is a heavy

emphasis on R&D activities in the agriculture sector. This emphasis is not only limited to increasing productivity but also covers downstream applications-oriented research in the processing of agricultural output and by-products, including research on end use product development and marketing, particularly in food processing industries. In the industrial sector, R&D activities are mostly focused on areas such as micro-electronics, information technology, automated manufacturing technology and material science. According to the Sixth Malaysia Plan (1991:190), local institutions have succeeded in designing and fabricating low cost small machinery for food processing and production, particularly for SMIs.

To supplement Malaysia's technological base, the government has imported foreign technology, which has always played an important role in accelerating industrial expansion in the country, and continues to do so. **Figure 2.9** shows that the level of technology imports in the food processing industry is relatively high.

Despite Malaysia's efforts at facilitating technology transfer, there is little evidence suggesting that Malaysian firms, particularly SMIs have succeeded in developing technological innovations. Their innovations have been mostly geared towards incremental improvements or marginal adaptations to meet local needs rather than the design and development of new products and processes. In the following section, we provide some insights into the dynamics of *Bumiputera* small-scale entrepreneurs in the FPI.

Figure 2.7: Technology Imports by Industry Group 1985-90



Source: Sixth Malaysia Plan (1991:Table 6-2)

2.10 Summary

The FPI is an important industry, both in terms of its contribution to national income and in term of employment generation. The industry has been prioritised as one of the twelve industries to spearhead Malaysia's effort to "leap frog" into an industrialised country. However, there are several critical issues in the development of the industry including delayed industrialisation, low indigenous

technology, problems of raw material, market concentration and the preponderance of small scale firms in the industry. The high involvement of small scale firms in the industry reflects the low entry barriers of the industry; firms with low capital can easily enter the industry. SMIs have played an important role in Malaysia's economic development including employment creation, savings mobilisation and equity participation. However, the SMIs face marketing, labour, technology and capital problem which prevent them from realising their full potential. Realising the importance of SMIs, the government and private sectors have established various programmes to provide marketing, financial, training and technological assistance to them. In theory, then, there is no lack of support to the SMIs. However, we doubt whether the tiny and small scale *Bumiputera* entrepreneurs have been able to benefit from these support programmes.

CHAPTER THREE

THEORETICAL BACKGROUND

3. Introduction

In this chapter, we will discuss in detail the main theoretical approaches used in this study. The chapter begins with an introduction to the different types of innovation. This will be followed by a discussion of various theoretical approaches used to explain innovation decisions in an organisation. This lays the theoretical foundation for our analysis of the influences on technology innovation decisions among small scale *Bumiputera* firms in the food processing industry in Malaysia.

3.1 Innovation: A Brief Introduction

A review of the literature reveals that there are various definitions of innovation, suggesting the ambiguity of the concept. Like Beimans (1992), we recognise that there is no single agreed definition of the term. Based on our review of the literature, we can define innovation based on three different concepts: (a) a "new item" itself (b) the process of adopting the "new item", (c) the process of developing the "new item",

(a) Innovation as a *`new item itself'*

According to Beimans (1992), innovation refers to "the item itself that has been invented" and regarded as new to the adopting unit. In this definition, innovation is viewed as an **outcome of a process**, that is the new item itself

(Beimans 1992:7; Rogers and Shoemaker 1971; Rogers 1983:11; Zaltman *et.al* 1973:10). Hannan and McDowell (1984), Mahajan *et. al* (1990), Masterson and Hayward (1979) and Damanpour (1991) have adopted this concept of innovation in their studies). The newness of the innovation is from the point of view of the potential adopter, and it may not be new to the world (Rogers and Shoemaker 1971). The new item is either new equipment for a production process, which is process innovation, or a new product produced, which is production innovation (see below).

(b) Innovation as a *`process of adopting new item'*

The second perspective views innovation as the process whereby the new item is adopted, and thus implemented by the adopting unit- organisation. Innovation is defined as the process of adopting of ideas, knowledge or techniques that are `new' to the adopting organisation (Aiken and Hage, 1971; Damanpour 1991, 1990; Herbig and Kramer 1993). If an entrepreneur discovers some knowledge, information or techniques which he or she perceives as "new" and "useful" to his or her firm and introduces those discoveries in his or her business, then innovation has taken place in that firm.

(c) Innovation as the *`process of developing the new item'*

Innovation in this category refers to the creative and development process that result in something new. In other words, innovation is viewed as a process which links together numerous activities of which the ultimate objectives are the creation of new products (Bradbury 1989, Nystrom and Edvarsson 1982). In this concept, innovation is defined from the perspective of the developing units, such as organisation which produce a new product for the market.

Some writers differentiated innovation into various types, such as *technological, administrative*[1] *and ancillary*[2] (Damanpour 1987, 1990; West and Farr 1990). Technological innovation is concerned with the use of knowledge for the creation and implementation of new technologies. It occurs in the technical system of an organisation and is directly related to the primary work activity of the organisation. It may take the form of either a product or process innovation. Holt (1983) classified product innovation into three categories, namely: (a) products new to the market, (b) products new to the company, and (c) improved company products. Process innovation involves the introduction of new elements (such as input materials, task specification, work and information flow mechanisms, new equipment) into a firm's production or service operation (Damanpour 1991; Utterback and Abernathy 1975). The development of process innovation toward improved output productivity often leads to capital intensiveness, improvement in labour productivity and larger product scale. Thus, it is always associated with performance improvement.

A review of the literature reveals that small firms as well as large are capable of innovative behaviour; it can be in the form of simple imitation, invention or radical innovation. However, it is widely accepted (e.g. Santarelli and Sterlacchini 1990) that the manner of innovation tends to differ between firms of different sizes. They showed that small firms tend to carry out their innovative activities without specific financial resources and formalised procedure. Unlike large firms, small firms are often organised along informal structures based on family business. Studies in Malaysian small firms (UKM 1990) have shown that

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[1] It occurs in the social system of an organisation. Examples of this type of innovation is the implementation of a new way of recruiting workers or employee performances appraisal. It comprises innovations in organisational structure and administrative processes.

[2] (Damanpour 1990: 127) defined Ancillary innovation, as organisation-environment boundary innovation. Such innovations go beyond the traditional function of an organisation.

the majority of small firms do not have specific plans or budget allocations for technology adoption, suggesting their lack of attention to such matters.

There are also differences in the type of innovation chosen. According to Dewar and Dutton (1986), Ettlie (1983), Ettlie *et. al* (1984), Harvey *et al.* (1992) and Meredith (1987), SSIs are more likely to adopt **incremental** rather than **radical**[3] innovation, because they have fewer financial and technological resources compared to LSIs. This explains why they are very selective in their investment decisions; scrutinising any investment, and evaluating its compatibility with existing equipment, cost effectiveness, feasibility and risks. By adopting incremental innovation, SSIs can maximise the benefits and minimise the cost from their limited financial resources.

Overall, it is widely accepted that LSIs are more innovative than SSIs as reflected by the number of innovations that have been made. The LSIs can reap the benefits of economies of scale, and have comparative advantages in terms of financial and technological resources. SSIs, however, have behavioural advantages (such as entrepreneurial dynamism, internal flexibility and responsiveness to changing circumstances) which make them responsive to innovative activities (Fiegenbaum and Karnani 1991; Rothwell 1989,1984). SSIs have the ability to respond quickly to changing market requirements because of their less formal management style. Regarding the source of innovation, it appears that SSIs are mostly engaged in informal innovative activities in contrast with the systematic research and development (R & D) activities within structured laboratories which are normally carried out by LSIs (Santarelli and Sterlacchini 1990; Variyam and Kraybill 1993).

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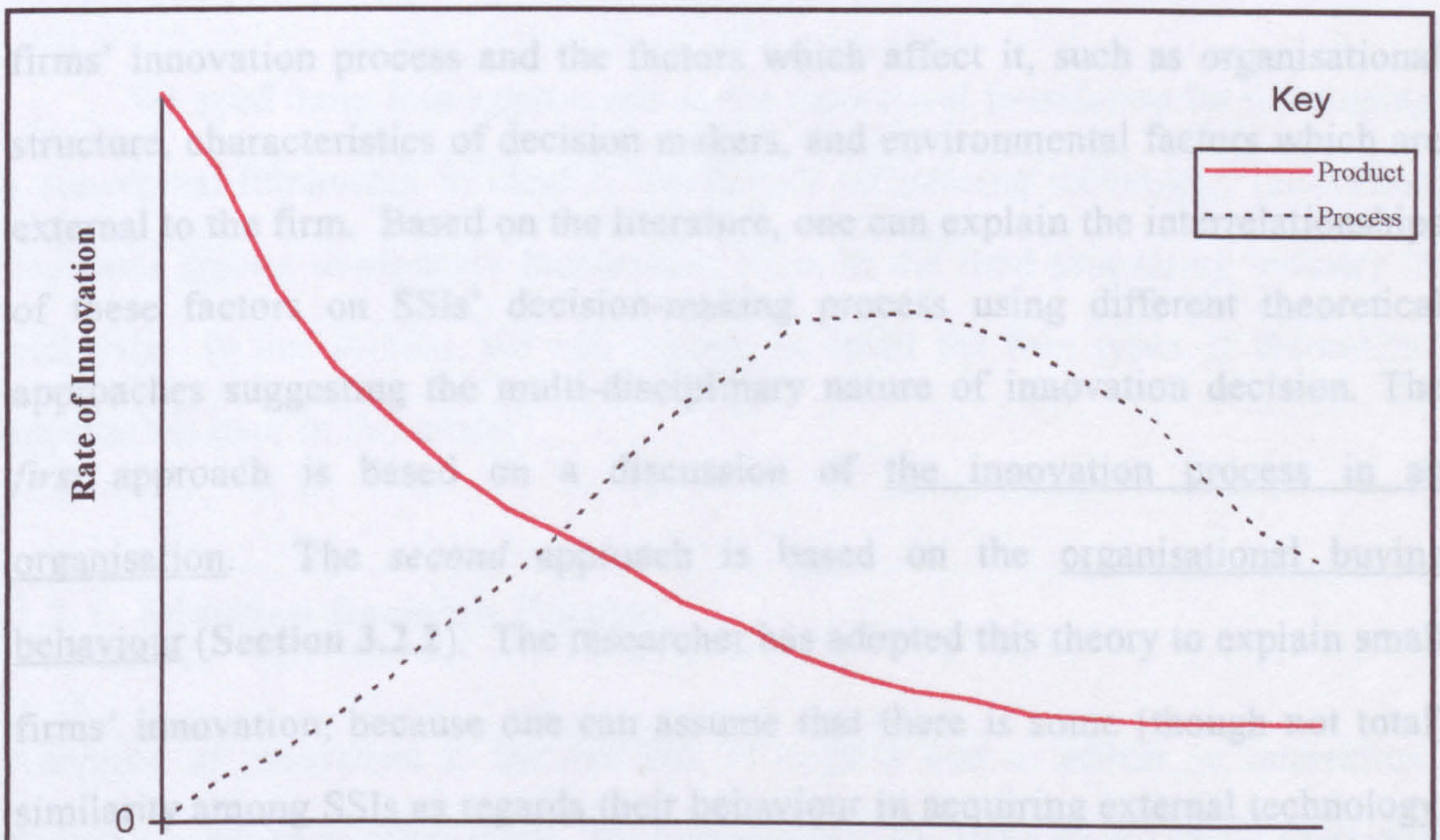
[3] West and Farr (1990) define radical innovation as something very different from what a organisation has done before. It is more disruptive than incremental innovation and requires more change within the organisation

The rate of process and product innovation in a firm is a function of its current stage of product development (Butler 1988; Utterback and Abernathy 1975). Product development can be classified into three stages, namely, ***uncoordinated***, ***segmented*** and ***systemic***. The relationship between rate of innovation and product development is exhibited in **Figure 3.1**. The figure shows that the rate of product innovation is higher at the uncoordinated stage, while process innovation is higher at the segmented stage. Both types of innovation decline in the systemic stage. One can explain this relationship as follows. At the **uncoordinated stage**, competition is often based on product performance. The production process at this stage is less standardised, which means that firms can easily change their products and compete.

Figure 3.1: Product and Process Innovation



Source: Adapted from Utterback and Abernathy (1975)

By the time the firm enters the **segmented stage**, the nature of competition has changed. To stay competitive, the firm needs to differentiate its products and increase production; one way to do this is to improve existing technological capabilities though process innovation. At the **systemic stage,** the rate of product and process innovation is lower, because cost minimisation is the main goal of the firm. Utterback and Abernathy (1975) hypothesised that firms at the **uncoordinated stage** are relatively smaller than those at the **segmented** and *systemic stages.* In the following sections, we shall discuss some of the theoretical approaches used in this study to explain innovation decisions.

3.2 Theoretical Approaches

In order to understand entrepreneurs' innovation decisions, we must first examine firms' innovation process and the factors which affect it, such as organisational structure, characteristics of decision makers, and environmental factors which are external to the firm. Based on the literature, one can explain the interrelationships of these factors on SSIs' decision-making process using different theoretical approaches suggesting the multi-disciplinary nature of innovation decision. The *first* approach is based on a discussion of the innovation process in an organisation. The *second* approach is based on the organisational buying behaviour (**Section 3.2.2**). The researcher has adopted this theory to explain small firms' innovation, because one can assume that there is some (though not total) similarity among SSIs as regards their behaviour in acquiring external technology, and the way an organisation purchases new products. For example, when an organisation buys something new, then innovation has taken place in that organisation. In SSIs, a process innovation may be considered to have taken place when they buy new machinery for the purpose of production. It is reasonable to

think that the organisational buying behaviour theory is useful in explaining SSIs' innovation decisions.

In order to understand the process involved in firms' innovation, it is useful to examine their decision process, which is affected by their organisational structure and the entrepreneur's role in an organisation. It is these two factors which distinguish the decision making process of SSIs from that of LSIs. In this study we use **firms decision theory** to explain how these two factors affect the innovation decision and process. (**Section 3.2.3**)

In small firms, entrepreneurs are the major decision making unit. It is reasonable to think that their personalities have some influence on their decision making and management strategies. To understand further how these factors are interrelated, we base our discussion on the theoretical argument forwarded by the **personality theory**. (**Section 3.2.5**)

We used these four approaches as the theoretical foundation for developing a conceptual framework to identify the factors influencing technology innovation decisions among small-scale *Bumiputera* firms in the food processing industry in Malaysia. In this section, we will discuss in detail the four types of theoretical approaches used in this study.

3.2.1 Adoption Decision Process

Adoption of innovation is the decision to acquire and to utilise an innovation. Before any adoption takes place, the entrepreneur has to be aware of the existence and function of the innovation. Only then can the appropriateness of the innovation to the organisation be determined. It is this exposure which will shape the entrepreneur's innovation decision. Rogers (1962, 1983), Rogers and Shoemaker (1971), divided the innovation adoption process into five stages; (a)

knowledge or awareness, (b) interest or persuasion, (c) evaluation or decision, (d) trial and implementation, and (e) confirmation or adoption. Time taken in the decision making process and the outcome of the decision are dependent on the various factors that influence the decision making process at each of these five stages.

The knowledge or awareness stage; is the stage when decision makers start to realise the existence of a particular innovation. At this stage, it is the entrepreneur's characteristics which determine the timing and types of information obtained. According to Rogers and Shoemaker (1971) and Rogers (1983), entrepreneurs who know earlier about the innovation and those who obtain most information on innovation have the following characteristics; they are better educated, have higher social status, better exposure to the mass media and interpersonal channels of communication, have more chances of agent contact, have higher social participation and are more cosmopolitan.

At the persuasion stage, decision makers form a favourable or unfavourable attitude toward the innovation. At this stage they start to develop interest in the innovation and actively seek information about it. In order to develop a favourable or unfavourable attitude toward the innovation, they visualise the applicability of the new idea to their present situation and anticipate future outcome if innovation takes place. Since innovation involves some degree of uncertainty, decision makers are motivated to seek more information on the innovation to reduce uncertainty about the innovation's expected consequences. The information obtained influences the decision maker's perception of the relative advantage, compatibility and complexity of the innovation.

The *third* stage in Roger and Shoemaker's framework, is the decision stage. It is at this stage that decisions are made. To cope with the uncertainty of

the innovation, decision makers may try out the new idea first before confirming their decision, though not all have the chance to do so.

The stage when an individual puts the innovation into practice is called the implementation stage. At this stage, a certain degree of uncertainty about the expected consequences of the innovation still exists. Questions on unexpected consequences such as incompatibility and operational problems may arise. These problems of implementation may be likely to occur when the decision makers and the implementors are different sets of people. Implementation problems can also occur when the decision maker has incomplete information on the innovation.

At the confirmation stage, decision makers seek reinforcement for the innovation decision already made. If they face conflicts about the innovation, they may decide to reject it, even after having had previously adopted it.

While Rogers and Shoemaker's theory may seem relevant to discussing the stages in the innovation decision, however, there is one drawback which compromises its applicability to our study. In our opinion, this theory assumes that innovation decisions always occur in phases or as a linear evolutionary process. What this theory fails to recognise is that decisions are made continuously and there is often overlap between one stage and another. Furthermore, this theory assumes that everyone has similar access to information and technology; it does not take into account the presence of market imperfections, such as subsidies and biases in government's policies towards certain communities or sectors.

One of the important predictors of adoption decision is the characteristic of the innovation itself (Down and Mohr 1976; Fichman and Kemerer 1993; Rogers 1983; Prescott 1995; Prescott and Conger 1995). Masterson and Hayward (1979) classified the characteristic of the innovation as traditional or non-traditional, while Dewar and Dutton (1986), Ettlie (1983) and Meredith (1987) classified innovation into two types, incremental or radical. Traditional or incremental

innovation involves a relatively lower technological advancement. Its cost is normally lower and firms can easily adopt it without having to make much adjustment to their existing production system. In contrast, the non-traditional or radical innovation involves considerable technological advancement, with a higher innovation cost, and has the ability to bring larger economic returns, although the initial cost are normally higher. Unlike traditional or incremental innovations, non-traditional or radical ones have a relatively slower adoption rate.

Prescott and Conger (1995) and Rogers (1983) identified five characteristics of innovation which can affect the diffusion of innovation. According to Fichman and Kemerer (1993), these characteristics is also tailored somewhat to fit better the context of organisational adoption of complex technologies. The characteristics are: (a) relative advantage, (b) compatibility, (c) complexity, (d) trialability, and (e) observability. Chin and Ghopal (1995) added two more characteristics. They are ease of use and enjoyment. Dewees and Hawkers (1988) recategorised relative advantage into two categories; namely economic advantage and other advantage. They also identify ease of use, compatibility and trialability as characteristics of the innovation in their study. In addition to these characteristics they added three more namely, prestige, plasticity and perceived risks.

(a) <u>Relative Advantage</u>

Relative advantage is the degree to which an innovation is perceived as being better than the technique or idea it supersedes. The degree of relative advantage is often expressed in terms of economic profitability, status giving, and time saving. Time taken for the decision making process and the decision to innovate or reject innovation are determined by the importance of each type of relative advantage (for examples, economic or social) to the adopter. The characteristics of

the potential adopters also affect which dimensions of relative advantage are most important.

One of the important motivations for almost any entrepreneur to adopt an innovation is the desire to achieve better economic performance (Chin and Ghopal 1995; Dimnik and Johnston 1993; Premkumar and Potter 1995; Prescott and Conger 1995; Rogers, 1983). Entrepreneurs will innovate if they feel that it will improve their economic returns and efficiency or increase their ability to capture bigger market shares. However, not all entrepreneurs are motivated by economic factors. Some entrepreneurs innovate because of the social status associated with such decisions. There is a relationship between relative advantage and rate of adoption. When individuals pass through the innovation-decision process, they are motivated to seek information in order to decrease uncertainty about the relative advantage of an innovation. Potential adopters want to know the degree to which the innovation is better than an existing one. So relative advantage is often the most important factor considered for innovation, and information search is normally related to this aspect. There are a number of sub-dimensions of relative advantage, about which potential adopters normally inquire, such as the degree of economic profitability, level of initial cost, degree of comfort and time saving, which Dewees and Hawkes (1988) categorised as "other advantages".

(b) <u>Compatibility</u>

Compatibility is the degree to which an innovation is perceived as consistent with the existing condition, past experiences, and needs of potential adopters. The degree of compatibility is influenced by the social, cultural and economic factors held by the potential adopter. From experience, we learn that old ideas are the main tools with which new ideas are assessed. The decision to innovate is, therefore, affected by the old system that it replaces or supplements. However, not

all compatible innovations are adopted. For example, if a new idea is completely congruent with existing practices, it may not be adopted because the potential adopter is unable to distinguish the benefit derived from the introduction of the new innovation. A positive experience with previous innovation can also have a positive effect on the adoption decision. Those who have experienced success in innovation are more likely to adopt innovations, compared to those who have experienced failure.

(c) Complexity

Potential adopters' decisions are also influenced by their perception of the complexity of a particular innovation. Complexity is associated with the degree of difficulty in understanding the function and use of the innovation, as perceived by the potential adopter. Firms which do not have skilled employees to operate an innovation may reject it.

(d) Trialability

Trialability is the degree to which an innovation may be used temporarily by the potential adopters before their commitment to adopt. Trialability can speed up the rate of innovation. Trialability is very important as the basis of decision-making for early adopters compared to late adopters. This is because they have no precedent to follow when they adopt, while late adopters have the opportunity to witness those who have already adopted the innovation before them.

(e) Observability

According to Rogers (1983:232), observability is the degree to which the results of an innovation are visible to others. The results of some innovations can be easily observed by potential adopters, and communicated to others, while others

can not. The observability of an innovation has some effect on potential adopters' decision to adopt the innovation.

(f) Ease of Used

Chin and Ghopal (1995) and Davis (1989) defined ease of use as the degree to which a person believes that using an innovation would be free of effort. In other words the innovation is simple to use. In their study, they found that enjoyment is positively correlated to the rate of adoption.

(g) Enjoyment

Chin and Ghopal (1995) defined enjoyment as the extent to which the activity of using the innovation is perceived as enjoyable, irrespective of its performance.

(h) Prestige

Dewees and Hawkers (1988) defined prestige as the degree in which an innovation is perceived to change adopters' level of prestige and admiration within their community. They showed that prestige is positively correlated to the rate of adoption.

(i) Plasticity

An innovation has plasticity when it is perceived to be adaptable to the potential situation (Dewees and Hawkers 1988). Besides fulfilling the current aim of the potential adopter in innovating, the innovation with this characteristic can also be used for other purposes. Plasticity is positively correlated to the rate of adoption.

(j) Perceived Risk

Perceived risk is defined as the degree to which the innovation is perceived to be economically or personally risky to the potential adopter (Dewees and Hawkers, 1988). The perceived risk is negatively correlated to the rate of adoption.

Other than the characteristics of the innovation, the adopter's competitive environment is one of the important predictors of adoption decisions (Acs and Audretsch 1988; Gatignon and Robertson 1989). Studies show that firms with greater concentration ratio will be more likely to adopt an innovation, which they use as a competitive tool.

3.2.2 Organisational Buying Behaviour

In this section, we shall discuss the second theoretical approach used in this study: the organisational buying behaviour. We use this theoretical approach to understand the different stages in the organisational buying process and factors influencing organisational buying behaviour.

The theory of organisational behaviour is often used in the study of large organisations, with a multilevel management hierarchy and various departments of specialised function. We recognise that SSIs do not have similar structures to LSIs. However, there is reason to believe that their innovation decision is similar; that is to "buy" either a product (in the case of an organisation) or technology (in the case of SSIs).

3.2.2.1 Stages in Organisational Buying Process

Previous researchers such as Bradley (1977), Ozanne and Churchill (1971), Rogers (1983) and Wind (1978) have developed various models to illustrate the

organisational buying process. These models vary in their complexity from only four stages (Bradley 1977) to twelve stages (Wind 1978). This variation exists because the models were developed to accommodate variations of organisation type, structure, product and buying situation. Although different stages have been proposed by researchers to describe organisational buying process, these stages can be simplified and recategorised into five stages equivalent to the stages in the adoption innovation process described by Rogers and Shoemaker (1971) and Rogers (1962, 1983). These five stages are (a) identification of problems and needs of the organisation, (b) development of interest in the objects intended for purchase and search for other alternatives to make comparisons, (c) evaluation of alternatives, searching for suppliers, and negotiations, (d) making the decision to buy or confirming on the selection of technology and trying it, if possible, and lastly (e) the adoption or usage of the technology bought.

Unlike the adoption innovation process, the organisational buying process has two additional elements, namely (a) the search for alternatives to the intended technology, and (b) the search and selection of suppliers of the selected technology. These two elements are included in the process because the theory assumes that the innovation needs come from the organisation and there is more than one way of innovating and sourcing information.

The first stage is the identification of organisational problems and needs to solve the problems. This may lead to recognition of a need of innovation and search for the environment of that particular innovation (buying situation). Organisational problems and needs stimulate decision makers to purchase the kind of technology that matches the innovation environment, solves their problems, and fulfils the needs of the organisation. At this stage, decision makers are already aware of the existence of the technology which they intend to purchase.

The second stage is when entrepreneurs or decision makers develop an interest in the technology, searching for information about it, while at the same time searching for other alternatives. The decision to buy can be viewed as a decision under uncertainty which involves risk. As such, decision makers' buying behaviour may be looked at as risk handling behaviour (Newall 1977). The search for alternatives is one way by which the decision makers reduce their uncertainty and perceived risks.

The third stage is when the decision maker evaluates the technology considered and its alternatives by comparing the alternatives available. At this stage, the characteristics of the technology and suppliers are important determinants in the process of comparing the alternatives. Technology attributes are important factors examined by decision makers in their selection process. Here lies the importance of the role of suppliers, on whom the object's trialability and observability largely depends. Decision makers are more likely to select suppliers that provide them with the best service. There is also reason to believe that entrepreneurs have some feeling of loyalty toward certain suppliers. The relationship between entrepreneurs and suppliers may even be the determining factors in selecting the technology supplier.

At the fourth stage, entrepreneurs or decision makers make the choice of which type of technology to buy and choose a supplier. Depending on the supplier or the technology, some entrepreneurs have the opportunity to use the technology on a trial basis before confirmation of purchase. Entrepreneurs who do not have the opportunity to try the technology will rely on the experience of others who are currently using it.

The last stage is when entrepreneurs make the final decision whether to buy or reject the technology. Those who decide to buy the technology will start

using it, while others may change their mind; at this point the whole buying process may start all over again.

3.2.2.2 *Factors Affecting Organisational Buying Behaviour*

Time taken for the overall buying process of an organisation is affected by various factors. Wind and Thomas (1980:243-245) have recategorised the factors that affect the organisational buying process, identified by previous researchers into two sets of factors; (a) the buying situation, and (b) the idiosyncratic personal, interpersonal, organisational, and environmental conditions.

Different decision processes and different sets of decision making unit are followed according to their *buying situations*. The buying situation can be looked at in term of the intensity of the need and purpose of the purchase (Kennedy 1982; Wind and Thomas 1980) and familiarity of the participant in the buying process with the technology under consideration (Robinson and Wind (1980) as quoted by Parkinson and Baker 1986). The buying situation determines the amount of information required by the decision maker (Anderson *et al.* 1987; Bunn 1993). If the purchase of technology is to achieve a new major task, such as making a new production line (radical innovation) then intensive problem solving is necessary and more information and more sophisticated evaluation techniques are needed of before the final decision. Hence, time taken for the decision to buy is longer. If the purchase of the technology is just casual, routine (repeat of a previous purchase) or an extension or modification of a previous purchase, then the decision process become less complicated (Bunn 1993). For such purchase, less information searching is required because the organisation already has most of the information on the technology. Parkinson and Baker (1986) suggest the buying situation will vary according to the type of technology, its requirement and its perceived importance, cost, its standardisation and complexity. The buying

process is also affected by the decision-maker's perception of the importance of the technology, its installation cost and degree of complexity. We believe that the buying situation affects the overall buying decision process, such as the different information needs, level of risk and propensity to search for suppliers.

Above, we have seen the importance of communication in the buying situation of an organisation. According to Moriarty and Spekman (1984), in an organisational buying process there are four sources of information. They are (a) personal commercial such as salespersons, (b) personal non-commercial such as colleagues, (c) impersonal commercial such as publications and (d) impersonal non-commercial, such as trade associations. Their work shows that the characteristics of the buying situation, organisational characteristics, individual characteristics and phases in the decision process are the determining factors that influence the usage of these sources of information.

The second set of factors which influence an organisation's decision process includes personal factors, decision-makers' personal characteristics, interpersonal relationships, and organisational characteristics. The **personal factors** include individual background, job responsibilities, perceived risk, education and experience, all of which are often associated with the buyer's decision process (Kennedy 1982; Newall 1977). These factors have some influence on their leadership quality, confidence, attitude toward change, personality and communication behaviour.

Interpersonal factors, are those which are related to the relationship among decision makers, that between decision makers and implementors, and individual communication behaviour within firm. The influence of interpersonal factors on an organisation's buying process is more marked in larger firms. This is because interpersonal factors are related to the organisational structure. The relationship includes the extent to which the organisation is centralised in its

operations, its level of hierarchy of powers, division of labour and department's role, function and specialisation. Larger firms have a multi-level power hierarchy and departments with specific roles, suggesting that their buying decision process involves more than one department or more than one group of individuals. The relationships among individuals in a group and between groups will affect their buying decision process. These interpersonal relationships act as communication paths which can speed up or retard the buying process. Small firms generally have a simpler organisational structure, less level of management hierarchy, and a more centralised decision process; the entrepreneurs have more decision making power. For example, a sole proprietor's buying process will be less affected by interpersonal factors. For small firms which have more than one owner (partnership or private limited company) the decision making process is more complicated because decisions are made jointly by a group of individuals (share holders). Interpersonal relationships within this group of decision makers can affect the organisational buying decision.

Past researches have shown that **organisational characteristics** are important factors influencing an organisation's buying decisions. Among organisational characteristics which affect organisational buying decision are **organisational size** (Cainarca *et al.* 1990; Kimberly and Evanisko 1981; Link and Bozeman 1991; Mohr 1982), **centralisation** (Damanpour 1991; Hage and Aiken 1967; Khan and Manopichetwattana 1989; Rogers 1983; Ruppel and Harrington 1995; Zaltman *et al.* 1973, Zmud 1982), **complexity** (Hage and Aiken 1967; Kimberly and Evanisko 1981; Rogers 1983), **formalisation** (Damanpour 1991; Rogers 1983; Ruppel and Harrington 1995; Zaltman *et al.* 1973; Zmud 1982), **organisational slack** (Cyert and March 1992) and **specialisation** (Ruppel and Harrington 1995).

Kimberly and Evanisko (1981), Link and Bozeman, (1991) and Mohr (1982) found **organisational size** to be the best predictor of both technological

and administrative innovation in an organisation Small firms are less innovative compared to larger firms. Though larger firms have longer decision making process, they have the financial and technological resources to innovate.

Centralisation is the degree to which power and control in a system are concentrated in the hands of relatively few individuals at the top of the organisation hierarchy. Centralisation has usually been found to be negatively associated with decisions to buy in an organisation (innovativeness), because centralisation restricts the channels of communication, thus reducing the availability of information (Muchinksky 1993). Although the initiation of innovations in a centralised organisation is less frequent than in a decentralised organisation, the centralisation may actually encourage the implementation of innovations, once the innovation decision is made (Khan and Manopichetwattana 1989; Rogers 1983).

Complexity is the degree of knowledge and expertise in members of an organisation. It is usually measured by the number of professionals and trained personnel in an organisation. Complexity encourages organisational members to conceive and propose innovations, but it may make it difficult to achieve consensus about implementing them (Rogers, 1983).

Formalisation is the degree to which an organisation emphasises following rules and procedures in the role performance of its members. Such formalisation acts to inhibit consideration of innovations by organisation members, but encourages implementation of innovations.

Organisational slack is the degree to which uncommitted resources are available to an organisation. It is the difference between total resources and total necessary payment required to maintain the firm (Cyert and March 1992: 41). Organisational slack is used as a cushion in the case of unfavourable conditions

within or external to the organisation. Slack resources allow an organisation to purchase innovation, absorb failure, and explore ideas that lead to an innovation.

The results of previous studies of organisational innovativeness, reveal rather low correlation between organisational structure (independent variables) and the level of innovativeness in the organisations. The basic reason for these results is that each of the organisational structure variables is related to innovation in one direction during initiation, and in the opposite direction during implementation. Low centralisation, high complexity, and low formalisation facilitates initiation in the innovation process, but these same structural characteristics make it difficult for an organisation to implement an innovation (Zaltman *et al.* 1973).

Degree of **specialisation** is the number of different job specialisation found in the organisation. Ruppel and Harrington (1995) believed that high degree of specialisation is related to a broader level of expertise, the cross-fertilisation of ideas, and the ability of the potential adopter to adopt an innovation.

Other than the factors mentioned above, Wind and Thomas (1980) suggested that other factors such as marketing, competition and environment should be included in establishing comprehensive studies of organisational buying behaviour. Parkinson and Baker (1986) responded to Wind and Thomas's (1980) suggestion by including environmental factors, such as the structure of the market, nature of competition, governmental intervention and changes in technology, in modelling influences on the buying process.

One of the reasons for increasing production in any firm is to accommodate the increase in product demand. To increase production, firms have to increase production rate by adopting new production techniques. The intensity of competition among firms also leads to a firm adopting new technology. Increased competition acts as a serious threat to firms, especially small firms, because it

affects their market share. Changes in competitive environment may make process technology obsolete (Hughes 1984). Hence, competition among firms is among the effective stimuli in the decision to buy new technology. The adoption of new technology is also affected by market impact and the need to satisfy existing or additional customers. The market impact may be to the extent of gaining a non adopter's market share. Competitive pressure faced by non adopters is affected by the strategies of adopters. In order to be competitive, non adopters will follow adopters in improving their products by adopting new technology.

There are various ways in which government policies can influence the buying behaviour of a firm. For example, a government trade policy which increases the cost of capital equipment can affect the buying rate of new technologies. Increases in interest rates may induce firms to undertake additional technical efforts in order to simplify or standardise their product design, reduce handling time, or improve management of inventories, with the purpose of shortening the duration of the production cycle (Copley 1990). Government fiscal and monetary policy has an immediate and obvious impact for the demand of firms' product, and hence, their decision to invest (Parkinson and Baker 1986).

The theory of organisational buying behaviour explains the buying decision process in organisations with complex structure and multi-level management hierarchy. However, this theory can also be applied to small firms' buying decision process, although small firms have a rather more simple organisational structure. Unlike large organisations, where different units and different management levels perform different functions, in small firms, decision makers, implementors and sometimes users are the same set of people. There may be a distinction between details of the decision making process of small firms and large organisation, but the factors influencing the buying decision in either type of firms should be the same. Individual characteristics, interpersonal characteristics, organisational characteristics, inter-organisational characteristics, the buying

situation and the environment are believed to have effects on small firms' buying decisions. These factors should be analysed in order to identify the determining factors that influence small firms to adopt an innovation.

3.2.3 Decision Theory of Firms

The third theoretical approach used in this study is the **decision theory of firms**. One strand of such theory is based on the rational model, which views decision making as a process involving the identification of goals, alternatives, and evaluation techniques. One decision maker's decision will be different from another's because he perceives the situation differently, or has different goals, or a different set of alternatives, or weighs the alternatives differently. This model can be represented in mathematical form by loading all values into a single function called the utility function. The development of the rational model is based on several assumptions. *First*, it assumes that a decision maker has a well-defined utility function, and hence that he can attach a cardinal numerical value to his liking of any particular scenario of events over the future. *Second*, it assumes that the decision maker is confronted with a well-defined set of alternatives from which to choose. These alternatives need not be one-time choices, but may involve sequences of choices or strategies in which each subchoice will be made only at a specified time using the information available at that time. *Third*, it assumes that the decision maker can assign a consistent joint probability distribution to all future sets of events. *Finally*, it assumes that the decision maker will (or should) choose the alternative, or the strategy that will maximise the expected value, in terms of his utility function, of the set of events consequent on the strategy. With each strategy, then, is associated a probability distribution of future scenarios that can used to weight the utilities of those scenarios (Harrison 1987; Simon 1988, 1959, 1955).

The decision process generally follows some or all of the following stages: (a) recognising opportunities based on complete information on environment; (b) diagnosis of a problem which is defined in terms of the objectives of the decision maker; (c) search for information on possible solutions; (d) creating possible solutions to the problem; (e) evaluation of possible solution; (f) choosing the optimal solution according to prior objectives; and (g) implementation of the solution (Butler 1991: 43). This model pictures decision makers as highly alert human beings who are very clear about their objectives. The decision makers are assumed to have **complete information** on their environment as a basis for making decisions. They understand and have knowledge of all alternative choices open to them, both at the present and future. They understand the consequences of each of the available choice strategies, at least up to the point of being able to assign a joint probability distribution to the future states of the world. They are able to select the alternative that will optimise utility.

In traditional economics, rationality is related to maximisation. The economic rational man is one who can maximise her or his utility. A related but not quite equivalent postulate of traditional economics is that the goal of firms is to maximise profit. The theory assumes that entrepreneurs are rational and they will select alternatives to obtain optimal solutions for goal achievement. When the rational model is applied in the theory of firms, it is assumed that entrepreneurs and firms have similar objectives, that is, to maximise profit and that firms operate with perfect knowledge. In our view, there are some weaknesses in this model, which compromise its applicability.

One critique of the rational model is that it is normative in nature. It explains how a decision maker should make decisions in order to achieve a particular goal, but it does not explain the actual decision process; it is more concerned with prescribing the stages a decision maker needs to follow to obtain

an optimal solution to his or her problem. There is a lack of evidence to show that the human decision process actually goes through these complex stages. The accuracy of this model also depends on the accuracy of the approximating assumptions and the data supporting them (Simon 1986a, 1986b). There is a strong possibility that the actual decision process is quite different from that described by rational model (Mohr 1982). Indeed, Nutt (1984) found that managers do not use the normative methods prescribed by scholars of good decision making.

According to Simon (1959), who developed the satisficing model, the aim of decision makers, in fact, is not the selection of the alternative which will yield an optimal solution, but rather, the search for a solution which is satisfactory at the time. The element of satisfaction embedded in the firm decision theory is influenced by psychological theories which see motivation to act as influenced by drives, and suggest that action will terminate when these drives are satisfied. The condition of satisfaction is not fixed but specified by an aspiration level that itself adjusts upward or downward on the basis of experience.

The rational model assumes that decision makers have full information to make decisions. In most circumstances, however, decision makers need to make decision with incomplete information, under pressure of time and other constraints. Obtaining full information on alternatives as a basis on which to make a decision is rare, because there are constraints on the information-processing capacities of the decision maker[4].

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[4] Simon (1959) proposed that although people makes decisions to pursue their own interests, they do not always know what these are; they are aware of only a few of all the possible alternatives, and are willing to settle for an adequate solution in contrast to an optimal one.

Another basic assumption of the rational model is that the decision maker has a well-defined utility function which can be measured. The development of the utility function in the decision process seems too good to be true. Naylor *et al.* (1984; 326) mentioned that 'Economists and management scientists do not know how to come up with an objective measure of utility for individual decision makers. In spite of the vast literature available on the use of utility theory for decision making under risk, we do not know of a single case in which a major corporate decision has been made where the decision maker's utility function was specified and quantified. The techniques which have been proposed in the literature for quantifying are impossible to implement in the real world. They are based either on information that is not available or information that can be obtained only at an inordinate cost in terms of the decision maker's time. In summary, utility theory is an abstract concept of limited practice value'.

3.2.3.1 *The goal of entrepreneurs*

To explain the decision process of an entrepreneur, first, we have to identify the goal of the entrepreneurs. As we have seen, according to the rational model, the goal of entrepreneurs is to maximise profit. When entrepreneurs make a decision to achieve their goal (to maximise profit), they have complete information on the alternatives available to them or him and on the likely outcome of each alternative, as a basis for decision making. The rational model appears to assume that profit maximisation is the sole goal of entrepreneurs and all decision or actions taken by them are directed toward achieving that particular goal. However, entrepreneurs, like anyone else also have personal motives (such as social responsibility). Profit maximisation may be only one of a number of considerations. Monetary return may not be the only objective of an entrepreneur. So when entrepreneurs want to maximise their utility, they sometimes have to balance profit against non-monetary objectives. According to

Simon (1959: 263), the actual motive of an entrepreneur is not to maximise profit but to earn a return at a satisfactory level.

Scitovsky as cited by White (1960: 187) showed that entrepreneurs' choice between "more and less activity" or between "more income or more leisure" are independent of their income. That is, their motivation to increase profit does not depend on their current income. This point raises a question about the effectiveness of profit as entrepreneurial motivation.

Rothschild (1947) as cited by Cyert and March (1992:9), has suggested that the primary motive of the entrepreneur is long term survival. According to this view, the aim is to maximise the security level of the organisation (i.e, the probability that the organisation will survive over the indefinite future). According to Rothschild, the long term aim of entrepreneurs is to stay in business. Since entrepreneurs are operating in an uncertain situation, they have a limited number of options from which to choose at any one time. In their attempt to play safe, it is not surprising that they adopt a set of yardsticks that promise reasonably satisfactory profits in the long run and a maximum of stability in relations with customers, suppliers and competitors (Curwen 1976: 136). This suggests that entrepreneurs are likely to adopt the principle of satisfactory profit rather than profit maximisation.

3.2.3.2 *The objectives of firms*

.The objectives of a firm supply the value premises that underlie decision making within it. Value premises are assumptions about what ends are preferred. The objective of a firm is the ultimate yardstick by which the managerial decision and the outcome will be judged. According to the rational model, the objective of a firm is the same as the goal of its entrepreneur; that is to maximise profit

(Douglas and Callan 1992). Therefore any policies or management strategies adopted by a firm are directed toward achieving maximum profit.

The assumption that firms' goal is to maximise profit has however, been criticised by Cyert and March (1992), Drucker (1954) as cited by White (1960), Simon (1959), and Seth and Thomas (1994). *First*, it is not clear in theory which profit (short-run or long-run) is to be maximised. *Secondly*, organisational objectives grow out of interaction among the various participants in the organisation This interaction produces a 'general preference function'. This general function may not be profit maximisation. *Thirdly*, in the common situation where the equity owner of firms and their executives are separate, the executives may not be motivated to maximise profit. *Lastly*, where there is imperfect competition among firms, maximising is an ambiguous goal, for what action is optimal for one firm depends on the actions of the other firms.

Peter Drucker (1954) as cited by White (1960: 187) stated that "the guiding principle of business economics ... is not the maximisation of profit: it is the avoidance of loss". According to Drucker, there is a minimum level of profit for each firm which is vital to its survival, but this does not imply a compulsion to maximise profit.

If one was to elaborate on this issue, one would find that the minimum profit targeted by firms is motivated by drives as explained by Simon (1959). Satisfaction will be achieved once a firm has managed to obtain above the minimum level of profit. From this elaboration, one could see that there is a parallelism between the *'avoidance of loss'* put forward by Drucker and Simon's concept of *'satisficing'*. Satisfactory profits represent a level of aspiration that the firm uses to evaluate alternative policies. The aspiration level may change over time. If we use the satisficing model to explain decision theory of firms, then it is

believed that firms' goal is not to maximise profit, but rather, to achieve a level of performance that satisfies the entrepreneurs or shareholders.

3.2.3.3 *The Decision Process of Entrepreneurs/Managers*

As has mentioned earlier, in classical economics decision theory of firms is based on the rational model, whereby it is assumed that the firm's goal is to maximise profit and decisions (operation of firms) are made on the basis of complete information. This traditional theory assumes that need, information and the available body of knowledge are given and unchangeable. They are independent of one another and of the action of firms. Another assumption in this traditional theory is that the decision process in a firm is not related to its structure. It fails to view the firm as an organisation (Cyert and March 1992: 11) and thus it neglects the internal organisation of the firm (Cleland 1960: 202) . In developing the theory of firms, classical economists are mainly interested in the market system and its resource allocation. It is the market environment rather than people in the organisation which is seem as limiting the firm's behaviour and constraining entrepreneurial decision making. This theory does not include organisational theory, as it assumes that the market will eventually destroy all firms that are not organised in the most efficient manner. This theory also contains no information theory, because it is assumed that, in a perfectly competitive society, the important pieces of information are known. It is assumed that entrepreneurs will organise their resources most efficiently in order to maximise profits. In this theory, therefore, to understand the decision making process of firms, one has to understand the market, not the firms themselves, because it is the market not the firm or people within it, which is considered to be the decision-making agent; the firm is considered as a passive reactor to market events, intent upon maximising profit.

The theory of management decision put forward by Cleland (1960) departs from this traditional theory. According to Cleland (1960: 208), this theory is built on three bases. *The first* is the external environment which provides real limits but which is also subject to countervailing pressure by the firm. *The second* is the internal organisational structure of the firm, which must be developed in order for the process of decision- making under conditions of uncertainty to be effective. *The third* is the communication system, which transmits information to and through the organisation. As well as demanding an understanding of how the market is organised, this theory also demands an understanding of how the firm is organised. Thus, entrepreneurs or managers, and not only the market, are key elements in the decision making process of a firm. This model emphasises that entrepreneurs or managers seek to control or influence the external forces (the product market and factor market) that had limit them. They wish to expand their field of choice and set of alternatives, while at the same time reducing the degree of uncertainty which they face (through the communication system which transmits information).

The managerial decision theory of firms assumes that wants, resources and the body of knowledge are changeable and changing. They are not independent of one another and can be influenced by the action of firms. This theory also assumes that information is unorganised, distorted and full of noise and that the acquisition and dissemination of relevant information to the firm and within the firm is a problem that must be solved internally. The decision process of firms is determined by the organisational structure of the firm which in turn determines the information system.

The main difference between the managerial decision theory and traditional theory is in terms of firms' goals. The goal of the firm under this theory is satisficing, not maximising profit. If the firm wants to achieve a target rate of return on its investment, the decision maker may choose to raise product

price in response to the factor price, rather than engage in a substitution of factors as the traditional theory of the firm would require (Cleland 1960: 210). In other words, the decision process comes from within the firm, from the decision maker (entrepreneurs, shareholders or managers) and is not forced externally by the market. The decision process is affected by the role and personality of the decision makers, the characteristics of the firm (such as organisational structure), and the flow of information (communication), as well as external factors.

An 'open system model' which is translated from Simon's work provides a rationale which does not require specific goals, alternatives or evaluation technique (McKenney and Keen 1974: 80). It is rather a process where individuals organise the information they perceive in their environment and use it for decision strategies. In this model, problem solving and decision making are processes based on a mode of thought which can be classified along two dimensions, information gathering and information evaluation. Individuals differ in their method of information gathering as well as information evaluation. However, this mode of thought can be developed through training and experience. McKenny and Keen put forward a model of cognitive style based on the idea of open system, which includes problem finding, although the main focus of the model is on problem solving. The decision maker scans his environment and organises what he perceives. His efforts are as much geared to clarifying his values and intents as they are to dealing with redefined problems. In certain situations, some problems do force themselves on his awareness. But generally the decision maker has some discretion in the selection of problems to deal with and in the level of aspiration he sets for himself.

The open system perspective recognises that the activities of entrepreneurs are not only bounded by the constraints of their formal job, but also by the more informal traditions and expectations implicit in their role. The decision-making activity is strongly influenced by their perception of their position. When

entrepreneurs or decision makers face some event or cue in the environment that activates them into a search-analyse-evaluate sequence and this results in a solution, then a decision process has taken place. This search-analyse-evaluate sequence in the decision process is initiated according to entrepreneurs' environment assessment.

The cognitive style model provides some explanation of the process affecting entrepreneurs or decision makers in assessing their environment. It includes problem finding, problem recognition and problem definition, which is an important aspect of decision behaviour. Cognitive style relates to the characteristics of the decision makers (such as their personality traits), resulting in different individuals assessing their environment differently (Ghosh and Ray 1992; Harrison 1987; Kirton 1994).

The `social model' put forward by Cleland (1960) and the 'open system model' put forward by McKenny and Keen (1974) are based on satisficing motivation of firms, not profit maximisation as assumed in the rational model. The rationale of these models is based on 'sensitivities' to undefined elements in the environment. The social model of decision making, then, calls for managerial decision making to operate in an 'open system' seeking satisfactory rather than optimal solutions (Rice and Hamilton 1979).

3.2.4 Small Firms Decision Process: Theoretical Convergence

In the previous section we discussed various theories of firms' decision process. In this section, we shall attempt to integrate and adapt the discussed theories, to suggest the decision process of small firms.

The satisficing model is normally used in analysing decision behaviour of big firms or complex organisations where there is a separation between ownership and management. There is strong evidence that the interests of managers do not

always coincide with those of the stockholders. In some cases, managers' functional and personal goals are more important than profit maximisation. The rational decision model is unable to incorporate managers' or employees' motivation. It primarily rests on weak assumptions: that firms, stockholders and managers are one and the same, that managers behave in a manner consistent with the interest of stockholders and that they share a common goal, that is, to maximise profit.

In analysing the decision process of small firms one might argue that the rational model is more appropriate because owner and manager can not be regarded as two separate entities; thus, they have a common goal. Small business owners who are normally sole proprietors or partners are highly involved in the operations of their firms, and thus involved in different aspects and levels of the decision making process. Their personal and functional goals can be identified with the goals of the firms which are fully owned by them or of which they are the major shareholders (Birley and Westhead 1990). They regard business profit as their personal income; therefore, we can assume that they are motivated to maximise profit in order to increase their personal wealth. If these assumptions are true, there should be a relationship between the entrepreneur's motivation for more income and his present income. However, according to diminishing marginal utility theory, as wealth increases the marginal utility decreases. Therefore, at a certain level of income the entrepreneur will prefer leisure and motivation to increase income will become less important.

There are a number of points to be considered in developing a theory of decision making of small firms. Birley (1989, 1983) considered goals, market or product choice, resources and organisational structure to distinguish the decision making process of small firms from those of big firms. Sharma (1994) showed that the decision process of firms is affected by their culture. Small firms' culture, which is classified as *entrepreneurial-oriented*, involves uncoordinated

strategies in the decision making process. There are only few decision makers and the decision making process is very simple. d'Amboise and Muldowney (1988) suggested that one perspective that can be used to analyse management decision theory of small business is the theme of small business evolution. In other words, the decision process which is usually reflected in management practice is related to the firm's stage of growth, age and organisational structure (bearing in mind that one can deduce a firm's age, structure, goal, resources, market and product choice based on its stage of growth). If that is the case, then, the rational model is not appropriate to explain decision making in small firms, especially those at the existence, survival and growth stages[5]. At these stages, the main goal of the business is to remain alive, able to generate enough cash flow and to ensure business resources. Success in small business always means survival. Generally, in small firms, survival means that entrepreneurs are able to keep their business operating as long as they do not make a loss (refer to the work of Rothschild, as explained in section 3.2.3.1). Based on the above arguments, the satisficing model is more appropriate to describe small firms' goals. Therefore, if one is to explain small firms' decision process based on this theory, one might expect that small firms' goal is not profit maximisation, but rather, to achieve satisfactory economic performance in terms of, for example, attaining a certain level of profit, sales, or production. This view is supported by a variety of research on small business (Birley 1983; Rice and Hamilton 1979).

On the other hand, some may argue that in order to survive, entrepreneurs will try their best to maximise firms' profit. Therefore, there is not much distinction between survival and profit maximisation in explaining small firms'

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[5] Churchill and Lewis (1983), Scott and Bruce (1987) put forward five stages of growth in small business. The stages are existence, success, growth, expansion and maturity. As firms go through these stages, size increases, there are changes in ownership and organisational structure and goal. Not all firms must go through these stages.

goal. Even if this assumption is true, we still cannot deduce that the rational model is more appropriate in explaining the decision process of small firms. As has been mentioned earlier, the rational model assumes that decisions are made under complete information or perfect knowledge. This is where the model fails to explain the decision process of small firms. Although small firms' entrepreneurs try to maximise their profit, they operate their business with limited skill and knowledge and do not have complete understanding of their business environment (Birley 1983; Rice and Hamilton 1979).

The works of Langley and Truax (1994), Fredrickson (1986), Shrivastava and Grant (1985), Rice and Hamilton (1979), suggest that small scale entrepreneurs utilised primarily a very informal approach to decision making. These authors have suggested that Simon's 'satisficing' concept is useful in analysing the factors shaping small scale entrepreneurs' decisions. The rational model seems to be much too ambitious an undertaking for small scale entrepreneurs (Rice 1980, 1983). Small scale entrepreneurs have an incomplete understanding of the environment affecting them. Their goals are often vague or inadequately defined, and are generally pragmatic and short range. Often small scale entrepreneurs are unable to determine the full range of alternatives open to them. This is due to their inability to process all the necessary information, because they lack the necessary skills, time or opportunity to analyse the relevant data. This is supported by Birley (1983), Robinson and Pearce (1984) who stated that small scale entrepreneurs lack expertise, trust and openness; and have limited knowledge of the planning process. They often manage their firms without proper training or help. Hamilton and Rice (1979) also concluded that small scale entrepreneurs operate in a manner described by the social model; making decisions based on their experience.

Mintzberg (1973) as cited by Davig and Brown (1992: 54), has said that the decision process of small firms is characterised by "reactive" solutions to existing

problems. The decision maker moves forward in incremental steps, focusing first on what is familiar, then considers convenient alternatives, as well as alternatives that differ only slightly from the status quo. It seems that this argument is similar to that of Rice and Hamilton (1979), who claimed that the goal of small firms are short term and rather fragmented, and that their decision process approach is informal and incremental.

3.2.5 Personality Theory of Entrepreneurs

Entrepreneurs' personality is widely discussed in studies of entrepreneurship (Chell 1991, 1986, 1985; Hebert and Link 1989; Keats and Bracker 1988; Naffziger *et al.* 1994). These studies suggest that entrepreneurs have certain personality traits that set them apart from other groups of individuals. From these writings, we gather that entrepreneurs are individuals who are high achievers, confident, pro-active, risk takers and have internal locus of control. In most studies of small scale entrepreneurs, the personality of entrepreneurs is analysed in association with firms' performances (Keats and Bracker 1988) and management constraints or barriers (Cainarca *et al.* 1990). There are hardly any studies; however which associate entrepreneurs' personality with innovation decision. Hence, in this study we intend to examine whether there is a relationship between entrepreneurs' personality traits and their decision to innovate.

It has been indicated above that small firms' culture is *entrepreneurial-oriented* and their ownership and management are inseparable; thus decisions (including innovation) are greatly influenced by entrepreneurs' personality. The relationship between entrepreneurs' personality and their decision making is shown by Miller and Toulouse (1986). Their personality influences their management style, business strategies, communication behaviour, perception and

search for business opportunities, which are considered important in adoption of an innovation decision process. Entrepreneurs' personality will not only affect their innovation adoption decision but also the whole process of innovation diffusion. Previous studies (Rothwell 1989, 1984; Rizzoni 1991; Santarelli and Sterlachhini 1990) have tended to ignore the importance of the entrepreneurs' personality in their discussion of innovation decision. They do not include entrepreneurial factors to explain the relationship between innovation and small firms. Only recently have there been attempts to include entrepreneurs' personality in study of small firms innovativeness (Khan and Manopichetwattana 1989; Lefebvre and Lefebvre 1992; Young and Francis 1991).

In the following section, we will discuss the personality traits of entrepreneurs that can affect the small scale entrepreneurs' innovation decision. The personality traits are locus of control, need of achievement and attitude toward risk.

(a) <u>Locus of Control</u>

Gilad (1982) theorised that locus of control influences the ability of entrepreneurs to see opportunities in their environment. Locus of control was used in this study to differentiate entrepreneurs from the general public, middle, senior or managers as well as to distinguish between successful and unsuccessful entrepreneurs. People with *internal locus of control* are those who believe they can control their destiny. In contrast, people with *external locus of control* are those who believe in fate; they are unable to control the situation or events around them. According to Durand and Shae (1974) and Hodgkinson (1992), individuals with internal locus of control are active seekers of information that is useful to them; they are likely to display entrepreneurial qualities.

Ward (1993) suggested that locus of control may be viewed from a theoretical viewpoint as a potential determinant of whether or not a person involved with a small business is aware of and seeking opportunities overlooked by others within a given economic environment. In view of this, we use the locus of control as a determinant of small firms' innovativeness.

(b) Need for Achievement (n-ach)

McClelland's in his classic work suggested that entrepreneurs are high achievers. High achievers are individuals who favour situations where they can take personal responsibility for finding solutions to problems. They evaluate their performance and search the environment, for opportunities to improve themselves. Entrepreneurs with a high need for achievement are more ambitious and have the desire to have as much control over their environment as possible. They do not want anything left to chance. One way to improve business performance is by adopting new technology or processing techniques so that the firm will be able to stay competitive. We believe that there is a correlation between adopting technological innovation and entrepreneurs' need of achievement. Entrepreneurs with high need of achievement are likely to be more innovative than those with lower need of achievement.

Entrepreneurs' personality is greatly affected by their background, such as family, education and social status. Achievement motivation, according Chell (1986, 1985), can be inculcated through socialisation and training. Training courses designed to develop achievement motivation have improved small business performance significantly in term of increased sales, profits and numbers employed. Thus, this study assumes that the need for achievement can be trained and improved through entrepreneurs' experience.

(c) Attitude Toward Risk

A technological innovation is a sort of game involving risk. The amount of risk will depend on how radical and unfamiliar the changes are for the firms concerned. It also requires great resources for creation and implementation. Although most technological innovation brings at least some advantages for its potential adopters, these advantages are not always very clear-cut to all intended adopters. They can seldom be very certain that an innovation represents a superior alternative to whatever it might replace. Technological innovation creates a kind of uncertainty in the minds of potential adopters (about its expected consequences). To reduce the uncertainty, potential adopters will take various steps such as re-examining the need for the innovation and the reaction of their main competitors to it. The amount of information processed depends also on the decision makers' attitude toward risks. Even if two entrepreneurs have similar goals, needs to innovate and financial capabilities, the same amount of information and a similar environment, yet they might make different innovation decisions. Under similar circumstances, it is the entrepreneurs' attitude toward risk which explains differential response or decision.

Generally, it is assumed that individual decision makers are risk averse. They prefer small risks to larger ones provided the outcome and other factors are constant. Rather than gamble, an individual prefers the alternative, the outcome of which is certain. Decision makers' definition of risk may differ significantly from the definition of risk in the theoretical literature and different individuals will see the same risk situation in quite different ways. There are differences between human behaviour theory and decision theory with regard to risk in the following respects. *First*, human behaviour tends to ignore events which, although possible, are very unlikely or very remote, regardless of their consequences. *Second*, human behaviour is only able to look at a few possible outcomes, not all.

Third, generally human behaviour deals with verbal risk rather than numerical risk. This attitude toward risk is usually pictured in term of properties of an individual which are likely to be related to their personality development (March and Shaper 1987:1404).

In a decision making process, the choice of alternative involves a trade-off between risk and expected return. Risk averse individuals prefer an alternative with low risk while risk seekers would prefer a relatively high risk. The decision theory assumes that decision makers deal with risk by first calculating and then choosing among the alternative risk-return combinations that are available (March and Shapira 1987). Entrepreneurs may, however, see risk in ways that are different from decision theory. *First*, entrepreneurs do not treat uncertainty of positive outcome as an important aspect of risk, suggesting that risk is often associated with negative outcome. *Second*, entrepreneurs do not perceive risk as a probability concept; to them, possible bad outcomes are more salient. *Lastly*, it is not easy for entrepreneurs to quantify risk. From here, we can conclude that entrepreneurs calculate the risks of available alternatives, based on their perception, which in turn is influenced by their attitude toward risk. The decision to adopt technological innovation is one that involves risk. Entrepreneurs' attitude toward risk influences their decision making (Ghosh and Ray 1992). Hence, it is expected that entrepreneurs' attitude toward risks will have a relationship with their decision to adopt or reject technological innovation.

3.3 Summary

In this chapter, we have discussed the four theoretical approaches, namely (a) adoption decision process, (b) organisational buying behaviour, (c) decision theory of small firms, and (d) personality theory of entrepreneurs, which we shall use to

develop a conceptual framework on technological adoption among small scale food processing industries in Malaysia. We argued that the adoption decision process of small firms is similar to that of any organisation. However, the time involved and factors affecting small firms' adoption decisions differ from those affecting large firms, due to the simplicity of their organisational structure, management style, environmental factors and the people who make up the organisation.

The second theoretical approach used in this study is the theory of organisational buying behaviour. This approach is relevant to this study because small firms innovate through buying not inventing. Factors affecting the decision process of small firms in buying an innovation are similar to those mentioned in the theory of adoption process forwarded earlier.

The adoption decision process is an aspect of a decision theory. In this study, we argued that small firms' decision process follows the satisficing model rather than the rational model. The non-separation of ownership and management in small firms suggests that the personality of entrepreneurs has a strong influence on their adoption decision. Personality theory has been widely used to distinguish entrepreneurs from other groups of people, and to differentiate successful entrepreneurs from the unsuccessful ones. We can use the personality theory to differentiate innovative from non-innovative entrepreneurs in small scale firms. We believe that entrepreneurs' level of innovativeness is influenced by three personality traits; locus of control, need of achievement and attitude toward risk.

CHAPTER FOUR

CONCEPTUAL FRAMEWORK

4. Introduction

In this Chapter we begin by discussing the concept of innovation adopted in this study. This then will be followed by the discussion of our conceptual framework with the aim to hypothesise factors that determine the decision of entrepreneurs of small firms whether to adopt a technological innovation. This conceptual framework provides the basis for the empirical analysis in Chapter Six to Chapter Eight.

4.1 Concept of Innovation Adopted in This Study

From our review of the literature, as has been mentioned in **Chapter Three,** we can define innovation according to three different concepts: (a) a "new item" itself, (b) the process of adopting the "new item" and (c) the process of developing the "new item". For the purpose of this study, we follow the concepts (a) and (b). Innovation is an item which is perceived as new to the organisation and the process of adopting the item. In this study the item is a machine or machines which is perceived as new by *Bumiputera* entrepreneurs of small scale FPI, considered for adoption or adopted by them during 1990-93.

As has been mentioned in **Chapter Three,** technological innovation is comprised of (a) product innovation and (b) process innovation. Process

innovation had been defined as the introduction of new elements such as new equipment (machines) into a firm's production or service operation (Damanpour 1991; Utterback and Abernathy 1975). The introduction of new equipment is part of the process of improving labour productivity, output productivity and performance. Hence, the adoption of a new machine which is perceived as new by small scale entrepreneurs is part of process innovation.

How fair is it to use the adoption of a machine which is perceived as new as a measure of process innovation in small scale FPI firms in Malaysia? First, we have to examine the nature of small scale FPI and technological innovation as undertaken by firms of such nature. According to previous research findings[1] the characteristics of small scale FPI in Malaysia are as follows. The organisational structure is rather simple in that the majority of small firms of FPI in Malaysia are sole proprietors (more than 55.0 per cent) and partnerships. In this type of firm, the management style is direct supervision or supervised supervision, that is, the owners of the firms manage almost every aspect of their organisation and directly manage their subordinates. There are at most three levels of management hierarchy. The owners of the firms are also their managers and they are the sole or major decision makers of their firms. The level of technology is rather low (semi-mechanised) and workers generally have low skill. The majority of firms do not use up-to-date technology. For example, sun-drying is the most popular method for drying (Asit and Siti 1988). Their aim in introducing a new machine is to improve output productivity and firms' performance through replacing

[1] The description of small scale FPI is based on the findings of Faridah and Madeline (1992), Fong (1989), Mohd and Shaari (1988), Ismail (1990) and MITI, Malaysia (1992) and UKM research group (1990).

manual methods or replacing an outdated machine. Capital and markets are the main growth constraints for these firms. The majority of the firms market their product locally, that is, within the community near their factory. Based on these characteristics we placed the small scale FPI in Malaysia in a taxonomy of small firms developed by Rizzoni (1991) to recognise the nature of their innovation.

According to Rizzoni (1991) one can develop a taxonomy of small firms in six categories. This taxonomy can be a substantial benchmark for recognising types of innovation in small firms and the development of analyses on the determinants and effects of technological innovation in small firms. The categories of small firms are (a) static (b) traditional (c) dominated (d) imitative (e) technology-based and (f) new technology-based. (These categorisations were developed based on a number of variables, namely, (1) the main factors of firm's success, (2) sectoral patterns, (3) types of process technology (4) types and source of innovation, (5) innovative strategy, (6) corporate strategy, (7) organisational structure and 8) factors of weakness). This taxonomy is exhibited in **Table 4.1**.

Based on the characteristic of small scale FPI in Malaysia, it is reasonable for us to conclude that the majority of them fall into the static and traditional categories. Some of the firms can be classified as 'Dominated' small firms. According to the taxonomy, the static and traditional types of firm have low manufacturing cost and technological innovation focuses only on machinery. Firms either buy new machinery or modify the existing machinery. This suggests that it is an incremental type of innovation. Rizzoni described innovative strategy for static firms as minimal or almost absent, and in traditional firms he

states that the innovative strategy comes from outside, for example (we may add) under the initiative of institutions (such as MARDI, MARA and KEMAS in the case of small scale FPI in Malaysia) responsible for the development of small firms, suppliers or firms which have already adopted the innovation. The above explanation justifies the usage of adoption of new machines as a proxy for technological innovation in *Bumiputera* small scale FPI in Malaysia. Previous studies of small scale firms in Malaysia and our pilot test for this study showed that the adoption of a new machine is a key part of process innovation for these firms. Even when the entrepreneurs' immediate aim was to replace the existing machine, their main purpose of adopting was to improve performance - thus process innovation.

Some may dispute the appropriateness of using the adoption of a new machine as a reflection of firms' level of innovativeness. However, previous studies did recognise its appropriateness. For example, Masterson and Hayward (1979) recognised the purchase of a capital equipment as innovative behaviour. Studies of the adoptions of technological innovations also recognised the adopters were more innovative than non-adopters (Rogers 1983; Damanpour 1991; Chin and Ghopal 1995, Lefebvre and Lefebvre 1992). In the case of small scale firms, we should recognise the financial and physical constraints faced by them which act as barriers to adoption of new machine. We should also recognise the activities the entrepreneurs had to go through in searching and introducing new machine in the firms such as undergo training, attending seminars and trade fair. Hence, their ability to search for, introduce, and overcome barriers of adopting, new machine does reflect their innovative behaviour.

Table 4.1: A Taxonomy of Small Firms and Technological Innovation

	'Static' Small Firms	'Traditional' Small firms	'Dominated' Small Firms	Imitative' Small Firms	'Technology-Based' Small Firms	'New Technology-Based ' Small Firms
1. Factors of Success	Low manufacturing cost.	Flexibility and Low manufacturing costs.	High Specification.	Flexibility and cost advantages.	Schumpeterian entrepreneurship and managerial skills.	High level of entrepreneurship and managerial skills.
2. Sectoral Patterns	Mature and Fragmented sectors; local markets.	Mature and fragmented sectors.	Mature or growing sectors, dominated by large firms.	Stabilised sectors; co-existence between large and small firms (in market niche).	Rapid-growth sectors; not standardised consumer demand.	New sectors, with high-technological opportunities.
3. Type of Process technology	Old, or new but simple, labour-intensive technologies.	Low capital intensive, simple technologies.	Low or medium capital-intensive technologies.	Sophisticated, sufficiently stabilised technologies.	Advanced technologies, not yet stabilised; skilled-labour intensive. New products (still, no radical innovations).	New soft technologies.
4. Type and Source of Innovation	Only innovations contained in machinery.	Design modifications, Incremental and imported innovations.	Incremental innovations; machinery procurement and agreements with large firms.	Incremental product innovations. Acquisition of patents and know-how 'Imitative' strategies. Crucial role in diffusion process.	Various sources of innovations. 'Defensive' or 'offensive strategies.	Radical innovations. In-house R&D. Intensive relations with universities. 'Offensive' strategies.

..... continue

5. Innovative Strategy	Absent	'Traditional' strategies. Technical change comes from outside	Upstream-led or downstream-led innovations	Medium-term objectives. Search for interaction and co-operation		
6. Corporate Strategy	Targets: survival in the short-term; non-growth.	Like static S.F.; Inter-firm co-operation.	Short-term objectives; more autonomy.		Development of distinctive competence. Inter-firm relations.	Focus on innovation. Growth as strategic goal.
7. Organisational Structure	Central figure: owner-entrepreneur.	Like static S.F.; occasional resort to consultants.	Technical entrepreneurship.	Entrepreneur is still important, but organisational structure is expanding in-house R&D is absent;	Good balance between technical entrepreneurship and managerial skills.	High and diffused technical-scientific skills; dynamic management. Planning deficiency in new product development and in growth.
8. Factors of weakness.	Weak entrepreneurship and management; limited financial and human resources.	Like static S.F.	Lack of internal resources and limited skills.	lack of financial resources.	Unplanned innovative activity; lack of financial resource.	

Source: Rizzoni (1991), Table 1

4.2 The Determinants of Technological Innovation Adoption: An Overview

The conceptual framework developed in this chapter was to hypothesise the determinants of technological innovation adoption among small scale FPI. It was developed by combining the concepts of firms' buying behaviour, the theory of the adoption process, entrepreneurs' personality theory and decision theory of small firms, which had been discussed in the previous Chapter. We believe that the analysis of small firms' adoption decisions is a form of dynamic decision analysis which involves the interaction of factors which are interrelated in a complex manner. One discipline alone, such as economics, cannot explain the interaction of factors which determine the decision of small firms' entrepreneurs to adopt a technological innovation. It makes sense to be eclectic in the choice of approaches on which to draw. Thus, we have drawn on the theory of organisational buying behaviour. In analysing the decision of small firms to adopt a technological innovation, the same concept can be used, in that the buying process takes place once the entrepreneurs adopt the technology. The equivalence of the concepts is revealed when analysing the behaviour of firms and the determining factors that cause such behaviour, prior to their final decision to adopt, postpone adoption or not to adopt.

Based on the theory of organisational buying behaviour, we can assume that small firms' buying motivation has two dimensions; task and non task. Task motives relate to the specific buying problem. Non-task motives, on the other hand, explain organisational behaviour in relation to a set of variables which do

not have a direct bearing on the specific buying problem, although they may be important determinants of the final adoption decision (Webster and Wind 1972a). Based on theory of organisational buying behaviour we learn that firms' decisions to buy are determined by their characteristics, the characteristics of decision maker, internal and external communication and environmental factors.

From the decision theory of small firms we learn that the entrepreneurs utilise primarily a very informal approach to decision making. The entrepreneurs operate their business with limited skill and knowledge and decision making is very much influenced by their experience. Decision making process in small firms was very much influenced by the characteristics of their entrepreneurs. Hence we believe the characteristics of entrepreneurs such as their personal background (or, as we shall put it , "personal demographics"), experience and personality traits influence their decision to innovate. The personality theory of entrepreneurs on the other hand indicates `that entrepreneurs' need for achievement, locus of control and attitude toward risk influence their innovative behaviour.

From the theory of the adoption process, we believe that in the process by which small firms search or become aware of the existance of the new technology to their final decision to adopt or reject it, they go through the five stages as had been described in the theory. As we recall, there are five stages in the adoption process; (a) awareness, (b) interest, (c) evaluation, (d) trial and (e) adoption. Small firms become aware of the existence of the technological innovation from various sources. *First*, they might have witnessed the innovation in other firms

which have already adopted it. *Secondly*, the innovation might have been introduced by suppliers. *Thirdly*, the innovation may be introduced by institutions responsible for the development of small scale FPI. Alternatively, the entrepreneurs might seek out technological innovation themselves.

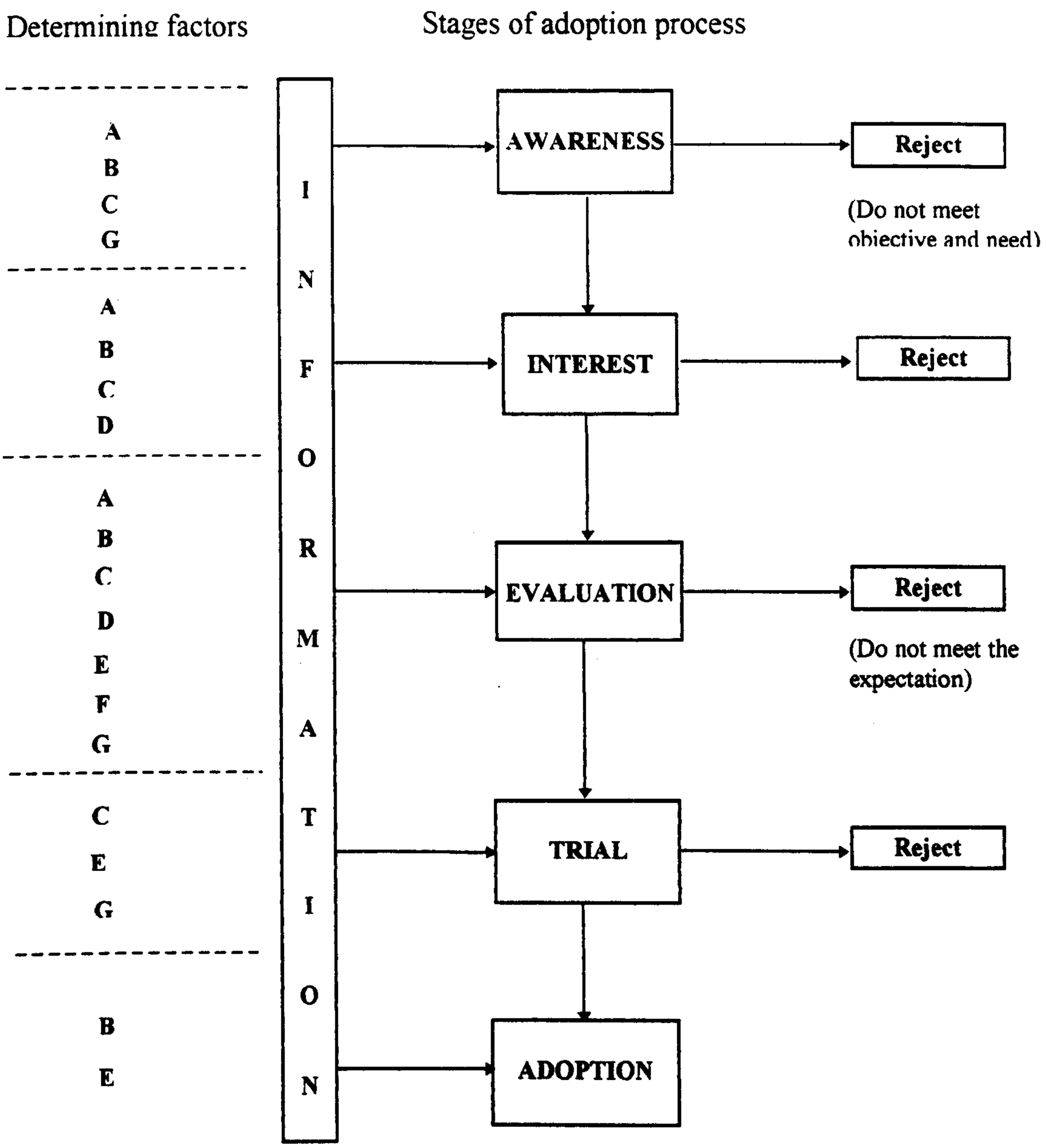
Being aware of the existence of a technological innovation, the entrepreneurs develop interest in it and this motivates them to enquire for more information about it. Then, the entrepreneur would evaluate the innovation to examine whether the innovation has the characteristics that will fulfil their need to innovate. Entrepreneurs will consider adopting an innovation if they perceive that it has the required characteristics, and the innovation will be adopted for a trial period. In this trial period, the entrepreneurs assess the performance of the innovation before their final decision to adopt it. The behaviour of firms or entrepreneurs demonstrated within the first four stages of the adoption process determines the final innovation decision process. At any particular stage, the process and the decision to move forward to the next stage or go backward to the previous stage is influenced by various factors. These factors can be internal or external to the firm. As has been discussed earlier, the entrepreneurs of small firms play a very important role in their firms' decision to innovate. Considering this fact, we believe that their personal demographic characteristics, education and skill level and their personality traits to some extent influence their decision process.

The characteristics of firms such as their size and structure, are also important factors that determine the process of the decision to adopt a

technological innovation. These characteristics can act as barriers or catalysts to firms' innovation decision. In addition to the characteristics of the entrepreneurs and their firms, we believe there are other factors which also influence small firms' decision. These factors are the characteristics of the technological innovation itself, entrepreneurs' communication behaviour, their perception of the innovation, their perception toward the procedure of buying the innovation and the environment, such as their intensity of institutional involvement and competitive intensity. The influence of these factors in each stage of the adoption decision process is exhibited in **Figure 4.1**.

We believe that the characteristics of the entrepreneurs are influential at the following stages: awareness, interest and evaluation. At the awareness stage, for example, entrepreneurs with higher levels of education, or those who have upgraded their skill by attending courses or those with a higher need for achievement, tend to have early awareness of the innovation. Entrepreneurs with these characteristics usually demonstrate innovative behaviour and search for opportunities to improve their firms' performance. Hence, at the interest stage, they tend to develop interest in the innovation because they believe that by adopting it they will improve their firms' performance. At the evaluation stage, the entrepreneurs' level of education, skill and attitude toward risk influence their perception of the innovation. Those with higher levels of education, skill or greater knowledge of the innovation, or with greater propensity to take risks, will evaluate favourably an innovation of a higher technical level.

Figure 4.1: Factors Influencing Decision by Adoption Decision Stages



A - Characteristics of entrepreneurs
B - Characteristics of firms
C - Communication
D - Perceived characteristics of the innovation
E - Objective characteristics of the innovation
F - Buying procedures
G - Environmental factors

The characteristics of firms influence the entrepreneurs' decision at the stages of awareness, interest, evaluation and adoption. Among small firms, relatively bigger firms have a greater tendency to become aware of the existence of the innovation earlier and show more interest in it. At the evaluation stage, for example, we believe that for the same level of technical complexity of an innovation, firms which have a lower level of complexity will evaluate differently from more complex firms.

Except for the adoption stage, communication plays an important role in all stages of adoption process. Through communication, information on innovation is accumulated from the stage of awareness to the trial stage. Communicative entrepreneurs tend to know about the existence of the innovation earlier. Having considerable information about the innovation, they tend to develop interest, have the ability to evaluate it and have the opportunity to try the innovation before confirming its introduction.

The entrepreneurs' perception of the innovation determines their decision at the interest stage and evaluation stage. Entrepreneurs develop interest in an innovation if they perceive that it has the required capability, function, and low risk. Their perceptions of the innovation are then confirmed in the evaluation stage. If the performance, function, capability and level of risk match those expected of the innovation, then the adoption decision process moves to the trial stage.

The objective characteristics of the innovation determine the entrepreneurs' decision to adopt a technological innovation at the stages of evaluation, trial and adoption. At the evaluation stage, as mentioned above, the objective characteristics of the innovation are examined in relation to the entrepreneurs' perceptions. At the trial stage, the performance of the innovation will determine whether the entrepreneur moves to the stage of adoption.

4.3 Factors That Determine The Decision To Adopt Technological Innovation: The Hypotheses

4.3.1 Characteristics of Entrepreneurs

In small and medium scale firms, entrepreneurs play an important role in decision making development. Their characteristics influence firms' behaviour, including firms' strategies, policies and innovative activities. Therefore we believe that the influence of entrepreneurs' characteristics is the major determinant of adoption decision. The characteristics of entrepreneurs could be divided into the following categories, namely (a) personal demographic characteristics, (b) personality traits, (c) knowledge and skill upgrading and (d) knowledge of innovation.

4.3.1.1 Personal Demographics

These include entrepreneurs' age, sex, education, length of managing in the company and previous work experience. According to Khan and Manipichetwattana (1989), young entrepreneurs are more innovative than older

entrepreneurs due to their higher level of education. Korteling (1994), Ray (1993), and Warr (1994) showed that young individuals are capable of handling complicated tasks and receptive to change. For this reason, we believe that young entrepreneurs are more innovative than older entrepreneurs. However, it is also argued that older people are equally capable of attitude change as younger people, provided that they have personal experience that leads to attitude change (Tyler and Schuller 1991). Considering this fact, we believe that there is a possibility that older entrepreneurs also can be as innovative as young entrepreneurs, based on their experience.

Entrepreneurs' level of education determines their innovativeness (Variyam and Kraybill 1993). Entrepreneurs with higher levels of education are likely to adopt a technological innovation. We believe that the entrepreneurs' level of education will be a determining factor in other factors' influence on their innovativeness. Khan and Manipichetwattana (1989) showed that young entrepreneurs innovate due to higher levels of education. Education is likely to be positively associated with adoption of highly technically complex technology. An entrepreneur who is highly educated or who has technical knowledge will be more likely to adopt new, technically complex technology, compared to less educated entrepreneurs.

In addition to the entrepreneurs' age and level of education, we believe their gender will also influence their innovative behaviour. Variyam and Kraybill (1993) showed that in small firms, there is a relationship between the entrepreneurs' gender and the adoption of a technological innovation. Female

entrepreneurs are less mobile, less communicative and have less opportunity to attend business courses due to their domestic commitments (Faridah 1990; Wan Sarah *et al.* 1992). Their main aim in venturing into a business usually is to contribute to the family income (Nor Aini and Faridah 1991, 1988; Madeline and Faridah 1991). Hence, in this study we predict that female entrepreneurs will be less innovative than male entrepreneurs.

Entrepreneurs' experience in managing their firm may have an effect on their decision to adopt new technology. Entrepreneurs who have been working for many years have more experience, are very familiar with their business environment, have wider business contacts, have better access to information and are able to seek business opportunities. Experience makes them confident in decision making. These entrepreneurs will be likely to adopt new technology earlier than their counterparts because they know about the existence of the technology earlier. However, there is a possibility that new entrepreneurs with less experience in managing their business will be innovative. These new entrepreneurs are under pressure to be competitive with existing and established firms. In order to be competitive, they have to be innovative.

Besides the entrepreneurs' experience in their current business, we predict that their previous work experience also influence their innovative behaviour. Entrepreneurs with longer previous work experience, usually are more confident and they saw setting up their own firms as a form of upward mobility (Birley 1989; Cooper 1979). Hence, they had a higher tendency to be innovative. Entrepreneurs who had previously worked in the same sector as they were

currently in, also had a greater tendency to be innovative compared to those who had worked in other sectors. This gave them an advantage over those who were less experienced or who had previously worked in sectors different from those in which they were engaged.

4.3.1.2 *Personality Traits*

As mentioned earlier in Chapter Three, the personality of entrepreneurs of small scale firms has an effect on their business decision process in general. Hence, it is believed that the technological innovation decision process and the decision to adopt technological innovation are affected by the personality of entrepreneurs. According to Gray and Starke (1988), personal factors such as level of education affect the personality of an individual. In view of this, we believe that the entrepreneurs' level of education has some influence in developing their personality, such as their need for achievement, locus of control and attitude toward risk.

(a) <u>Locus of Control</u>

Entrepreneurs' locus of control is believed to have some effect on their formulation of business strategy, such as an adoption of new technology. It reflects the beliefs individuals have about who controls the events of their life. Internal- oriented entrepreneurs perceive their lives to be controlled by their own action, skills and ability. On the other hand, external-oriented entrepreneurs perceive their life to be controlled by external factors. Locus of control plays a

mediating role in determining whether persons become involved in pursuit of achievement (Lefcourt 1976). Internally-oriented entrepreneurs are more likely to plan ahead, actively seeking information about business achievement, and have a tendency to lead rather than follow competitors (Hodgkinson 1992). They are more likely to adopt new technology than entrepreneurs with external locus of control.

(b) Need for Achievement

Need for achievement of entrepreneurs can be considered as a factor that contributes in explaining entrepreneurs decision behaviour. High achiever entrepreneurs are motivated by their desire to perform to the best of their ability. They take a long-term view in their planning for the success of their firms. These entrepreneurs are not easily satisfied with the performance of their firms, despite firms' progress, and are always willing to make changes if they believe that such changes can bring progress to their firms. High achiever entrepreneurs are likely to adopt new technology. On the other hand, low achiever entrepreneurs do not have the motivation to improve their firms. They are easily satisfied with their firms' performances, as long as they do not make a loss. This type of entrepreneur is normally less innovative and unlikely to adopt new technology.

(c) Attitude Toward Risk

Attitude toward risk is believed to be one of the main factors that significantly influence entrepreneurs' decision to adopt technology, since the adoption decision

is one that involves risk. Risk-taking entrepreneurs make decisions to adopt in the condition of uncertainty, by balancing success against potential loss. Some entrepreneurs would not think of taking a risk, regardless of the probabilities of success. They prefer to stay in a secure position. Kim *et al.* (1993) and Lefebvre and Lefebvre (1992) showed that entrepreneurs who are risk takers are likely to adopt technological innovation, while risk averse entrepreneurs are unlikely to adopt it.

Some studies which have looked at the impact of personality on organisational buying decisions have found only limited direct relationships. See Hakansson and Wootz (1975), Peters and Venkatesan (1973), Sheth (1973) and Wilson (1971). However, in the case of small organisations such as small and medium scale FPI in Malaysia, it is believed that entrepreneurs' personality does play an important role in determining firms' decision to adopt new technology. This is because the majority of the entrepreneurs are the founders of their firms. Furthermore they are the sole-proprietors or the active partners of the firms. Therefore, the personality and attitude of the entrepreneurs are believed to have a great influence in the adoption of technological innovation.

4.3.1.3 *Knowledge and Skill Upgrading*

As has been mentioned in Chapter Two, small scale entrepreneurs lack knowledge and skill in management. Their knowledge and skill can be upgraded by attending business courses or training offered by various institutions such as MARA and NPC. Lack of skill and knowledge is a constraint to adoption of technological innovation (Foley and Watt 1994). Hence, we believe that the entrepreneurs who

upgrade their knowledge and skill have a stronger tendency to adopt technological innovation.

4.3.1.4 *Entrepreneurs' Knowledge of The Innovation*

Entrepreneurs' knowledge of the technology itself, in terms of its applicability, influences their adoption decision. Entrepreneurs may adopt technology after having gained extensive understanding of it. This knowledge may depend on the extent of exposure to information obtained from external or internal sources. Facts about advantages and limitations of the technology may come from various sources such as competitors, research institutes, or the company's own research and development unit. Incomplete understanding of the technology makes the adoption unlikely.

4.3.2 Organisational Characteristic

As has been mentioned in Chapter Two certain characteristics of small firms, such as their simple structure, are conducive to innovation. On the other hand, other characteristics of small firms, such as their lack of capital, and lack of skilled workers, act as barriers for them to innovate. Therefore, the influence of organisational characteristics on the innovation adoption process is worth examining. Organisational characteristics such as firm size, firm's age, firm's structure and availability of skilled labour are among the factors which can influence the adoption of technological innovation among small scale FPI in Malaysia

4.3.2.1 *Firm Size*

Firm size has played an important role in examinations of the adoption process. Kimberly and Evanisko (1981) found organisational size to be the best predictor of technological innovation. Their research revealed that larger organisations are more likely to adopt an innovation. Lefebvre and Lefebvre (1992), and Variyam and Kraybill (1993) showed that firms' size is a predictor of the degree of innovativeness among small firms. Larger firms normally give greater attention to the use of formal techniques in their investment evaluation decision, they are likely to have more specialists involved in different management functions such as purchasing and thus they are more innovative. These firms are believed to be more efficient in their performance and financially more stable, compared to smaller firms. Although larger firms take a longer time in their decision making process, they are likely to adopt new technology earlier. In view of this, we predict that within small scale FPI, larger firms are more likely, other things equal, to adopt new technology.

We must also bear in mind the existence of some "reverse causation" here. The more innovation the firm, the faster it is likely to grow, and the larger it is likely to become. Thus, in the empirical work we shall have to take care to identify the direction of causation as clearly as possible.

4.3.2.2 *Organisational Structure*

Aspects of organisational structure of small firms which are believed to have some degree of influence on the decision to innovate are (a) centralisation, (b) formalisation and (c) complexity.

(a) Centralisation

Within small scale FPI we expect there is a variation in their degree of centralisation. Khan and Manopichetwattana (1989), Kim *et al.* (1993) found that centralisation of small firms in U.S.A and Korea respectively is negatively associated with the decision to adopt a technological innovation. As has been mentioned in Chapter Three, the negative correlation between level of centralisation and firms' innovativeness is due to restricted channels of communication, which reduce the availability of information. Hence, in this study we hypothesise that firms with a lower level of centralisation are more innovative than more centralised firms.

(b) Formalisation

Formalisation is the degree of emphasis placed on following rules and procedures in role performance (Damanpour 1991; King 1990). Firms that emphasise formality in the decision making process have fewer autonomous, more committee decisions, and this lengthens the decision making process. Firms with a lesser degree of formalisation normally emphasise performance and minimise status differences between individuals within firms. The relationship between

employees and employers is usually rather informal. Innovation is likely to occur more quickly in firms with a lower degree of formalisation in decision making and administrative structure (Baker 1975; Kim *et al.* 1993).

(c) <u>Complexity</u>

Complexity of firms is measured by the number of professional workers the firms have. The degree of complexity is believed to be positively correlated to innovativeness. Therefore, firms with a greater number of professional workers such as engineers, are likely to adopt technological innovation.

4.3.2.3 Mismatch of the Existing and Required Labour Force

The adoption of technological innovation involves the reallocation of resources in the firm. For example, if a firm buys a new machine to replace an old one, labour, capital and materials must be available to accommodate the existence and the usage of the new machine. Hence, in the case of adopting technological innovations, as a result of adopting new technology, some workers may be thrown out of work, at least temporarily; others must be retrained to operate the new equipment or new skilled employees must be hired.

One of the problems of small firms is shortage of skilled labour (Chee 1991a; El-Namaki 1988). Shortage of skilled employees to operate new technology has an important influence in firms' reaction to new technology (Foley and Watt 1994; Harvey *et al.* 1992). The availability of skilled employees to operate new technology fastens the process of adoption. Attitude toward

recruitment and training of employees is an important determinant of whether firms without the availability of skilled labour to operate it, will adopt new technology. Firms which do not, are likely to postpone or not to adopt the new technology.

For some firms, restructuring of labour force and redundancy may occur if they adopt new technology. As a result, certain employees may be promoted, transferred or lose their jobs. Firms that perceive redundancy may occur if they adopt new technology, are unlikely to adopt it.

4.3.2.4 Financing

Evaluation of capital requirement is part of the technological innovation adoption process. Without an injection of capital investment, adoption may not take place. Hence, the decision to innovate is the decision to earmark internal or borrowed capital to finance the adoption (Josty 1990; Oakey 1984). One of the problems faced by small firms is lack of financing. For capital investment, most small firms use their own funds (Bruch 1983; Chee 1991a; Himmelberg and Petersen 1994; Ishak and Wook 1988; UKM 1990). Small firms face difficulties in obtaining financing from formal private financial institutions such as commercial and development banks. The unwillingness of these institutions to finance small firms is due to small firms' lack of collateral and lack of proper formal feasibility studies which make the institutions uncertain of the viability of the proposed investment. Some small firms do not even attempt to obtain financing from commercial banks, due to inaccessibility, lack of confidence that

they will obtains a loan, inability to provide collateral or high interest rate (Chee 1990, Oakey 1984).

Other than commercial and development banks, there are government agencies such as 'Majlis Amanah Rakyat (MARA)', or the Department of Co-operative Development which play a role in providing financial credit to small firms. Previous studies on small firms in Malaysia have, however, indicated that not many small firms are able to get financing from these sources (Chamhuri *et al.* 1990; UKM 1990).

Adopting new technology normally involves a usage of large amount of funds. In view of this, entrepreneurs may have difficulty in using informal institutions (such as relatives and friends) as their source of financing. Lack of financial resources might cause entrepreneurs to abandon the idea of adopting the innovation or delay the adoption process until they are able to obtain financing (Kleinknecht 1989). In view of this, we believe that firms which have difficulties obtaining financing from external sources of financing are less able to adopt a technological innovation.

4.3.2.5 Firms' Age

There is a relationship between firms' age, their stage of growth and strategic choice (Churchill and Lewis 1983; Dodge *et al.* 1994; Scott and Bruce 1987; Quinn and Cameron 1983). As firms mature, there is a tendency that size and management style also change. Young firms which are in the early stage of their life cycle usually; are smaller in size, invest highly in working capital, and have a management style which

is more entrepreneurial and individualistic. As firms mature, their size might increase, and their major investment is on marketing effort and management style is more towards professional or administrative (Scott and Bruce 1987). Hence, we believe that firms' age can be used as one of the determining factors that could predict firms' innovativeness. Young firms whose main effort revolves around developing a commercially acceptable product and establishing a place for it in the market are more willing to accept changes as they have not yet established the same sort of set routines as older firms. Hence, we hypothesised that younger firms have a greater tendency to be innovative compared to older firms.

As has been mentioned above, management style of young firms is more entrepreneurial or individualistic. This is due to direct supervision by top management - entrepreneurs. It is believed that strategic choice of small firms at this stage is strongly influenced by the entrepreneurs. Therefore, entrepreneurs' characteristics are expected to play an important role in determining new technology adoption decisions in young firms. On the other hand, mature firms have a more professional and administrative style of management. We therefore predict that firms' performance will be an important factor in determining strategic choice for small firms at this stage. Hence, firms' performance is believed to be a factor which at this stage influences small firms to adopt new technology.

4.3.2.6 Firms' Performance

Firms' performance (in terms of return on investment, fixed asset turnover and labour productivity) may well be an important factor in determining their decision to

adopt new technology, since it is either the means or the end of entrepreneurs' management strategies. However it is far from clear what the causal relationships are. According to Singh (1986), firms' performance is negatively correlated with their subsequent innovativeness, because firms which perform poorly are pressured to innovate in order to improve performance. He showed that poor performance is related to risk taking in organisational decisions (Singh, 1986: 580). Singh here is clearly assuming that entrepreneurs are satisficers. In Chapter Three we found in favour of the satisficer assumption as regards small firms (see Section 3.2.4). It could alternatively be argued, however, that successful firms also have a tendency to innovate because they have the physical and financial ability to do so. This by implication assumes that they are maximisers not satisficers.

4.3.3 Communication

March (1994) stated that the amount and source of information influence decision making. Looking at the stages of the innovation adoption process, as exhibited in **Figure 4.1**, information plays a very important part at every stage. Hence, the amount of information and the source of information on the innovation affect entrepreneurs' decision to adopt it.

The amount of information about the innovation is determined by the entrepreneurs' communicative behaviour, that is, the frequency of communication between the entrepreneurs and sources of information. Ebadi and Utterback (1984) and Schroeder *et al.* (1989), showed that there is a relationship between entrepreneurs' communicative behaviour and technological innovation.

Communicative entrepreneurs have the ability to gather a large amount of information from various sources. Hence, in this study we suggest that entrepreneurs' communicative behaviour is one of the determining factors that influence their decision to innovate. The entrepreneurs' communication behaviour is exhibited in terms of the use of information sources, both external and internal. Past research on sources of information has shown that the entrepreneurs of small firms regularly use external rather than internal; informal rather than formal; customers or suppliers rather than competitors as their sources of information (Hartman *et al.* 1994). This suggests that contact among entrepreneurs, between entrepreneur and suppliers; customers; and other external sources of information could become influential factors in entrepreneurs' decision to adopt a technological innovation. A basic issue in communication is the influence these individuals have, in convincing each other of the importance of adopting the innovation.

Technological innovation adoption, like creating and assimilating new processes and products, is essentially a learning process. This takes place by means of communication between information providers and information receivers (entrepreneurs). In the case of small scale FPI, internal information providers are less important because the entrepreneur is the main decision maker and initiator of the firm's activities. External sources of information such as suppliers, experts from research institutions and entrepreneurs who have already adopted the innovation (earlier adopters) are very important information providers. Information from these sources reduces uncertainty about the innovation. Once the technology is introduced, it spreads like an epidemic, with

non adopters being influenced by adopters in the course of their contacts with them, leading to eventual adoption (Kalish 1985).

Entrepreneurs' contacts with external sources of information occur through various communication channels. Among them are business associations, subscribing to business magazines, and attending seminars or expositions. In Malaysia there are several business associations relevant to small scale producers such as *Persatuan Peniaga Kecil*, which are to some extent beneficial to small scale food manufacturers. We believe that business associations can create interpersonal communication among entrepreneurs, enabling them to learn from each others' experience. Information on a technological innovation can also be obtained from business magazines. It is usual for suppliers to advertise the latest technological developments in business magazines, therefore subscribing to such magazines, can create awareness among the entrepreneurs of the existence of the innovation and this can lead to communication between entrepreneurs and suppliers. Business seminars are well attended by some small scale entrepreneurs of FPI and suppliers (UKM 1990). Usually these seminars are organised by business association or institutions responsible for developing small scale industries in Malaysia. Experts, bankers and academicians are usually invited to present their experience or research in such seminars. Hence, these events create communication linkage between entrepreneurs and experts, suppliers and other entrepreneurs (information providers). Similarly, business expositions or trade fairs also create communication linkage between entrepreneurs and information providers. Entrepreneurs use expositions to promote their products while suppliers promote the latest technological innovations that they can supply to

potential customers. Experts, meanwhile, promote the services provided by their institutions. The extent to which entrepreneurs use these communication channels is termed their communicative behaviour. Communicative entrepreneurs use these communication channels more frequently than less communicative entrepreneurs. This study hypothesises that communicative entrepreneurs have a greater tendency to adopt a technological innovation.

Entrepreneurs communicative behaviour is determined by various factors. Rowland *et al.* (1984) showed that entrepreneurs', and firms' characteristics, together with the buying situation, influence entrepreneurs' communicative behaviour.

4.3.4 The Objective Characteristics of the Technology

The characteristics of the technology are expected to influence the decision of entrepreneurs in making a decision to adopt or reject it. The characteristics of the new technology can be viewed in terms of (a) their technical level and (b) their price and installation cost.

4.3.4.1 Technical Level

This refers to technical complexity of the new technology. In this respect, the technology can be categorised as manual, semi automatic and fully automatic. There is normally a relationship between the technical level of a machine and the number of workers needed to operate it. Compared to manual machinery, fewer workers are required to operate semi-automatic machinery. In the case of fully

automatic technology, although in terms of numbers, far fewer workers are required to operate it, normally, these workers need a higher level of skill. As it has been mentioned in **Chapter Two** that small firms had a shortage of skilled workers; thus, we hypothesised that entrepreneurs have a greater tendency to adopt an innovation with a low technical level.

4.3.4.2 Price and Installation Cost

This refers to the price of the new technology and cost incurred in installing it. Although firms might receive the same price quotation for the new technology, installation cost might vary between firms. The price and installation cost is expected to influence the decision of entrepreneurs to adopt the technology. Low cost innovation are likely to be adopted by entrepreneurs.

4.3.5 The Perceived Characteristics of the Technology

The characteristics of technology as perceived by entrepreneurs influence their decision to adopt. Entrepreneurs will form an opinion on the cost of the machine relative to the financial position of the firm, and the extent of available knowledge to use the innovation. Some technology is adopted readily because it is not too great a technological advance. When new concepts need to be integrated, it may slow down the adoption rate or act as a barrier to the adoption process. The characteristics of technology perceived by entrepreneurs can be classified into a) economic advantage, b) simplicity, c) prestige, d) perceived risk, and e) compatibility.

4.3.5.1 *Economic Advantage*

This is the degree to which an innovation is perceived to be economically more profitable than the existing technology. Entrepreneurs are likely to change to new technology if they believe that it will improve product quality and increase firms' productivity, which may in turn lead to increase in sales and profit. Thus, perceived economic advantage should be positively related to increased likelihood of adoption.

4.3.5.2 *Simplicity*

This is how entrepreneurs perceive the new technology as relatively easy to understand and use. Simplicity of the new technology as perceived by the entrepreneurs is believed to influence their decision to adopt it. Entrepreneurs who feel that the technology can be operated and managed by the existing employees, are more likely to adopt it.

4.3.5.3 *Prestige*

Having new technology is sometimes perceived to enhance one's prestige within the community of entrepreneurs of the same industry. Entrepreneurs who feel that the technology will increase their prestige may be more likely to adopt it.

4.3.5.4 *Perceived Risk*

Newall (1977) has shown how the organisational buyer's behaviour is also influenced by the risk which the buyer perceives to be associated with the

decision. If entrepreneurs feel that it is risky to adopt the new technology, it is unlikely that they will do so.

4.3.5.5 *Compatibility*

This is the perception of entrepreneurs regarding the compatibility of the machine with their existing production techniques. This can be viewed in term of entrepreneurs' perception of the suitability of the new technology to the physical and financial capabilities of the firms; and the ability of the technology to meet whatever need prompts the innovation. Entrepreneurs who perceive that the technology is compatible with their existing production techniques will be likely to adopt it.

4.3.6 Entrepreneurs' Perception of the Buying Procedure

This is a function of entrepreneurs' experience of the related situation and their attitudes in dealing with it. Entrepreneurs' perception of the buying situation is influenced by the difficulties faced by them in dealing with buying procedures and other related circumstances; searching for suppliers, negotiating with them and obtaining a loan to finance the purchase is not a simple process for some entrepreneurs.

The buying process may take time and can cause entrepreneurs to be absent from their firms for a considerable period. As owner-operators in their own firms, their absence is a problem for some small scale entrepreneurs, whose

firms' operations are heavily dependent on them (UKM 1990). Entrepreneurs who are relying on assistance from a financial institution to adopt a technological innovation, may face difficulties in obtaining loans. Loan procedures normally involve contracts and legal matters which are too complicated for some entrepreneurs to handle. Entrepreneurs' perception of buying procedures can be a barrier to innovation. In view of this, we hypothesise that entrepreneurs who have difficulties in finding suppliers, negotiating with them, dealing with legal matters, being absent from the firm for a long period and obtaining financing will be less likely to adopt a technological innovation.

4.3.7 Environmental Factors

A firm is more likely to be an early adopter of new technology when it appears to have a positive attitude to the collection and use of information on changes in its environment. The influence of external factors on the decision making of firms is called environmental influence. Some of the principal environmental influences are (a) competitive intensity, and (b) institutional involvement.

4.3.7.1 Competitive Intensity

As Hannan and Mc Dowell (1987) and Reinganum (1981) stated that the decisions of firms to adopt take account of not only the costs and benefits of the innovation itself, but also the effects of competitors' adoption upon pre- and post adoption profit rates. By witnessing the development of competitors' performance as the result of adopting new technology small firms are motivated to adopt,

although at a later stage, to be competitive in the market. The work of Hartman *et al.* (1994) showed that small firms receive stimulus to innovate by observing their competitors. Hence, competition between firms creates pressure for adoption. The acceptance of new technology among small firms is posited to be maximised if firms face intense competition.

Competitive intensity faced by small firms can be viewed in terms of (i) mode of competition, and (ii) competitive price intensity. The logic is that firms in the industry pay close attention to each other's competitive moves. The greater the competition faced by an industry, the greater the likelihood of adoption of new technology. The mode of competition faced by firms will determine their reactions toward their competitors' moves. If the main competitors of the firms are big firms, firms will have a tendency to be more innovative in order to be more competitive. Larger firms are believed to be more innovative; therefore, any changes in these firms will affect the reaction of small firms which feel the threat of being left behind. Small firms competing with firms of their own size will pay less attention to their competitors as they can more easily predict any move made by them. Small and medium firms are believed to be less innovative compared to larger firms. Therefore, it is expected that firms in the study which feel small or medium scale firms to be their competitors will be less innovative compared to firms which feel their main competitors are big firms. Therefore, it is hypothesised that firms facing competitions with large firms are likely to be more innovative and to adopt new technology.

Some firms are more likely to compete on price than on other aspects of marketing mix. It is expected that high competitive price intensity reduces receptivity to innovation because the firms' financial resources are depleted (Gatignon and Robertson 1989, 1986). Therefore, the greater price intensity within industry, the less likely the adoption of new technology.

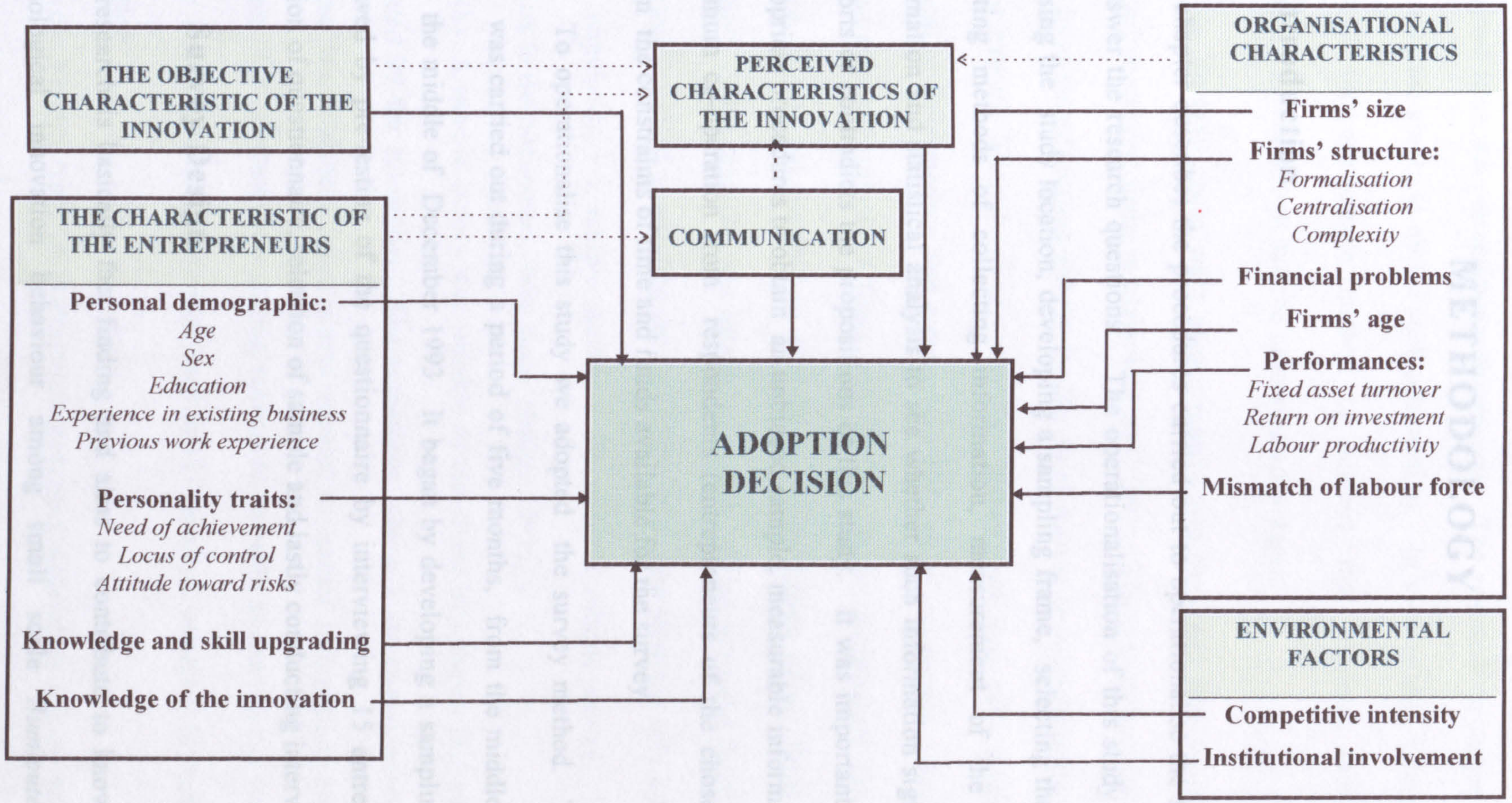
4.3.7.2 *Institutional Involvement*

The distribution aspect of the technology defines who is to have access to the innovation, in what way, and when. Institutions which are responsible for diffusion of innovation are the major actors in the diffusion process. Their diffusion strategies determine not only what segments of the population under study are to have access to the innovation, but also the subjective aspects of the innovation associated with the potential adopters' perception about their diffusion agencies (Brown 1981). Small firms have greater tendency to rely on external sources, especially institutions for the acquisition of technical knowledge (Variyam and Kraybill 1993). Malaysian Agricultural Research Development Institute (MARDI) is responsible for developing production processes in small scale FPI in Malaysia. MARA conducts management courses and motivation courses which are believed will indirectly influence the innovative behaviour of entrepreneurs. It is believed that entrepreneurs' involvement with these institutions and other government agencies influence their ability to adopt technological innovation.

4.4 Summary

The conceptual framework which has been developed to explain firms' behaviour in the buying decision, can be appropriately adapted to develop a conceptual framework of small firms' decision to adopt new technology. We have considered a number of factors which are likely to influence entrepreneurs' adoption decision. These factors can be internal or external to firms and their relationship to the adoption decision is presented in **Figure 4.2.** Internal factors which are likely to influence small firms' adoption decisions are entrepreneurs' characteristics, organisational characteristics, communication and the perceived characteristics of new technology. External factors which are considered in this conceptual framework are competitive intensity and institutional involvement.

Figure 4.2: Conceptual Model of Determinants of Technological Innovation among Small Firms



CHAPTER FIVE

METHODOLOGY

5. Introduction

This chapter describes the procedures carried out to operationalise the study and to answer the research questions. The operationalisation of this study included choosing the study location, developing a sampling frame, selecting the sample, selecting methods of collecting information, measurement of the required information and statistical analysis to see whether such information significantly supports or contradicts the propositions of this study. It was important to adopt appropriate procedures to obtain an unbiased sample, measurable information and maximum co-operation from respondents (entrepreneurs of the chosen firms) within the constraints of time and funds available for the survey.

To operationalise this study we adopted the survey method. The field work was carried out during a period of five months, from the middle of July until the middle of December 1993. It began by developing a sampling frame, followed by pre-testing of the questionnaire by interviewing 15 entrepreneurs, revision of questionnaire, selection of sample and lastly conducting interviews.

5.1 Survey Design

The research is basically fact finding and aims to contribute to knowledge of technological innovation behaviour among small scale *Bumiputera* food processing firms. Therefore, the information required for this research pertained

to the entrepreneurs' experience in technological innovation and this could only be obtained from the entrepreneurs themselves. The research technique chosen had to have the ability to obtain such information. In view of this, a survey was considered the appropriate method to achieve that purpose. Information gathering by survey design had the following advantages:

(a) In 1989, there were approximately two thousand *Bumiputera* small scale food processing firms in Malaysia (MITI 1992). The type of business varied widely from manufacturing snacks for the local market to manufacturing instant food for export. Their level of technology also varied from fully manual and traditional to fully modern and mechanised methods of production. Because of the geographical location of firms, and their scattered distribution throughout Malaysia, it was not feasible to conduct an investigation of all firms in the population. This research was conducted within limited time and funds. The most feasible way of conducting the investigation was by studying only a fraction of this population - a sample survey. By using a sample survey, we can generalise to the population under study (Miller 1991).

(b) A sample survey was suitable to test those hypotheses that had been formulated by the researcher. The researcher chose a structured interviewing technique with standard form (questionnaire) to gather information on firms. Adoption of a standard questioning technique as well as employing valid and reliable measurement of variables facilitated statistical analysis for testing of hypotheses.

(c) Various types of information gathering techniques can be employed when one uses a sample survey. For this particular study, for example, in addition

to conducting structured interviews, we also used observation and informal interview and discussion with entrepreneurs.

5.2 Research Location

Malaysia comprises 14 states of which 12 are situated in the Peninsula and the other two states are situated in the northern part of the island of Borneo. Due to this geographical location and the history of formation of Malaysia in 1963, the division of Malaysia usually referred to are not the states, but its three main regions, namely Peninsular Malaysia, Sabah and Sarawak.

The population of Malaysia is approximately 18 million, and approximately 80 per cent of them reside in Peninsular Malaysia. In terms of distribution of small firms, 89 per cent of small firms are located in Peninsular Malaysia (MITI 1992). In view of this background, we chose Peninsular Malaysia as the study area.

5.3 Sampling Technique

5.3.1 Population

The population of the study is small-scale *Bumiputera* food processing firms that had been operating for at least last five years and had adopted or considered adopting a technological innovation during the last three years (after 1989)[1].

[1] We assumed that firms which are five years old or more had innovate had a greater tendency to improve their production by adopting new machine.

5.3.2 Sampling Frame

The researcher developed a sampling frame from three main sources, namely, Malaysian Agricultural Research Development Institute (MARDI), Majlis Amanah Rakyat (MARA) and *Persatuan Pengilang Bumiputera* (Association of *Bumiputera* Manufacturers). MARDI and MARA are the main institutes which are responsible for the development of *Bumiputera* entrepreneurs in Malaysia and *Persatuan Pengilang Bumiputera* is one of main associations for *Bumiputera* entrepreneurs. *Firstly*, the researcher obtained a list of entrepreneurs who had attended courses conducted by the Department of Food Technology in MARDI. *Secondly*, the researcher obtained lists of *Bumiputera* food processing firms which had been compiled by MARA and *Persatuan Pengilang Bumiputera*. These three lists of firms were then merged to form a sampling frame for this study. However, the information on the firms was limited to firms' name, address and types of products produced. Considering that the population of this study was defined as firms that had been operating for at least five years, not all firms in the list might meet the required criteria. The number of firms listed in the sample frame, broken down according to regions in Peninsular Malaysia, is shown in **Table 5.1**.

Table 5.1: Number of Firms Listed in the Sample Frame and The Number of Firms Selected in this Study According to Geographical Regions in Peninsular Malaysia

Region	No. of firms in sampling frame	No. of firms selected	Percentage of firms selected
Northern	122	43	35.2
Eastern	161	66	41.0
Central	122	34	27.9
Southern	141	54	38.3
Total	546	197	36.1

Source: Survey 1993

5.3.3 Sample Selection

Based on this sampling frame, the researcher used a purposive sampling technique, by identifying towns in the regions that had the greatest number of firms. These firms were selected for interview. However, not all the considered firms could be interviewed by the enumerators (the researcher and field workers). This was due to two main reasons. *Firstly*, it was not possible to locate some firms, as they had already moved to other places or the firms had closed down. *Secondly*, some firms did not fulfil the criteria of a respondent. The researcher and field workers successfully interviewed 197 firms, that is, 36.1 per cent of all firms listed in the sampling frame (refer to **Table 5.1**). This percentage might seem small and one may question its representativeness of the population specified. To examine the representativeness, the characteristics of the firms selected in this study were compared with those characteristics of small firms which had been widely quoted by past researches and MITI of Malaysia. The researcher used types of organisation, number of workers and level of mechanisation as the basis of comparison between this study and studies conducted by MITI (1992), UKM (1990) and Mohd and Shaari (1988). The outcome can be observed in **Table 5.2.**

As exhibited in **Table 5.2** small firms surveyed by these three researches and surveyed by this study revealed similar characteristics. The majority of *Bumiputera* food processing firms were sole proprietors and had less than 5 full-time workers. In terms of their level of mechanisation of processing technique, the majority were semi-mechanised.

Table 5.2: Percentage Distribution of Firms' Characteristics Based On Research Finding of Various Institutions and This study

Firms' characteristics		MITI (%)	UKM (%)	Mohd and Shaari (%)	This study (%)
Form of organisation	Sole proprietor	69	46.3	-	67.5
	Partnership	16	32.1	-	18.8
	Private limited company	15	21.6	-	13.7
Number of workers	Less than 5	49	36.4	-	46.2
	5-9	31	31.8	-	28.4
	10 or more	20	31.8	-	25.4
Level of mechanisation	Manual	33	16.7	21	9.6
	Semi-mechanised	64	76.6	70	81.3
	Mechanised	3	6.7	9	9.1

Note: Survey by MITI was carried out in 1992
Research by UKM was conducted in 1990 and research by Mohd and Shaari was conducted in 1988.

5.4 Collection of Information

In order to have a full understanding of technological innovation among small size *Bumiputera* food processing industries, internal and external factors which were expected to have a certain degree of influence on the innovation decision were investigated. Information on internal factors such as organisational and entrepreneurs' characteristics could be investigated only by personal interaction between the investigator and the owners of firms under study. On the other hand, information on external factors such as the roles of institutions which supposedly have some influence on the development of food processing industries in

Malaysia, could only be obtained through interactions of researcher and the officers concerned and through investigation of documents published by those institutions. Thus, the types of information needed to conduct this research influenced the choice of information collection techniques.

Three basic techniques of information collection were used in this study. These techniques were (a) structured interviews with the entrepreneurs of the selected firms, (b) unstructured interviews with officers of government agencies that provide assistance to food processing firms, and (c) a detailed study of documents published by various institutions that provide information on food processing industries in Malaysia.

For the structured interview, we used a questionnaire to administer the questions put during the course of the interview. The questionnaire was written in the Malay language (an English translation is given in **Appendix II**). The interviews did not depart from the questions shown in the questionnaire, except on occasion to the extent that some rephrasing was necessary in order to clarify them. The questionnaire had been previously tested by the researcher by interviewing 15 entrepreneurs to examine the appropriateness of the questions asked and the method of measurement of the information provided by them. Because of the large number of firms and their widely scattered location, the researcher hired five field workers to assist her in conducting the interviews. During the period of this field work, she conducted 30 interviews (inclusive of interviews for questionnaire pre-testing) and the rest of the respondents were interviewed by the five field workers. These field workers were final year UKM undergraduate students from the Faculty of Management Studies. They were selected on the basis of their previous

experience of conducting interviews in survey research. These field workers were then given training for two days and provided with a research manual to familiarise them with the questions in the questionnaire. This training emphasised how to identify and approach respondents, interviewing technique and questionnaire administration. Each interview section took 2 to 3 hours. The collection of information by interviewing and administering structured questionnaires to all the 197 respondents took place from early September to the end of November 1993.

5.5 Definitions

5.5.1 Technological innovation

This study defines technological innovation as the adoption of new technology in firms' processing technique (please refer to **Chapter Four, section 4.1** for concept of innovation adopted in this study). Although technology is a much wider concept than this, for our purposes we have defined technology as machinery new to the firms in this study, adopted to improve their production process during the past three years from the time the survey was conducted. Because the firms in this study did not produce the same type of food products, the machinery adopted or considered for adoption by the entrepreneurs may vary in nature, function and value. However, the machine adopted or considered for adoption by the entrepreneurs were perceived as new by them, and the aim of adopting was to improve performance.

5.5.2 Level of Innovativeness

Firms' level of innovativeness was measured in two categories: innovative and non-innovative. Innovative firms are firms which had already adopted at least one new process technology, embodied in a new machine, after 1989. Since this study was conducted at the end of 1993, innovative firms were firms which adopted at least one new process technology within the period 1990 - 1993 (4 years). We refer to the entrepreneurs of these firms as innovative entrepreneurs. Non-innovative firms are firms which did not adopt any new process technology during that period although they had considered doing so. The entrepreneurs of non-innovative firms are referred to as non-innovative entrepreneurs.

We recognised the limitation of using a period of time to measure firms' level of innovativeness such as its inability to capture firms which had innovated prior to the time period (1989 or before). Recalling that firms in this study were firms which had considered adopting a technological innovation, however, only a proportion of them had actually adopted the considered innovation. Hence, compared with firms which were unable or unwilling to adopt, the fact of firms successfully adopting a technological innovation to some extent reflects their innovative behaviour (bear in mind that small firms faced financial and physical constraints which act as barriers to technological innovation). Furthermore, if innovativeness is a persistent characteristic of firms, it may be that innovativeness as measured between year 1989 to 1993 (4 years) is a good proxy.

5.5.3 Firms' Size

There is no standard procedure for measuring firms' size in Malaysia. Different government agencies have adopted different methods of measurement. For example, the Coordinating Council for Development of Small and Medium Industries (CCDSI) used firms' fixed asset and paid up capital to indicate their size. This agency defined SMIs as those which have fixed assets of less than RM250,000 (about £62,500). Small industry was defined differently for *Bumiputera*-owned firms and non-*Bumiputera* owned firms. *Bumiputera*-owned firms, were considered small if the paid up capital did not exceed RM200,000 (about £50,000). For non-*Bumiputera* firms, the criterion level was only RM100,000 (about £25,000). Finally the original provision of the Industrial Coordinating Act exempted SMIs from applying for a licence if they had less than RM250,000 in shareholders' funds and employed fewer than 25 full time workers (Chee 1986)

In this study we define the size of a firm by its number of full time workers. Small firms are defined as firms employing less than 50 full time workers in 1989; medium firms are firms which employed 50 to 199 workers and large firms as those which employed 200 or more full-time workers, in 1989. We pointed out in Chapter Four that there might be some dispute over causal direction if a correlation was found between size and innovativeness. It will be noted that the lag between the date of measurement of size and the period of measurement of innovativeness makes it more likely that the direction of causation is from size to innovation.

5.5.4 Entrepreneurs

The term entrepreneur in this study refers to a person or small group of persons who have owned and managed the existing business for more than five years and stand to gain or lose significant financial reward based upon the success or failure of that business. This includes the main shareholder of the business who actively manages it and takes part in major decision making. Managing the business is their main economic activity. Entrepreneurs as so defined, are the respondents of this study.

5.6 Measurement of Variables

The questionnaire consisted of six sections. The first section was on the firms' background. The second and the third sections concerned firms' machines and the procedures of acquiring the latest machine or the considered machine (for entrepreneurs who had not adopted any machine after 1989 until the filed work of this study was conducted). The fourth section covered firms' economic performance. Section five investigated the entrepreneurs' background, while the sixth section was about the entrepreneurs' personality traits. The sample of the questionnaire (which had been translated) used in this study is exhibited in **Appendix II**.

Several types of scales were used to measure variables, depending on their appropriateness. The following is a description of scales used in measuring variables considered in the conceptual framework. One of the main issues in the study of choice behaviour is the assurance of the existence of a relatively unique

numerical scale which in some sense represents the choice behaviour of respondents. The questionnaire developed was believed to have the ability to measure the behaviour and the perception of entrepreneurs in the study.

5.6.1 Innovativeness

Firms innovativeness was measured by whether or not the firms had adopted a technological innovation in the three years before this study was conducted. If the firms had adopted an innovation, these firms were categorised as innovative firms while firms which had not adopted any innovation were categorised as non-innovative firms.

5.6.2 The characteristics of Entrepreneurs

5.6.2.1 "Personal Demographic"

Variables categorised under "personal demographic" are the entrepreneurs' sex, age, level of education, years of managing the existing business and years of experience in their previous work. The possible answers to the questions on sex, age and level of education were pre-coded in the questionnaires using nominal and interval scales. The variables, years of experience in the existing business and previous work were measured by a ratio scale[2]. The entrepreneurs stated the number of years they had already managed their existing business and their

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[2] A ratio scale possess an absolute zero point, so that multiplication and division become meaningful operations. Ratio scales enable a researcher to state the relationship among variables as a product or ratio.

previous work. The entrepreneurs also had to reveal the types and sectors of their previous work. Information on the entrepreneurs' personal demographics could be obtained in question number 4,5,6,7 and 8 in section **E** of the questionnaire.

5.6.2.2 Personality Traits

Three variables were used to measure the personality of entrepreneurs, namely, need for achievement, locus of control and attitude toward risks. Information on personality traits was obtained in section **F** of the questionnaire (refer to questions 1,2 and 3 of section F in the questionnaire).

(a) <u>Need for Achievement</u>

The work of McClelland in 1960s suggested that the key to entrepreneurial behaviour lies in achievement motivation. A person endowed with such a need to achieve will spend time considering how to do a job better or how to accomplish something important to them. High achievers are said to like situations where they can take personal responsibility (Chell 1991) To measure entrepreneurs' need for achievement, the researcher developed several items describing behaviour that reflected the need for achievement of respondents. The statements were based on several aspects of individual motivation such as (i) they seek recognition by performing well, (ii) they have high aspiration level, (ii) they have strong striving for upward mobility and (iv) their time perspective is very much future-oriented. For each statement, respondents were required to indicate the degree of the similarity of their behaviour to that described, based on a five point Likert scale,

whereby 1 meant the statement was almost never true for the respondent, 3 meant occasionally true for respondent and scale 5 meant that the statement was true for the respondent most of the time. Scores were reversed for statements that indicated low need for achievement.

(b) Locus of Control

To measure locus of control of an entrepreneur, the researcher adapted the measurement developed by Hodgkinson (1992). We develop eleven items that could measure respondents' belief about his or her strategic management and experiences in their firms. The items were balanced with respect to the number of internally and externally worded items. Respondents were required to indicate the extent to which they agreed with statements on a five point Likert scale ranging in the case of externally worded items from 1 (strongly disagree), through 3 (unsure) to 5 (strongly agree). Internally worded items were reverse scored. Total scores received by respondents represented their locus of control.

(c) Attitude Toward Risks

To measure the attitude toward risk, choice dilemmas procedure was used as an instrument. This measurement was first introduced by Wallach and Kogan in 1959. The instrument contains descriptions of situations that a person might encounter in everyday life. In each situation, a person is faced with a choice between two alternative courses of action. The first alternative is more desirable and attractive than the second alternative, but the probability of achieving the first

alternative is less than the second alternative. For each situation, the respondents were asked to indicate the minimum probability of success they would require before recommending the first alternative to be chosen. The respondent's selection of the probability level for the risky alternative's success that would make it sufficiently attractive to be chosen, would thus reflect the deterrence of failure for him in a particular decision area (Kogan and Wallach 1964). The instrument is semi-projective in nature, the respondent being asked how he or she would advise others in the situation described. It is assumed that his advice would reflect his own regard for the desirability of success, relative to the disutility of failure. Probability levels provided for the success of the risky alternative were 1 in 10, 3 in 10, 5 in 10, 7 in 10 and 9 in 10. A subject might also refuse to gamble on the risky alternative, no matter what the probabilities. In that case, a score of 10 out of 10 was assigned to the item. It can be seen that higher scores are associated with greater conservatism[3].

5.6.2.3 Skill upgrading

Skill upgrading was measured by number of business courses attended by the entrepreneurs in the five years prior to the conduct of this study. Other than the number of business courses, the entrepreneurs also had to reveal the types of courses and the organiser of the courses attended by them (refer to question number 9 in section **E** of the questionnaire).

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[3] In the logistic regression model, the score is reversed. A higher score indicated that the entrepreneurs were risk takers.

5.6.2.4 Entrepreneurs' Knowledge of the Technology

It is assumed that entrepreneurs would have a deeper knowledge of the innovation if they had used various methods of searching for information and learning about the innovation. This study measured this variable by asking the entrepreneurs whether they had carried out any detailed study on the considered machine before deciding whether or not to adopt it. If the entrepreneurs said they had conducted a study, they were asked to state the types of studies they had carried out. This information was obtained in questions 19 and 19.1 in section **B** of the questionnaire.

5.6.3 Organisational Characteristics

5.6.3.1 *Firms' Size*

This study hypothesised that firms' size determine innovativeness. Hence, the size of firms was measured before firms' adopt a technological innovation. We used number of full time workers at the end of 1989 to measure firms' size.

5.6.3.2 Firms' Structure

Firms' structure was viewed in terms of their level of formalisation, centralisation and complexity.

(a) <u>Formalisation</u>

To measure the level of formalisation, 10 statements were formulated that describe levels of formalisation in various situations in any firm. The situations described concerned the relationship between employer and employee, the

decision making process and direction of communication in the organisation. Using a Likert scale, for each statement, the respondents had to indicate the degree of correspondence between the statement and their firm`s situation.

(b) <u>Centralisation</u>

Firms' level of centralisation was measured by the number of individuals who took part in the decision making process. This study measured firms' level of centralisation by form of the firm, such as sole proprietorship, partnership and limited private company.

(c) <u>Complexity</u>

Firms' level of complexity was measured by the number of skilled workers. Skilled employees were those who worked in the management and technical levels.

5.6.3.3 Mismatch of the Existing and Required Labour Force

This was measured by the following information on the occurrence of the following situations when or if firms adopt new technology: (i) the existence of enough labour able to operate the technology, (ii) restructuring of labour force as a result of adoption, (iii) existence of redundancy, (iv) retraining of employees and (v) recruiting of new employees.

For firms which had already adopted the new technology, the above information revealed by firms reflected the actual situation that obtained when

they adopted the technology. For firms which had not adopted the technology, the measurement is done on the perception of entrepreneurs of the existence of the above situations if they were to adopt the considered new technology.

5.6.3.4 Financing

As well as enquiring about their source of financing for technology adoption, we measured the degree of difficulty firms had to obtain financing to adopt new technologies. Five statements were formulated describing the situation of obtaining financing and the respondent had to indicate the degree of difficulty that they might face or had already encountered in each of the situations. A four point Likert scale was used to measure the degree of difficulty.

5.6.3.5 Firms' Age

Firms' current life cycle is measured by number of years firms had been operating (refer to question 5 in section **A** of the questionnaire).

5.6.3.6 Firms' Performances

Firms' performance was measured by the following ratios: (i) Fixed asset turnover ratio, which represents efficiency ratio, (ii) return on investment, which represents profitability ratio and (iii) labour productivity. These ratios were calculated as follows:

(i) Fixed asset turnover = Sales /Fixed assets,

(ii) Return on investment (ROI) = Net operating income/ total asset,

(iii) Productivity of labour = value added/ number of full-time workers.

5.6.4 Communication

To measure entrepreneurs' communication behaviour, 4 items were measured. These items were (1) membership of associations, (2) frequency of attending seminars (3) frequency of attending trade fairs during the past five years and (4) subscribing to business magazines.

5.6.5 Entrepreneurs' Perception of the Buying Situation

Five statements describing the situation of buying procedure were given to respondents. Using a Likert scale, for each statement, respondents had to indicate the degree of problems that they had already faced or they might encounter during the buying process. Scale 0 indicated no problem, 1 indicated minor problem that could be solved by them, 2 indicated serious problems that required external assistance, and 3 indicated serious problems that could not be solved (refer to question 24 in section **B** and question 8 in section **C** of the questionnaire).

5.6.6 The Objective Characteristics of the Innovation

As had been mentioned in Chapter Four, the objective characteristics of the innovation can be viewed in term of their technical level and the cost incurred. However, due to the heterogeneity of the innovation that had been adopted or considered to be adopted by respondents, this study measured the objective characteristics of the innovation only by total cost incurred to install the innovation. We assumed that cost of innovation is positively correlated with their levels of technicality.

5.6.7 The Perceived Characteristics of the Innovation

The characteristics of technology perceived by entrepreneurs were classified into five categories, namely (a) economic advantage, (b) simplicity, (c) prestige, (d) perceived risk and (e) compatibility. To measure respondents' perception of each of the characteristics of technology, three statements were used to describe each category. Using a five point Likert scale, entrepreneurs were asked to indicate the extent to which they agreed with each statement (refer to question 25 in section C of the questionnaire).

5.6.8 Environmental factors

5.6.8.1 Competitive Intensity

Competitive intensity was viewed in terms of (i) form of competition, and (ii) competitive price intensity. Form of competition was measured by identifying who were the major competitors of the firms in the study. The measure of competitive price intensity was the frequency with which price-cutting had taken place in the firm during the last 3 years[4].

5.6.8.2 Institutional Involvement

This was measured by (i) kind of assistance such as financial or subsidy received from government agencies (ii) participation in any government agencies' activities, such as attending courses and (iii) number of visits to government

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[4] In the logistic regression model, we only used form of competition as a proxy for competitive intensity. We could not use price intensity as a proxy for competitive intensity because only two firms (of 197 firms) had price cut within the time period asked.

agencies for consultations (refer to question 14 in section **B** and questions 10, 11 and 12 in section **E** of the questionnaire).

5.7 Validity and Reliability of the Measurement

Adams and Schvaneveldt (1985: 79) defined validity and reliability of research as follows:

> *'... validity refers to the general correctness of the fact or evidence used in understanding behaviour, while reliability refers to the consistency or dependability of the fact itself.'*

Realising the importance of validity and reliability of measurement to obtain correct and precise information, we will discuss some tests we conducted to ensure the validity of the measurement used. However, for this study, only relevance of methods of measurement required some test of reliability. Information measured by a ratio scale, for example, did not require such test.

5.7.1 Validity

The validity of research measures deals with what is actually being measured by the assessment device. In other word, the validity of research instruments refers to whether those instruments measure what they are designed to measure. This study used a questionnaire as a research instrument. Generally, there are four types of validity that are addressed in building good research instruments (Adams and

Schvaneveldt 1985:80). These are face validity, criterion-related validity, content validity and construct validity[5].

One way to ensure the validity of this instrument was through a pilot test. Fifteen entrepreneurs participated in the pilot test of the questionnaire. The researcher took care to choose the correct variables to represent the information sought and which entrepreneurs would be able to provide. Since all respondents were Malays with different levels of education, the variables were then translated into simple, direct questions in Malay language, to avoid ambiguity. Collecting the information by using questionnaire and interviewing meant that the questions could also be rephrased by the field workers if required, according to situations and respondents. Information from the pilot test was analysed to ensure that the instrument was capable of measuring the proposed theoretical constructs, by examining the related variables that made up these constructs.

5.7.2 Reliability

Reliability of the measurement used refers to the amount of agreement between independent attempts to measure the same theoretical construct. There are two types of reliability. The first type is *internal consistency*, where two or more methods are used to measure the same theoretical concept at the same point in time. The second type is known as *test-retest* reliability or *stability* where measurement of the same theoretical concept is repeated over time. Therefore, a

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[5] Face validity is to ensure the instrument appears to measure the subject matter under consideration. Criterion-related validity shows that the individual's test score predicts the probable behaviour on a second variable. Content validity is a subjective judgement of the relevance of an item to a scale and construct validity deals with assessing the degree of accuracy in measuring the underlying elements (construct) of a scale.

highly reliable measure is one that gives the user consistent results over time, places, and occasions. Reliability is typically reported by means of a correlation coefficient which is technically called a reliability coefficient. One of the most frequently used reliability coefficients is Cronbach alpha[6]. Cronbach alpha has the value between 0 and 1 inclusive, with higher values indicating greater reliability. Cronbach alpha greater than 0.60 is generally accepted for exploratory research to indicate reliability for the measurement, though a value greater than 0.70 is more preferable (Bagozzi 1994:18). This alpha value can easily be calculated by SPSS statistical package.

The second type of reliability was not relevant for this study. However, the first type of reliability test had its relevance to some of the theoretical constructs used in this study. The theoretical constructs of entrepreneurs' need for achievement, locus of control and attitude toward risks (**section F**, questions 1, 2 and 3 in the questionnaire) and firms' formalisation (**section A**, question 15 in the questionnaire) required this type of reliability test. The calculated Cronbach alpha obtained for each construct after eliminating a few items, is exhibited in **Table 5.3.** After eliminating certain items in certain constructs, except the

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[6] The measurement of Cronbach alpha was calculated by the following formula:

$$\alpha = \frac{n}{n-1}\left(1 - \sum s_i^2 / s_t^2\right)$$

where:

- n = number of measurement
- s_i^2 = variance of measure i
- s_t^2 = variance of total scale formed by the sum of square. This can be computed by adding the variances and covariance among the multiple measures from the covariance matrix.

measurement of attitude toward risks, the alpha values obtained were above 0.70, indicating that the constructs had *internal consistency* reliability. The alpha value of 0.6592 of attitude toward risks was still in the acceptance region.

Table 5.3: Reliability Test

Constructs	**No. of items**	**Items eliminated**	**Cronbach alpha**
Firms' formalisation (Question 15 section A)	10	-	0.7081
Need for achievement (Question 1 section F)	18	items j and b	0.7533
Locus of control (Question 2 section F)	11	items b, e and i	0.7183
Attitude toward risks (Question 3 section F)	6	-	0.6592

Source: Survey 1993

5.8 Statistical Analysis

5.8.1 Development of Mathematical Model

In Chapter Four, **Figure 4.2** showed the factors that had been hypothesised as having a significant effect on the entrepreneurs' decision to adopt a technological innovation. It was essential to develop a mathematical model based on that figure to test the significance of the effect of each factor simultaneously. There are various multivariate statistical techniques that can measure or explain cause or effects of independent variables on a dependent variable. For this particular model, the independent variables were the proposed determining factors and the dependent variable was the entrepreneurs' decision to adopt or reject the innovation. However, before we chose the appropriate technique, it was

necessary to consider the nature of the data. The set of independent variables comprised of continuous data and discrete data. Data on the entrepreneurs' sex, government assistance, and competitive intensity were discrete in nature while others were continuous. The dependent variable, on the other hand, had dichotomous or binary value (the value of 0 or 1). There are various techniques that can be used to predict a binary dependent variable from a set of independent variables. Multiple regression analysis and discriminant analysis have been used by some researchers. However, when the dependent variable has only two values, the assumptions necessary for hypothesis testing in regression analysis are violated. For example, it is unreasonable to assume that the distribution error is normal. The interpretation of the regression equation is not straightforward. It might also be difficult to interpret the predicted values in terms of probability because they are not constrained to fall in the interval between 0 and 1 (SPSS 1990: 1).

Linear discriminant analysis on the other hand, is capable of predicting a binary dependent variable. However in order to be optimal, the assumption of multivariate normality of the independent variables, as well as equal variance-covariance matrices in the two categories of dependent variable, is required.

Considering the constraints of the two statistical techniques mentioned above, we developed a mathematical model based on **the logistic regression model**. This model requires far fewer assumptions than discriminant analysis; and even when the assumptions required for discriminant analysis are satisfied, logistic regression still performs well (SPSS 1990:1).

The dependent variable in this study has two values; 1 or 0. Value 1 indicates that firms are innovative and value 0 indicates that firms are non-innovative (definitions of innovative and non-innovative firms have been given above). In logistic regression, we estimate the probability that firms in the study will fall in the innovative category. The Logistic regression model can be written as:-

$$P(Y_i = 1) = \exp\left\{ \beta_0 + \sum_{j=1}^{k} \beta_j X_{ij} \right\} \Big/ \left[1 + \exp\left\{ \beta_0 + \sum_{j=1}^{k} \beta_j X_{ij} \right\} \right]$$

Where:

Y_i = The innovation variable for $firm_i$

(state 1 of Y_i corresponds to innovative firms and

0 to non-innovative firms)

X_{i1}, X_{i2}, X_{i3} .....X_{ik} are the independent variables.

k = number of independent variables

β_j's = utility corresponding to one unit of variables j

j = 1, 2, 3, ...k

Positive value of the coefficients β_j increases the likelihood of firms being in the innovative category. The coefficients β_j are estimated by maximising the log likelihood functions.

5.8.2 Collinearity

When independent variables are correlated with one another, a collinearity problem arises. *Perfect collinearity* means that at least one independent variable

is a perfect linear combination of the others (Menard 1995:65). If each independent variable is treated as a dependent variable in turn and the rest of the independent variables as predictor variables, and its coefficient of determination (R^2) is calculated, perfect collinearity exists if R^2 of 1 for at least one of the variable exists. Perfect collinearity seldom occurs.

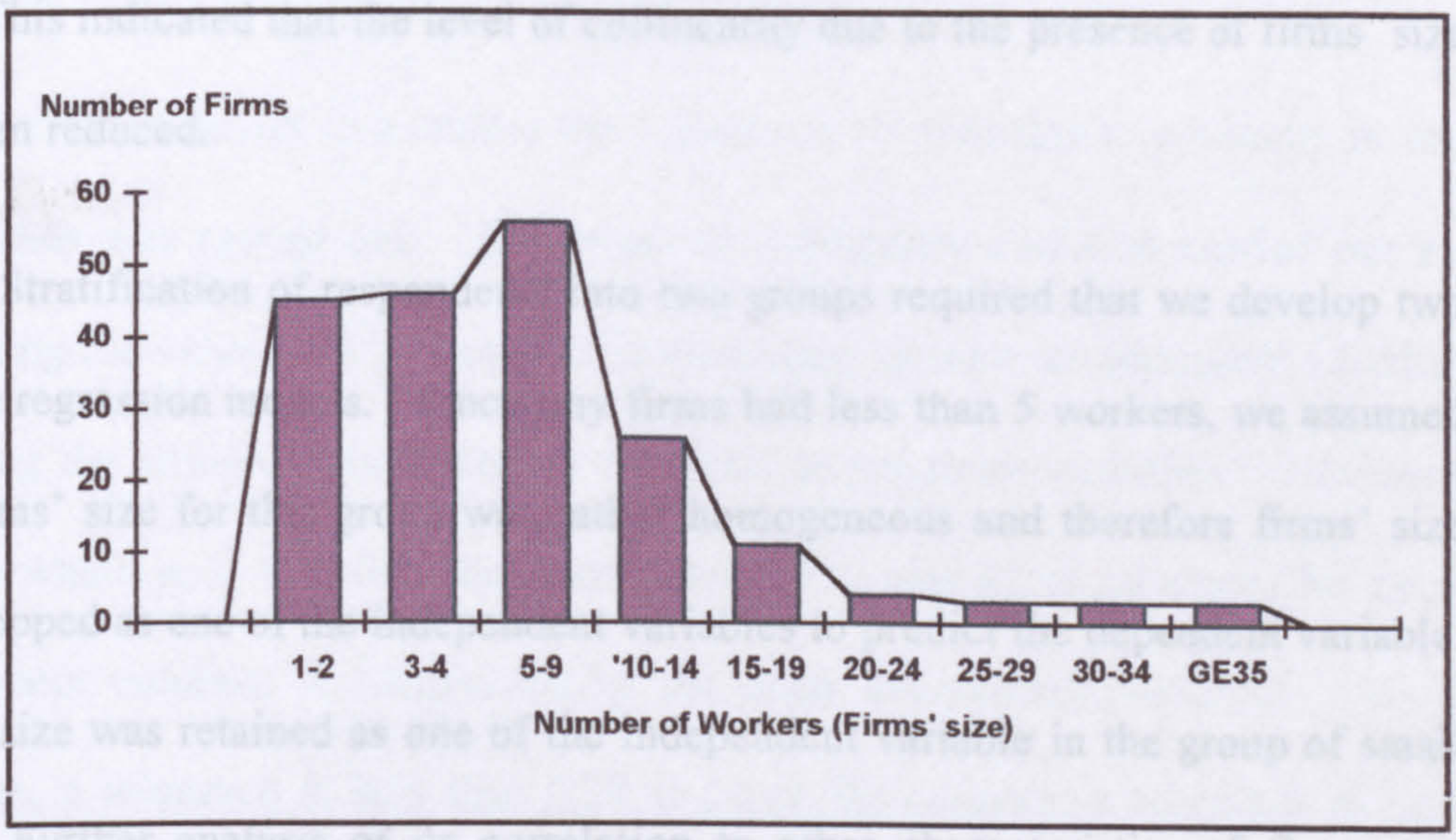
In most regression equations, less than perfect collinearity is rather common. Collinearity may be present when the standard errors for logistic regression coefficients are large. Unbiased estimates may be obtained and their level of efficiency may be poor. However, generally, low levels of collinearity are not problematic and are acceptable in a regression model. Menard (1995) defined high collinearity as where the value of at least one R^2 is 0.80 or more but less than 0.90. Very high collinearity is when the value of at least one R^2 is 0.90 or more. High levels of collinearity tend to produce problems and very high collinearity leads to coefficients that are not statistically significant, even though the value is quite large.

The independent variables used in this study were expected to have some correlation, one with another. In theory, firms' size, for example should have some correlation to other characteristics of firms. Bigger firms usually have higher levels of complexity and formalisation and a lower levels of centralisation. Indication of some extent of collinearity was shown when only six independent variables (PREXP, COURSE, SIZE, FINANCE, MACOST and ASSIST) were significant at 85 per cent confident level to predict the dependent variable in logistic regression function. The coefficient of variable EDU in that function, although was not significant but had wrong sign (**Appendix III**). To further

examine the extent of collinearity of the data, we conducted correlation analysis among the variables. The correlation coefficients which emerged are tabulated in **Appendix IV**. As exhibited in that appendix, at least at 85 per cent confidence level, firms' size was correlated with most of the independent variables. We suspect high level of collinearity occur due to the presence of firms' size as an independent variable. Thus, this variable has to be controlled to observed the contribution of other independent variables to the dependent variable.

The distribution of the respondents' firms' size can be seen in **Figure 5.1.** The skewed distribution is evident.

Figure 5.1: Distribution of Firms' Size



Source: Survey 1993

There was a higher concentration of respondents with firms' size of below 10. Thus, without controlling firms' size, the marginal contribution of other independent variables to the dependent variable would be biased toward firms whose size was below 10. Descriptive statistics showed that the median of this

variable is 5. Considering these facts, stratifying the respondents into two groups based on their firms' size was a way of controlling firms' size in the analysis. The first group consisted of firms with less than 5 workers and the second group consisted of firms with 5 or more workers. The first group was called **tiny firms** and the second group was called **small firms**. Stratifying the respondents into two groups also gave us an extra advantage because we could observe whether or not the proposed independent variables had a similar effect on these two groups of firms. Correlation analysis among independent variables for each group of respondents showed that there was a reduction in the number of independent variables that correlated with firms' size (refer to **Appendix V** and **VI**). This indicated that the level of collinearity due to the presence of firms' size had been reduced.

Stratification of respondents into two groups required that we develop two logistic regression models. Since tiny firms had less than 5 workers, we assumed that firms' size for this group was rather homogeneous and therefore firms' size was dropped as one of the independent variables to predict the dependent variable. Firms' size was retained as one of the independent variable in the group of small firms. Further analysis of its correlation to other characteristics of firms was made. It was found that it was correlated with firms' centralisation (CENTRAL), complexity (COMPLEX), intensity of financing problem (FINANCE) and firms' age (YESB)[7]. The correlation of these variables to firms' size could be reduced by using their value in relation to firms' size instead of their actual value. This relative value was calculated as follows:-

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[7] names in the brackets; CENTRAL, FORMAL, FINANCE and YESB are variables names.

For example:

Centralisation of firms (CENTRAL) is found to be correlated with firm size (SIZE). The predicted value of CENTRAL for a particular firms' size can be calculated by using simple regression. The regression function of the two variables is

$$\mathbf{CENTRAL = \alpha + \beta SIZE + \varepsilon}$$

Predicted value of CENTRAL is E(CENTRAL) = a + bSIZE

where a and b is the estimates of the regression coefficients.

Relative value of centralisation is,

$$\mathbf{CENT\text{-}R = CENTRAL \,/\, E(CENTRAL).}$$

CENT-R is a new independent variable.

Further analysis to examine the existence of collinearity problems in the two models was carried out. Detection of collinearity could be carried out by calculating the value of R^2 for each of independent variable as dependent variable and using the remaining independent variables as predictor variables. *Tolerance* statistic which is 1- R^2_X was then calculated. R^2_X was R^2 or variance for each independent variable, X, explained by the other independent variables. As a guideline, a tolerance of less than 0.20 is cause for concern; a tolerance of less than 0.10 almost certainly indicates a serious collinearity problem (Menard, 1995: 66).

To detect collinearity in the two logistic regression functions developed, we used the procedures described above. The tolerance levels of each independent variable are displayed in **Table 5.4**. As shown in that table, the tolerance value for each independent variable for both tiny and small firms' models were more

than 0.20. Based on the criteria mentioned above, this suggested that collinearity existing in the data was not cause for serious concern, and we could conclude that the collinearity level did not reduce the efficiency of the estimates of the two logistic regression models.

Table 5.4: Testing for Collinearity

Dependent variable	**Independent variables**	**Tolerance:** Model for tiny firms	**Tolerance:** Model for small firms
Innovativeness	AGE	0.4714	0.3513
	SEX (1)	0.6123	0.6142
	EDU	0.4212	0.3812
	MANAGE	0.3177	0.2619
	PREXP	0.4230	0.5311
	NACH	0.4124	0.4187
	LOC	0.4154	0.4722
	RISKS	0.5376	0.7621
	COURSE	0.2912	0.2954
	KNOW(1)	0.7214	0.6421
	SIZE	-	0.6782
	FORMAL	0.6631	0.7269
	CENTRAL	0.6025	-
	CEN-R	-	0.5981
	COMPLEX	0.6151	-
	COM-R	-	0.7467
	FINANCE	0.5897	-
	FIN-R	-	0.6121
	YESB	0.3081	-
	YESB-R	-	0.2964
	FATURN89	0.3233	0.2139
	ROI89	0.3085	0.2612
	PROD89	0.5967	0.5945
	MISMATCH	0.5819	0.6643
	COMMU	0.3945	0.4176
	BUY	0.4996	0.6932
	MAC	0.5645	0.6830
	MA-COST	0.5923	0.5998
	COMB(1)	0.5634	0.4914
	COMM(1)	0.5617	0.4531
	INST	0.2363	0.2475
	ASSIS(1)	0.6852	0.7168

Source: Survey 1993

Note: **See Appendices VII and VIII for the definition of independent variables.**

5.8.3 Evaluation of the Logistic Regression models

We used -2log-likelihood[8] and 'model chi-square' statistics to evaluate the logistic regression function of tiny and small firms. 'Model chi-square' is the difference between the value of -2log-likelihood with none of the independent variables in the model (*Initial -2log-likelihood*) and the value of -2log-likelihood with all of the independent variables in the model *(model -2loglikelihood*). 'Model chi-square' provides a test of the null hypothesis[9] that $\beta_1 = \beta_2 = \ldots\ldots\ldots \beta_{k-1} = \beta_k = 0$; that none of the independent variable can predict the dependent variable. The value of -2log-likelihood and 'model chi-square' of logistic regression function of tiny and small firms can be observed in **Table 5.5** . For tiny and small firms, the values of 'model chi-square' statistics were equal to 81.405 and 109.713 respectively, and these values were significant at 99.9 per cent confidence level. This indicated that we could reject the null hypothesis that none of the independent variables can predict the dependent variable. As we observed in **Appendices VII and VIII**, 17 and 20 independent variables were found to be able to predict the dependent variable at least at 85 per cent confidence level in the logistic regression function for tiny and small firms respectively.

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[8] In logistic regression function, the *log-likelihood* is a criterion for selecting parameters (Menard, S. 1995, p 19). This is just like the sum of squared errors (SSE) in the linear regression function. SPSS statistical package calculates the value of the log-likelihood and multiplies it by -2 so that the value has approximately a χ^2 distribution. The value of -2log-likelihood is an indicator of how *poorly* the model fits.

[9] 'Model chi-square' is analogous to the multiple variate F test for linear regression, as well as the regression sum of squares.

Table 5.5: Statistical Tests for Model Evaluation

	Chi-square	d.f.	significance
Model of tiny firms: -2log-likelihood *(initial)* -2 Log likelihood *(model)*	119.757 34.322		
Model chi-square	85.435	27	0.000001
Improvement	85.435	27	0.000001
Goodness of fit	73.618		
Model of small firms: -2 log likelihood (initial) -2 log likelihood *(model)*	143.829 41.989		
Model chi-square	101..839	28	0.00001
Improvement	101.839	28	0.00001
Goodness of fit	551.409		

Source: survey 1993

Note: For further detail see **Appendices VII** and **VIII .**

We used a classification table[10] to indicate how well the function was able to classify the respondents' dependent variable (innovative and non-innovative) based on the independent variables. As we observed in **Table 5.6**, the percentage of respondents that were correctly classified by logistic regression of tiny and small firms was 91.20 per cent and 91.51 per cent respectively. The high percentage of respondents correctly classified by these regression functions, showed that the models had high classification efficiency, and hence, they had higher predictive efficiency[11].

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[10] The classification table is provided by the SPSS logistic regression program. It provides the observed value and predicted value of dependent variable.

[11] Positive correlation between classification efficiency and predictive efficiency

Table 5.6: Classification Table of Logistic Regression Functions

Firms Category	Observed	Predicted		Percent Correct (%)
		Non-innovative	Innovative	
Tiny firms	Non-innovative	48	3	94.12
	Innovative	5	35	92.98
				91.20 (Overall)
Small firms	Non-innovative	44	5	89.80
	Innovative	4	53	94.73
				92.51 (Overall)

Source: survey 1993

Note: For further detail see **Appendices VII** and **VIII .**

5.9 Summary

This study was carried out in Peninsular Malaysia, due to the higher concentration of *Bumiputera* entrepreneurs' involvement in FPI in that region. We used a survey method to operationalise this study. A sampling frame was developed from three main sources - data base of MARDI, MARA and Association of *Bumiputera* Manufacturers. From this sampling frame, we selected areas which had larger numbers of firms. All these firms were selected to be interviewed, though we only managed to interview 36.1 per cent (197 firms) of the firms in the sampling frame. Comparative study of the characteristics of the selected firms with the characteristics of firms in other research findings showed that there was no significant difference. We could therefore deduce that our sample was representative of the actual population of *Bumiputera* small scale FPI.

To obtain information on the characteristic of the entrepreneurs, firms and the process of adopting a technological innovation we used a structured interviewing technique together with a questionnaire. Information on institutions such as MARDI, MARA was obtained by informal interview with the officers concerned. Other than these two techniques, we also obtained information from documents and observation during factory visits. Since we used a questionnaire, we tested the validity and the reliability of the measurement of the variables. The value of reliability coefficient was within the acceptance level. We also developed two logistic regression functions to test the relationship of factors (variables) that had been hypothesised to have significant influence on the adoption decision of entrepreneurs in tiny and small firms. These models did not have a serious problem of multicollinearity and had the ability to classify entrepreneurs into two categories - innovative and non-innovative.

CHAPTER SIX

ENTREPRENEURS' CHARACTERISTICS AND ADOPTION OF TECHNOLOGICAL INNOVATION

6. Introduction

In the conceptual framework we developed in Chapter Four, we hypothesised a relationship between the dependent variable (innovativeness), and independent variables. This chapter presents the outcome of an empirical test of this relationship which we conducted by using two **logistic regression functions**. The first function was estimated using information from 91 entrepreneurs from tiny firms and 106 entrepreneurs from small firms were used to estimate the second function. In this study we conducted separate analyses on tiny and small, *first*, because we recognise that tiny and small firms have different characteristics, potentials and constraints, and *second*, in order to compare and contrast the factors that influence innovativeness in small and tiny firms.

The estimators of the logistic regression function are presented in **Table 6.1** (for tiny firms) and **Table 6.2** (for small firm). Throughout this study, we used a confidence level of 85 per cent as the minimum cut-off point of interval estimation of coefficient of each factor to determine its significance.[1]

[1] The significance of each factor can be examined by the value at its respective Significant Level column in **Table 6.1** and **Table 6.2**. If the value in this column is less than 0.15, the respective factor is considered as a determining factor in this study.

From **Table 6.1**, we can identify 17 independent variables which are statistically significant to explain the innovativeness (as the dependent variable) of tiny firms. In the case of small firms (**Table 6.2**), twenty independent variables were found to be statistically significant in explaining innovativeness.

Table 6.1: Logistic Regression Function in Tiny Firms

Factors	Independent variables	B	Standard Error	Wald statistics	Significant level
The entrepreneurs' characteristics:					
a) Demographic characteristics:	AGE	-0.531	0.253	4.289	0.0372***
	SEX (1)	4.203	2.311	3.653	0.0560**
	EDU	0.687	0.431	2.630	0.1126*
	MANAGE	-1.301	0.797	2.721	0.1035*
	PREXP	0.402	0.308	1.628	0.1796
b) Personality traits:	NACH	5.823	2.917	4.136	0.0487***
	LOC	-3.126	1.5085	1.302	0.2531
	RISKS	4.124	2.301	3.450	0.0820**
c) Skill upgrading:	COURSE	5.456	3.127	3.213	0.0927**
d) Knowledge of innovation:	KNOW(1)	1.728	1.594	1.174	0.2785
Organisational characteristics:					
a) Firms' structure:	FORMAL	1.343	2.458	0.299	0.5848
	CENTRAL	0.079	0.062	1.646	0.1996
	COMPLEX	1.418	2.930	0.234	0.6283
b) Financial problems:	FINANCE	-3.996	1.482	2.383	0.1178*
c) Firms' age	YESB	-1.828	1.128	2.627	0.0965**
d) Performance:	FATURN89	-0.067	0.766	.008	0.9302
	ROI89	0.692	0.950	0.532	0.4659
	PROD89	-0.420	0.154	4.672	0.0301***
f) Mismatching of labour forces	MISMATCH	0.567	0.341	2.345	0.1382*
Communication	COMMU	1.541	.637	5.857	0.0155***
Perception of buying procedures	BUY	-2.371	1.413	2.816	0.0933**
Perception of the innovation	MAC	2.477	1.452	2.910	0.0880***
Obj. Characteristics of the innovation:	MA-COST	-0.184	0.119	2.415	0.1091*
Environmental factors:					
a) Competitive intensity:	COMB(1)	0.176	0.576	0.094	0.7595
	COMM(1)	-2.856	2.132	1.521	0.1932
b) Institutional involvement:	INST	3.954	2.076	3.457	0.0612**
	ASSIS(1)	1.792	.616	8.475	0.0036*
Constant:	constant	12.676	28.823	.223	0.636

Note:

(1) *** Significant at 95% confidence level
** Significant at 90% confidence level
* Significant at 85% confidence level

(2) Dependent variable z which measured innovativeness is a dichotomous variable. Value 1 means innovative while value 0 means non-innovative.

(3) Variables SEX, KNOW, COMB, COMM, ASSIS are dichotomous variables

(4) - 2 Log likelihood 34.322
Goodness of Fit 73.618
Model chi-square = 85.435 (d.f=27, significance at α=0.00001)

(5) This regression function is able to classify 91.20% of the respondents correctly.

(6) Definition of variables:

AGE - age of entrepreneurs
SEX - sex of entrepreneurs
EDU - years in formal education
MANAGE - number of years managing the existing firms
COURSE - number of courses attended for the last five years
PREXP - years of the previous work experience
NACH - scores of need for achievement measurements
LOC - score of locus of control measurement
RISKS - score of measurement of attitude toward risk taking
KNOW (1) - study in detail about the innovation
FORMAL - formalisation of firms
CENTRAL - centralisation of firms
COMPLEX - complexity of firms
FINANCE - degree of financing problem
YESB - age of firms (number of years the firms had been established)
FATURN89 - fixed asset turnover for year 1989
ROI89 - return on investment for year 1989
MISMATCH - mismatch between employees and innovation
COMMU - communication index
BUY - degree of problems in the buying process
MAC - index measuring the perceived characteristics of machinery
MA-COST - the cost of innovation
COMB - big companies as main competitors
COMM - medium sized companies as main competitors
INST - measure of interaction of institutions and entrepreneurs
ASSIS - whether entrepreneurs received government assistance or not

Table 6.2: Logistic Regression Function in Small Firms

Factors	Independent variables	B	Standard Error	Wald statistics	Significant Level
The entrepreneurs' characteristics:					
a) Demographic characteristics:	AGE	-2.123	1.158	2.903	0.0736**
	SEX (1)	-.334	.786	0.181	0.6709
	EDU	2.781	1.821	2.912	0.099**
	MANAGE	-.296	0.199	2.217	0.136*
	PREXP	.333	.160	4.301	0.0381***
b) Personality traits:	NACH	3.104	1.864	2.773	0.0959**
	LOC	4.543	2.069	4.819	0.0281***
	RISKS	2.445	1.136	4.634	0.0314***
c) Skill upgrading:	COURSE	1.513	.803	3.552	0.0595**
d) Knowledge of innovation:	KNOW(1)	.795	.871	.833	0.361
Organisational characteristics:					
a) Firms' size	SIZE	0.379	0.135	7.946	0.0048***
b) Firms' structure:	FORMAL	-.4675	1.243	0.141	0.7069
	CEN-R	-4.769	2.946	2.620	0.1055**
	COM-R	2.209	1.252	3.111	0.0778**
c) Financial problems:	FIN-R	-4.803	2.282	4.431	0.0353***
d) Firms' age	YESB-R	-0.637	1.877	0.115	0.7344
e) Performance:	FATURN89	.427	0.209	4.199	0.0404***
	ROI89	-1.399	0.626	4.996	0.0254***
	PROD89	.361	.133	7.347	0.0067***
f) Mismatching of labour forces	MISMATCH	0.138	0.121	1.319	0.2507
Communication	COMMU	1.117	.7344	2.315	0.1281*
Perception of buying procedures	BUY	-4.071	2.111	3.719	0.0538**
Perception of the innovations	MAC	1.044	1.743	0.359	0.549
Obj. Characteristics of the innovation:	MA-COST	-0.053	0.020	6.848	0.0089***
Environmental factors:					
a) Competitive intensity:	COMB(1)	.866	.769	1.269	0.2600
	COMM(1)	-1.138	.959	1.407	0.2355
b) Institutional involvement:	INST	2.016	1.042	3.747	0.0529**
	ASSIS(1)	4.198	1.727	5.907	0.0151**
Constant:	constant	17.522	14.985	1.367	0.2423

Note:

(1) *** Significant at 95% confidence level
** Significant at 90% confidence level
* Significant at 85% confidence level

(2) Dependent variable z which measured innovativeness is a dichotomous variable. Value 1 means innovative while the value of 0 means non-innovative.

(3) Variables SEX, KNOW, COMB, COMM, ASSIS are dichotomous variables

(4) - 2 Log likelihood 41.989
Goodness of Fit 551.409
Model chi-square = 143.829 (d.f=28, significance at α=0.00001)

(5) This regression function is able to classify 91.51% of the respondents correctly.

(6) Definition of variables:

AGE - age of entrepreneurs
SEX - sex of entrepreneurs
EDU - years in formal education
MANAGE - number of years managing the existing firms
COURSE - number of courses attended for the last five years
PREXP - years of previous work experience
NACH - scores of need for achievement measurements
LOC - score of locus of control measurement
RISKS - score of measurement of attitude toward risk taking
KNOW (1) - study in detail about the innovation
SIZE - Number of full time worker for year 1989
FORMAL - formalisation of firms
CEN-R - centralisation of firms relative to firms' size
COM-R - complexity of firms relative to firms' size
FIN-R - degree of financing problem, relative to size
YESB-R - number of years the firms had been established, relative to size
FATURN89 - fixed asset turnover for year 1989
ROI89 - return on investment for year 1989
MISMATCH - mismatch between employees and innovation
COMMU - communication index
BUY - degree of problems in the buying process
MAC - index measuring the perceived characteristics of machinery
MA-COST - the cost of innovation
COMB - big companies as main competitors
COMM - medium sized companies as main competitors
INST - measure of interaction of institutions and entrepreneurs
ASSIS - whether entrepreneurs received government assistance or not

In this section we begin our discussion by analysing the personal demographic factors, followed by a discussion of entrepreneurs' personality traits, skill upgrading, and knowledge about the innovation that they were considering adopting. We believe that these four factors have a significant influence on the entrepreneurs' decision to adopt a technological innovation.

6.1 Personal Demographics

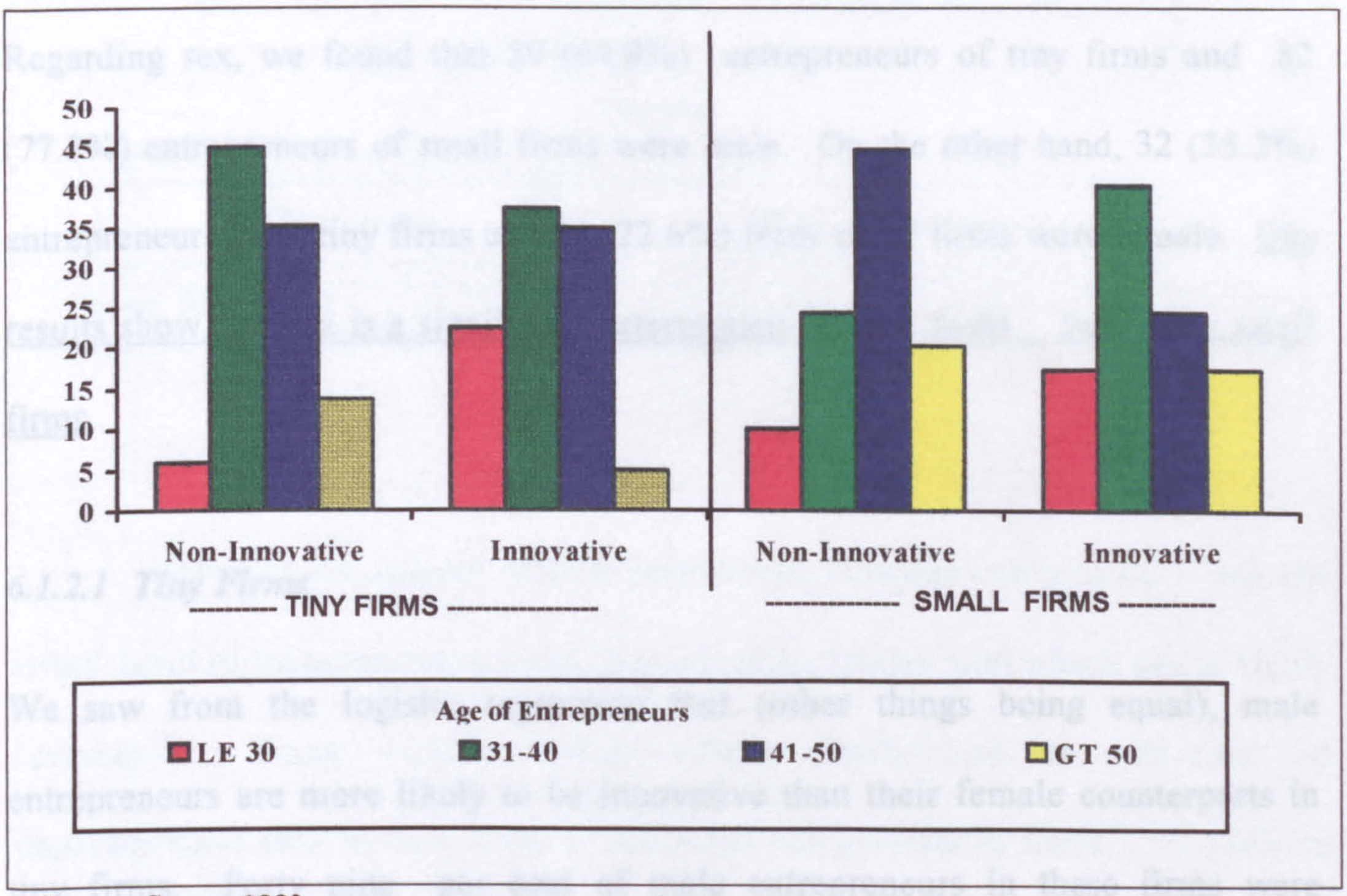
In this section, our analysis will focus on five personal demographic factors: entrepreneurs' age, sex, educational background and work experience (current and previous).

6.1.1 Age

The results of this study as shown in the logistic regression functions in **Table 6.1** and **Table 6.2**, revealed that there was a statistically significant tendency among entrepreneurs in both tiny and small firms, for age to influence innovative behaviour - youth made for more innovativeness. The majority of the entire sample were less than 50 years old. If we relate human age and productivity, the fact that majority of the entrepreneurs were in this age group implies that they were in the stage of high productivity. From **Figure 6.1,** we can see that 60.0 per cent of innovative entrepreneurs from tiny firms and 57.9 per cent of them from small firms were aged 40 years or below. There is reason to believe that younger entrepreneurs are likely to be more receptive to change, more willing to take the calculated risk involved in technological innovation and more capable of handling

a complicated task, than older ones. Those aged below 30 years old are at the beginning of their career and this motivates them to work hard and be innovative. Those in the age group of 30 to 40, in career terms are in the growth stage and are also likely to have other responsibilities (such as family) that motivate them to be innovative in order to be successful in their career (business).

Figure 6.1: The Distribution of Age of Entrepreneurs in Tiny and Small Firms



Source: Survey 1993

Note: Tiny firms: Chi-square value= 6.73066, df=3, significance=0.08100
Small firms: Chi-square value= 6.33389 ,df=3, significance=0.09645

We found a negative correlation between the entrepreneurs' age and level of formal education (for tiny firms, r=-0.3715 and p=0.00001; for small firms, r=-0.6147 and p=0.00001). It indicated that younger entrepreneurs had higher level of education. This characteristic is likely to influence their ability to search for information, upgrade skills and undergo training, in all of which those with higher education have the advantage over those with lower education. Most training

institutes in Malaysia impose a certain minimum education requirement as a criterion for admission to training courses, so, those with higher education (younger entrepreneurs) have better opportunities of being selected to attend training programmes.

6.1.2 Sex

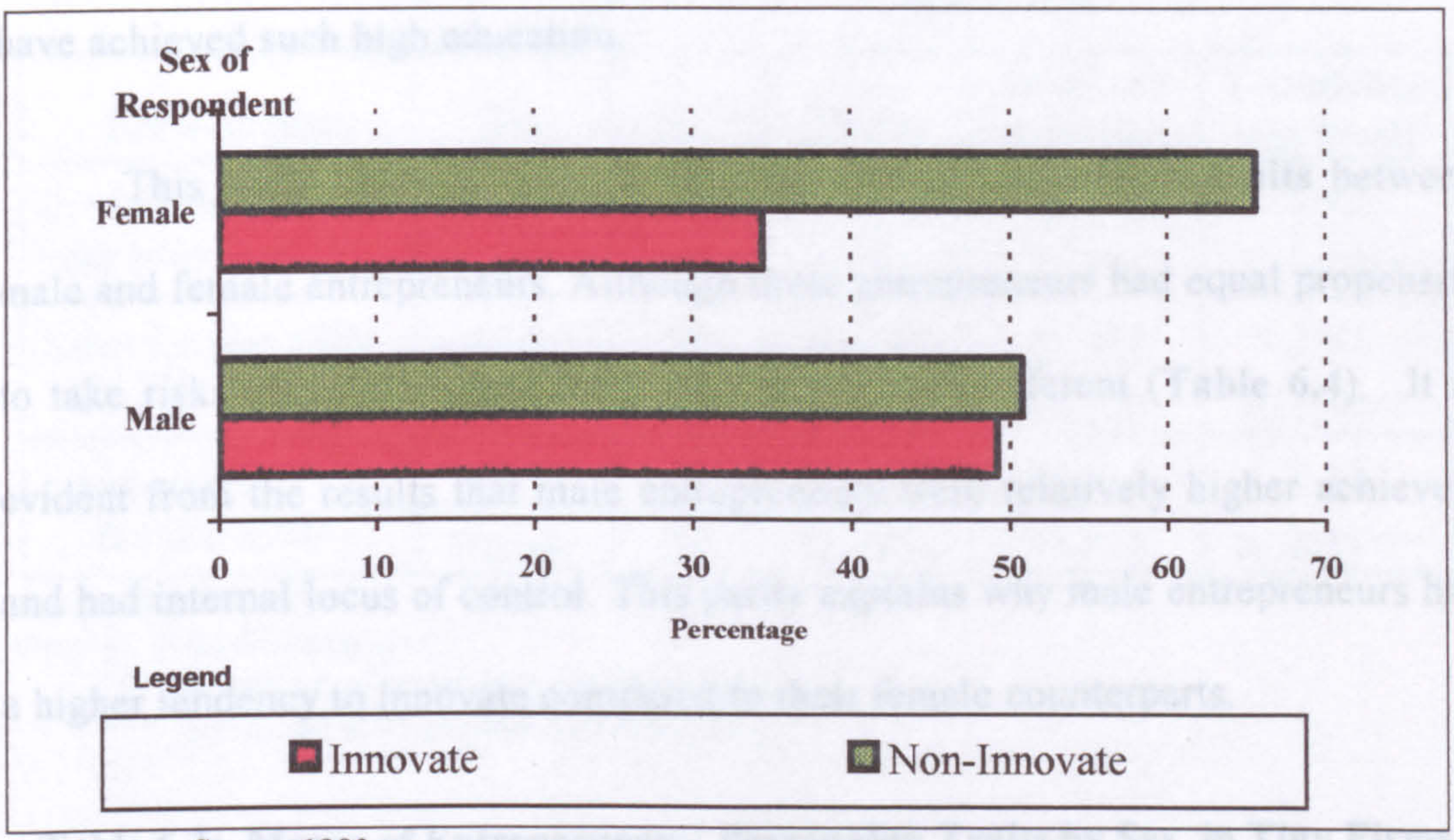
Regarding sex, we found that 59 (64.8%) entrepreneurs of tiny firms and 82 (77.3%) entrepreneurs of small firms were male. On the other hand, 32 (35.2%) entrepreneurs from tiny firms and 24 (22.6%) from small firms were female. Our results show that sex is a significant determinant in tiny firms, but not in small firms.

6.1.2.1 Tiny Firms

We saw from the logistic regression that (other things being equal), male entrepreneurs are more likely to be innovative than their female counterparts in tiny firms. Forty nine per cent of male entrepreneurs in these firms were innovative, compared with only 34.4 per cent of females (**Figure 6.2**).

It seems that a disproportionately high percentage of the innovative males came from the state of Johor while the innovative females came from the state of Kelantan. The high level of innovativeness among the female entrepreneurs in Kelantan could be traced to historical and social factors. Studies by Nor Aini and Faridah (1988, 1991) have highlighted the high rate of entrepreneurial activity among Kelantanese female entrepreneurs, particularly in petty trading.

Figure 6.2: The Distribution of Entrepreneurs by Sex and Firm Categories in Tiny Firms.



Source: Survey 1993

Note: Chi-square value=2.83915, d.f=1, significance=0.1450

However, we suspect that the relationship between entrepreneurs' sex and firms' level of innovativeness work through other factors with which sex is highly correlated. These include factors which clearly had an influence on innovativeness such as their level of education and personality traits. In addition to that we found that male entrepreneurs were more mobile and business owned by them were relatively larger.

That male entrepreneurs were more innovative than females is due to a difference in their educational achievement. Female entrepreneurs in this study had lower levels of education compared to their male counterparts. Forty-one per cent of female entrepreneurs in tiny firms, compared to 22.0 per cent of male entrepreneurs had primary (or lower) education. While 11.7 per cent of male

entrepreneurs had tertiary education, none of the female entrepreneurs claimed to have achieved such high education.

This study shows a significant difference in **personality traits** between male and female entrepreneurs. Although these entrepreneurs had equal propensity to take risks, their n-ach and locus of control were different (**Table 6.4**). It is evident from the results that male entrepreneurs were relatively higher achievers and had internal locus of control. This partly explains why male entrepreneurs had a higher tendency to innovate compared to their female counterparts.

Table 6.3: Means of Entrepreneurs' Personality Traits by Sex in Tiny Firms

Personality traits	Sex of Entrepreneurs		t-statistics [Sig. level]
	Male	Female	
Need for achievement	3.8291 (0.430)	3.6745 (0.511)	1.53 [0.129]*
Locus of control	3.8571 (0.414)	3.5848 (0.368)	3.11 [0.002]***
Attitude toward risks	3.4435 (0.635)	3.3542 (0.461)	0.77 [0.444]

Source: Survey 1993

Note: ( ) standard deviation

[ ] Significance level

* Significant at 85 per cent confidence level

*** Significant at 95 per cent confidence level

Businesses owned and managed by male entrepreneurs were relatively larger than those owned and managed by female entrepreneurs. **Table 6.3** shows that males' firms had higher production, sales and fixed assets, suggesting that they would have more need and capability for technological advancement.

Table 6.4: The Means of Firms' Production, Sales and Fixed assets (RM'000) By Sex of Entrepreneurs in Tiny Firms.

Performances	Sex	No.	Means	Standard deviation	T-statistics [sig. level]
Production for year 1989	Male	59	75.8612	65.028	1.90
	Female	32	47.6725	71.749	[0.060]**
Sales for year 1989	Male	59	81.200	81.547	1.67
	Female	32	51.4575	80.720	[0.099]**
Fixed assets for year 1989	Male	59	34.1844	31.914	2.89
	Female	32	18.3276	18.812	[0.005]***

Source: Survey 1993

Note: [ ] Significance level

** Significant at 90 per cent confidence level

*** Significant at 95 per cent confidence level

Female entrepreneurs operated smaller firms and the majority (75%) of them still used manual and electric portable equipment in their processing techniques. Furthermore, the majority of female entrepreneurs were involved in making *keropok* or traditional snacks requiring only a low level of technology. Snack making is very popular among female entrepreneurs because such activities require little capital, use simple techniques of production, and most important, they can be carried out at home; it allows the female entrepreneurs to combine their productive and homemaking roles (Nor Aini and Faridah 1988 ; Madeline and Faridah 1991).

Male entrepreneurs had higher mobility compared to their female counterparts; they were able to spend more time to obtain advisory services and attending courses. Our survey results show that male entrepreneurs tended to rely on research institutions for improving raw materials, product and processing techniques while female entrepreneurs tended to rely on research conducted

personally or by fellow entrepreneurs. In fact, 52.5 per cent of male entrepreneurs had attended business courses compared to 43.8 per cent of female entrepreneurs. Besides, male entrepreneurs were better able to obtain government assistance to finance their innovation because of their mobility and better access to information. Our survey shows that of 15 entrepreneurs who had received assistance from KEMAS, 12 (80%) were male.

6.1.2.2 Small Firms

We hypothesised that female entrepreneurs are less innovative than male entrepreneurs because they are less mobile, less communicative and have less opportunity to attend business courses due to their domestic commitments. However, from the logistic regression function as exhibited in **Table 6.2**, the sex factor is unable to predict entrepreneurs' innovativeness in small firms. Although in bivariate analysis as exhibited in **Table 6.5**, we found that female entrepreneurs were less communicative than male entrepreneurs, this did not make them less innovative than male entrepreneurs. In fact, compared to male entrepreneurs, we found that female entrepreneurs were equally mobile. They had greater opportunity for access to information from institutions as their institutional involvement was higher than that of males. Also, from **Table 6.5** we found that the number of courses attended by female entrepreneurs were equal to male entrepreneurs which indicated that they have equal opportunity to attend business courses.

Unlike tiny firms, in small firms, entrepreneurs' sex do not correlate with factors that have causal influence on firms' level of innovativeness such as

entrepreneurs' level of education, their personality traits and their firms' structure. Males and females in this group had almost similar characteristics in terms of education and personality traits. They managed firms with similar structure (**Table 6.5**).

Table 6.5: Entrepreneurs and Firms Characteristics, Communication and Institutional Involvement By Sex in Small Firms

Factors		Sex of Entrepreneurs		t-statistics
		Male means/(std.dev)	Female means/(std.dev)	[sig. level]
Level of education (years)		9.7805 (3.432)	9.6250 (4.030)	0.19 [0.852]
Personality Trait	Need of achievement (score)	3.9075 (0.469)	3.8889 (0.509)	0.17 [0.867]
	Locus of control (score)	3.8676 (0.447)	3.8274 (0.504)	0.38 [0.707]
	Attitude toward risks (score)	3.5935 (0.609)	3.5903 (0.301)	0.03 [0.975]
Firms' Structure	Centralisation (index)	81.2195 (25.078)	70.2917 (33.931)	1.37 [0.163]
	Formalisation (index)	2.9500 (0.421)	2.9625 (0.417)	-0.13 [0.898]
	Complexity (index)	1.9268 (1.878)	1.6250 (1.173)	0.74 [0.458]
Number of Courses attended		0.9390 (1.346)	1.2917 (1.517)	-1.10 [0.275]
Communication (index)		1.4146 (1.507)	0.8750 (0.8750)	2.01 [0.050]***
Institutional involvement (index)		1.9634 (2.045)	2.7083 (2.7083)	-1.56 [0.122]*

Source: Survey 1993

Note: * Significant at 85 per cent confidence level

*** Significant at 95 per cent confidence level

The average educational level of male entrepreneurs was 9.7 years and educational level of female entrepreneurs was 9.6 years. As **Table 6.5** shows, no distinction was found in personality traits, need for achievement (n-ach), locus of control and attitude toward risk. Nor was there any difference in terms of the

structure of firms managed by these two groups of entrepreneurs. The firms managed by male entrepreneurs and female entrepreneurs had similar degrees of centralisation, formalisation and complexity.

6.1.3 Level of Formal Education

As we indicated in Chapter Three, previous studies have shown that one of the characteristics that differentiates early and late knowers of innovation is their level of education. Those who are aware of the existence of innovation at an early stage, have a tendency to adopt innovation earlier than those who do not learn about it till later. Thus, we hypothesised that entrepreneurs level of education had causal relationship with their innovative behaviour. Entrepreneurs are more likely to innovate if they have a higher level of education.

The importance of education in determining the innovativeness of entrepreneurs is reflected in the logistic regression equations displayed in **Table 6.1 and 6.2**. The positive results indicated that in both small and tiny firms, entrepreneurs with higher levels of education had a greater tendency to be innovative. This can be seen in **Table 6.6**; on average, innovative tiny and small entrepreneurs had received 9.7 and 10.34 years of formal education respectively, compared to 8.8 and 9.00 years for non-innovative entrepreneurs in tiny and small firms respectively[2].

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[2] Test of significant difference in mean;

(a) between innovative and non-innovative in tiny firm: N_i=40, $mean_i$=9.7000 years and SD_i=3.204; N_n=51, $mean_n$= 8.8235 years, SD_n=2.575: t-value=-1.45, df=89, sig.=0.150

(b) between innovative and non-innovative in small firms: N_i=57, $mean_i$=10.38 years ansig.=0.041

Entrepreneurs with higher levels of education are more able to identify new product and business opportunities, more flexible to adjustments and more receptive to new ideas. This explains why better educated entrepreneurs tend to be more innovative compared to their less educated counterparts.

Table 6.6: Entrepreneurs' Levels of Education By Level of Innovativeness

Level of Education	Tiny Firms				Small Firms			
	Non-Innovative		Innovative		Non-Innovative		Innovative	
	No.	%	No	%	No	%	No	%
No formal education	1	2.0	-	-	2	4.1	1	1.8
Primary education	14	27.5	11	27.5	14	28.6	15	26.3
Lower secondary	22	43.1	14	35.0	14	28.6	14	24.6
O-Level	11	21.6	7	17.5	13	26.5	8	14.0
A-Level	1	2.0	3	7.5	4	8.2	6	10.5
Tertiary	2	3.9	5	12.5	2	4.1	13	22.8
Total	51	100.0	40	100.0	40	100.0	57	100.0

Source: Survey 1993
Note: For tiny firms: Chi-square pearson=15.05660, df=5 sig=0.0409
For small firms: Chi-square pearson=9.4751, df=5 sig=0.0915

The correlation matrix among variables in the regression functions are presented in **Appendices V** and **VI**, from which it can be seen that the level of education is positively correlated with variables COURSE[3], COMMU[4] and INST[5]. The correlation results suggest that there is a relationship between entrepreneurs' level of education and their communicative behaviour and institutional

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[3] for tiny firms, r=0.2602, p=0.013; for small firms, r=0.2365, p=0.015

[4] for tiny firms, r=0.3518, p=0.001 and for small firms, r=0.1949, p=0.045

[5] for tiny firms, r=0.2735, p=0.032; for small firms, r=0.2554, p=0.008

involvement. This result suggests that entrepreneurs' education leads to other innovative behaviour. A positive correlation between the level of education and communication, in terms of number of courses attended and institutional involvement, indicates that entrepreneurs with higher levels of education, tend to be more communicative, attend more courses and have a higher involvement with institutions. This explains further why entrepreneurs with higher education are more innovative than those with lower education.

In small firms, we found a correlation between entrepreneurs' level of education and their firms' structure[6] (in **Section 8.3.1** and **Section 8.3.2**). Entrepreneurs with higher levels of education tended to manage firms with lower levels of centralisation and higher levels of complexity. Based on firms' structure, this gives the indication that firms managed by the entrepreneurs with higher level of education are relatively larger.

6.1.4 Number of Years Managing Existing Business

In **Chapter Four** we hypothesised that entrepreneurs with longer experience are more likely to innovate compared to those with less experience. There is reason to believe that experienced entrepreneurs are more familiar with their business environment, have wider business contacts and access to information, and greater capability in seeking business opportunities. On the other hand, new entrepreneurs also can be innovative because they are under pressure to perform well in their business in order to compete with those who are already established.

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[6] Variable EDU is negatively with variable CENTRAL (r=-0.3092, p=0.001) and positively correlated with variable COMPLEX (r=0.2016, p=0.038)

The logistic regression function (**Table 6.1** and **6.2**) shows that there was a negative relationship between the number of years entrepreneur had been managing their existing business (MANAGE) and their innovative behaviour. This was true for both tiny and small firms. What this result shows, is that entrepreneurs with less experience had a greater tendency to innovate. A closer examination of the survey results show that innovative and non-innovative entrepreneurs from tiny firms had 6.8 years and 8.0 years of experience[7] respectively in managing their existing business. For small firms, we found that the non-innovative and innovative entrepreneurs had 11.5 years and 6.7 years of experience respectively[8]. Thus, entrepreneurs from small firms were relatively more experienced compared to those in tiny firms[9]. Our findings support the hypothesis that less experienced entrepreneurs are more likely to innovate compared to experienced ones, suggesting that innovation is a necessity to compete with those businesses which are well established.

This study also found that the entrepreneurs' experience in managing their current business (MANAGE) was negatively correlated with their level of education (EDU)[10], and attitude toward risk (RISK)[11] which were also the factors that have causal influence on entrepreneurs' innovative behaviour. This

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[7] Test of significant difference in mean between innovative and non-innovative in tiny firms: N_i=40, $mean_i$=6.8250 years and SD_i=4.506 ; N_n=51, $mean_n$=8.0980 years, SD_n=3.700: t-value=1.48, df=89, sig.=0.142

[8] Test of significant difference in mean between innovative and non-innovative in small firms: N_i=57, $mean_i$=6.6667 years and SD_i=5.705 ; N_n=51, $mean_n$=11.5510 years, SD_n=7.821: t-value=3.71, df=104, sig.=0.0001

[9] Test of significant difference in mean between innovative and non-innovative in small firms: N_S=106, $mean_S$=8.9245 years and SD_S=7.163 ; N_T=91, $mean_T$=7.5385 years, SD_T=4.100: t-value=1.69, df=171.32, sig.=0.092

[10] For tiny firms: r=-0.2877, p=0.006; For Small firms: r=-0.4696, p=0.00001

[11] For tiny firms: r=-0.2255, p=0.032; For Small firms: r=-0.1586, p=0.104

correlation suggested that the less experienced entrepreneurs were better educated and more prepared to take risk. These were the characteristics of innovative entrepreneurs.

In tiny firms, entrepreneurs' length of experience in managing their current business was also negatively correlated with their skill upgrading (COURSE)[12] and their communicativeness (COMMU)[13], the factors which had causal relationship with firms' level of innovativeness. This shows that less experienced entrepreneurs were communicative and upgraded their skill and knowledge by attending courses. It appears to us, therefore, that it was the less experienced entrepreneurs (compared to the more experienced ones) that had these characteristics of innovative entrepreneurs.

6.1.5 Previous Work Experience

In our previous discussion (**Section 6.1.4**), we saw a negative relationship between entrepreneurs' experience in managing their current business and their innovativeness. Besides discussing their experience in their current business, it is also useful to discuss the influence of previous work experience on their innovative behaviour. We believe that previous work experience is the determinant of firms' level of innovativeness.

It was hypothesised that entrepreneurs' previous work experience would have a positive effect on their innovation decisions. Both type and duration of

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[12] r=-0.1620, p=0.125

[13] r=-0.2012, p=0.056

experience might be relevant. Entrepreneurs with previous work experience in the same sector as their current business, have an advantage over those whose previous work experience was in a different sector. For example, an entrepreneur who had previously worked as an employee in a food processing firm and then came to own a firm producing a very similar range of products might be more aware of the relevant technology, have more contacts in the sector, etc., than one who had switched sectors or never had any previous work experience.

6.1.5.1 Previous Work Experience of Entrepreneurs in Tiny Firms

Of the total 91 entrepreneurs in tiny firms, 51 had previous work experience before venturing into their existing business. Of these, 29 were non-innovative while the other 26 were innovative. Referring to **Table 6.1**, the number of years of the previous work experience is not a significant predictor of innovativeness in tiny firms.

One reason why past experience did not have a significant effect on entrepreneurs' innovativeness in tiny firms is that their work experiences had not been directly related to their current type of business. **Table 6.7** shows that the majority of entrepreneurs were previously employed in economic activities different from their current business.

As shown in **Table 6.7**, only 17 entrepreneurs had previously owned small businesses, and all of these were in the retail business. The majority of entrepreneurs were once employees in government or private sectors. Only 5 entrepreneurs had previously been employed in the manufacturing sector; 4 of

them had worked in food processing firms. While they may have been employees in food processing firms, none of them were classified as innovative entrepreneurs. Although these entrepreneurs had previously worked in the same type of business, their experience did not seem to have much influence on their willingness to innovate. Upon closer examination, we found that their previous work experience did not give much advantages and knowledge to their current business. One of them worked as a production worker and the other two worked as labourers in their former firms.

Table 6.7: Previous Work Experience of Entrepreneurs From Tiny Firms

Types of Previous	Non-innovative		Innovative		Total	
Work (Experience)	No.	%	No.	%	No.	%
Production worker	1	3.45	2	7.69	3	5.45
Salesman	2	6.89	2	7.69	4	7.27
Small business owner	8	27.58	9	34.61	17	30.91
Army Personnel	1	3.45	2	7.69	3	5.45
Clerical worker	7	24.13	5	19.23	12	21.82
Farmer/fisherman	4	13.79	3	11.54	7	12.72
Labourers	2	6.89	2	7.69	4	7.27
Others	8	27.58	3	11.54	11	20.00
Total number of respondents	29	-	26	-	55	-

Source: Survey 1993
Note: the total of columns percentage were more than 100% due to multiple responses

Another reason why previous work experience did not have any effect on innovativeness is the presence (or lack) of government assistance. This study shows that government assistance has an important role to play in technological

innovation decisions (**Table 6.1**). Of all entrepreneurs without previous work experience, 38.9 percent had received government assistance. In contrast, only 14.5 per cent of entrepreneurs with previous work experience had received government assistance. **Table 6.8** shows that among those who received government assistance, work experience did not determine entrepreneurs' innovativeness, whereas, for those without government assistance, their previous work experience had a significant influence on their decision to innovate. What the results suggest, is that government assistance can help to overcome the disadvantage of those without previous work experience to be innovative. As we have discussed in Chapter Two, the government have played an important role in promoting technological innovation among tiny firms, by providing them with subsidies, machine and loans.

Table 6.8: The Distribution of Entrepreneurs in Tiny Firms Based on Previous Work Experience, Firms' Categories and Government Assistance

Previous work experience	Firms With Government Assistance						Firms Without Government Assistance					
	Non-innovative		Innovative		Total		Non-innovative		Innovative		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
No	3	75.0	11	61.1	14	63.6	19	40.4	3	13.6	22	31.9
Yes	1	25.0	7	38.9	8	36.4	28	59.6	19	86.4	47	68.1
Total	4	100	18	100	22	100	47	100	22	100	69	100
Statistical test	Chi-square pearson=0.27282 df=1, significance=0.60145						Chi-square pearson=4.95185 df=1, significance=0.026060					

Source: Survey 1993

6.1.5.2 Previous Work Experience of Entrepreneurs in Small Firms

Of the entrepreneurs in small firms, 64 (60.4%) claimed to have had previous work experience before managing their current business. Our results (**Table 6.2**) show that entrepreneurs' previous work experience (PREXP) had a significant influence on their decision to adopt technology. The positive sign of that coefficient shows that entrepreneurs with longer previous work experience had a greater tendency to adopt new technology. Distribution of entrepreneurs' work experience based on their innovativeness can be seen in **Table 6.9**.

Table 6.9: Previous Work Experience and Level of Innovativeness of Entrepreneurs in Small Firms

Previous work	Firms' Level of Innovativeness				Total	
	Non-innovative		Innovative			
	No.	%	No.	%	No.	%
No previous work	25	51.0	17	29.8	42	39.6
Food processing firms	8	16.3	10	17.5	18	17.0
Other sectors	16	32.7	30	52.6	46	43.4
Total	49	100.0	57	100.0	106	100.0

Source : Survey 1993
Note: Chi-square statistic= 5.43408, df=2, sig=0.06607

Among innovative entrepreneurs, 29.8 per cent did not have any previous work experience before venturing into their current business, 17.5 per cent had previous experience working in food processing firms and 53.6 per cent had previously worked in non-food sectors (**Table 6.9**). Among the non-innovative entrepreneurs, 51.0 per cent did not have any previous work experience, 16.3 per cent previously worked in food processing firms and 32.7 per cent previously

worked in non-food sectors. Of the 18 entrepreneurs who had previously worked in food processing firms, 8 of them had worked in firms that produced similar products to those they were currently producing. Of these eight entrepreneurs, 6 were innovative while the other 2 were non-innovative.

Types of previous work also had some influence on entrepreneurs' innovativeness. **Table 6.10** shows variations in the level of innovativeness among different types of work experience, suggesting that some work experience is more conducive than others to innovativeness. We can see from **Table 6.10,** that the majority of those who innovated had previously worked as managers, executives, administrators, clerks, in the army or as salespersons. On the other hand, the non-innovative entrepreneurs were those who had previously worked as labourers, drivers, fishermen and farmers.

Entrepreneurs who had previously worked in the same sector as they were currently in, had a greater tendency to be innovative compared to those who had worked in other sectors. The result suggests that entrepreneurs' previous work experience which was relevant to their current business, gave them an advantage over those who were less experienced or who had previously worked in sectors different from those in which they were engaged at the time of the study.

Table 6.10 shows that 54 per cent of those who had previously worked as production workers were innovative. One explanation for this is that the majority of them had previously worked in the food industries. They also had longer working experience (more than 8 years). Although they were previously production workers, their years of experience in the food industry enabled them to

become accustomed to the business environment, management style and production in the industry. With their vast experience they felt they already had the skill to start their own firms. Seventy-three per cent claimed the main reason for choosing their current business was due to their past work experience and skill. Most saw setting up their own firms as a form of upward mobility.

Table 6.10: Previous Work Experience and Level of Innovativeness of Entrepreneurs in Small Firms

Types of Previous Works	No.	Firms' Level of Innovativeness			Years of Experience	
		Non-innovative	Innovative	Total	Means	Range
Production worker	12	45.5	54.5	100.0	6	2-11
Manager/executive/ administrator	8	-	**100.0**	100.0	7	1-13
Small business	13	46.1	53.9	100.0	8.8	1-20
Clerk	15	26.7	**73.3**	100.0	7.8	1-20
Army	6	-	**100.0**	100.0	12.2	11-13
Salesperson	4	25.0	**65.0**	100.0	7	3-11
Farmer/fisherman	5	**60.0**	40.0	100.0	5	3-8
Driver	2	**100.0**	-	100.0	8.5	7-10
Labourers	3	**66.7**	33.3	100.0	14	10-18
Others	4	50.0	50.0	100.0	7	5-10

Source: Survey 1993

As **Table 6.10** shows, those who had previously worked at managerial level had a greater tendency to be innovative in their current business. It seems to us that their knowledge and experience in management or administration, even in non-food sectors (government and private sectors), influenced them to be innovative in their current business. However, entrepreneurs who were once involved in small businesses did not seem to have benefited from their previous experience. Of the 13 entrepreneurs who had previously owned small businesses,

11 were retailers. Although they may have had limited experience in manufacturing, 53.9 per cent of them had taken the step of introducing new technology.

The majority of entrepreneurs who had previously worked as clerks (73.3%), in the army (100%) or as salespersons (75%) were innovative. Those who had previously worked in the army had an advantage because they could use their retirement pensions to finance their business and innovation. Furthermore, they had acquired basic entrepreneurial skills through a government-sponsored pre-retirement programme. Thus, their experience, skill and capital gave them a greater capacity to be innovative. Those who had previously worked as clerks had a relatively higher level of education, which enabled them to be more receptive to new ideas and business environment. The majority of them had also attended courses prior to their involvement in their current business. Their education and skill background, made them more responsive to innovation. Regarding salespersons, their communicative experience would gave them wider business contacts and better access to information on innovation and institutions, which would explain why they were innovative in their current business.

Those who had previously worked as farmers, fisherman, drivers and labourers were less innovative compared to the categories discussed above. This may be ascribed in part to the lack of relevance of their previous work experience to their current business. Furthermore, the majority of them had low levels of education, less communicative experience and lack of entrepreneurial skill. In fact, none of them had ever attended any courses related to their business.

6.2 Personality Traits

In this section we shall discuss some of the personality traits of the entrepreneurs, focusing on such aspects as their need for achievement (n-ach), locus of control and attitude toward risk. These personality traits are determining factors of entrepreneurs' innovative behaviour. Hence, we believe that they had causal relation to firms' ability to adopt a technological innovation.

6.2.1 Need for Achievement (n-Ach)

This study hypothesised that entrepreneurs with a high need of achievement are more likely to be innovative compared to those with lower n-ach. Those with high n-ach will always find ways and means to succeed; one way is to introduce new ideas and techniques of production. Thus, such people tend to be more innovative compared to those with lower n-ach.

The research findings show that n-ach was indeed a significant determinant of entrepreneurs' innovativeness in both tiny and small firms (**Tables 6.1** and **6.2**). A positive coefficient of the variable that measured entrepreneurs' need of achievement (NACH) in the logistic regression functions displayed in **Tables 6.1** and **6.2** indicate that entrepreneurs with higher n-ach were more likely to adopt technological innovation compared to those with lower n-ach.

As we have discussed in our conceptual framework, entrepreneurs' n-ach is determined by their personal background. In the case of tiny firms, there was a correlation between entrepreneurs' n-ach and their education, age and sex.

However, in small firms there was no relationship between n-ach and level of education. age and sex.

In this study, we measured entrepreneurs' n-ach using a 5 point Likert scale (**Chapter Five**). For analytical purposes we classified the entrepreneurs into two groups; (a) "high achievers", whose n-ach score was above the median score of 3.75 for tiny firms and 3.9 for small firms and (b) "low achievers", whose n-ach score was below or equal to the median score. Our survey results show that 40.7 per cent of entrepreneurs in tiny firms were high achievers, while and 59.3 per cent were low achievers. In the case of small firms, 50.9 per cent and 49.1 per cent were high and low achievers respectively.

6.2.1.1 Need for Achievement of Entrepreneurs in Tiny Firms

As indicated in **Chapter Four** there is a significant positive relationship between n-ach and entrepreneurs' personal background such as their level of education. Hence, in this section, we would to observe whether such relationship exist in tiny firms. The entrepreneurs' level of education also correlated significantly with n-ach ($r=0.2242$, $p=0.033$), implying that those with higher education are more likely to have higher n-ach compared to those with lower level of education. Perhaps, it is more the case that those with high n-ach extend their education as a way of meeting their need for achievement.

Entrepreneurs' n-ach correlates not only with their personal characteristics but also with other personality traits. We found positive correlation between n-

ach and the variables, locus of control (r=0.4937, p=00001) and entrepreneurs' attitude towards risk (r=0.2765, p=0.008). The results suggest that entrepreneurs with higher degree of n-ach also have internal locus of control and they are risk takers. The results in this survey indicate that personality traits are important determinants of innovativeness for entrepreneurs in tiny firms.

High achieving personality lead to other innovative behaviour such as communicative and highly involved with institutions. We can infer from the positive correlation between variable NACH and variable COMMU (r=0.2740, p=0.009) that entrepreneurs' with high n-ach have strongly communicative behaviour, i.e. are better exposed to various communication channels. **Table 6.11** shows the relationship between n-ach and communication behaviour.

From **Table 6.11,** we can see that entrepreneurs who were members of at least one association, or attended seminars and expos, had a higher mean n-ach score compared to those who were not members of any association and never attending such events. Thus, being communicative seem to have a positive influence on entrepreneurs' level of n-ach. Or perhaps it is the other way round, i.e, high n-ach impels people to communicate, seek information etc., to increase their chance of success and so meet that need.

Table 6.11: Entrepreneurs' (Tiny Firms) Need of Achievement Mean Score by Communication Channels

Communication channels	Categories	N	Means of NACH	t-statistics	F-statistics
Being a member of an association	No	76	3.7292 (0.444)	-2.16 [0.034]***	-NA-
	Yes	15	4.0056 (0.504)		
Attending business Expo	Never	70	3.7381 (0.4512)	-NA-	3.9242 [0.0233]***
	1-5 times	19	3.8202 (0.4490)		
	more than 5 times	2	4.6250 (0.1768)		
Subscribing business magazines	No	86	3.7674 (0.461)	-0.62 [0.537]	-NA-
	Yes	5	3.9000 (0.535)		
Attending seminars	never	75	3.7267 (0.4478)	-NA-	3.1022 [0.0499]***
	1-3 times	13	3.9359 (0.4873)		
	more than 3 times		4.2778 (0.4276)		

Source: Survey 1993
Note: ( ) standard deviation, [ ] two tail significance level
*** Significant at 95% confidence level
NA - Not applicable

We also found entrepreneurs' n-ach to be positively correlated with their institution involvement (r=0.3538, p=0.001). Entrepreneurs with higher n-ach will use opportunities to improve their production performance and product quality, including making use of the facilities offered by various institutions and agencies that function as small scale industries' development agents. As we discussed in Chapter Two, there are various agencies providing marketing, capital, labour, technological and skill upgrading support to SSIs in Malaysia. Entrepreneurs with high n-ach are more likely to engage in greater institutional involvement, because the support they receive not only helps them to minimise their problems (such as

marketing, capital, technology), but also improves their entrepreneurial skills to meet business challenges and identify opportunities.

The type and structure of firms managed by these two groups of entrepreneurs was also found to differ. A disproportionately high percentages of high achieving entrepreneurs were involved in business with high economic return and high durability such as tomato or chilli sauce making. On the other hand, a disproportionately high percentage of low achieving entrepreneurs were involved in snack and noodle making. A casual look at the kind of business activities reveals that the production of tomato and chilli sauce is relatively more complex compared to noodle and snack making. The results show that the high achievers also registered high productivity (PROD89), high fixed turnover (FATURN89) and managed firms with a greater level of complexity (COMPLEX)[14].

6.2.1.2 Need for Achievement of Entrepreneurs in Small Firms

While the literature (see Chapter Four) may have suggested that there is a significant positive relationship between n-ach and entrepreneurs' personal background, our study does not seem to show a distinctive trend. Our study shows that entrepreneurs' n-ach is not correlated with their age, sex or education. As exhibited in **Table 6.12**, in our survey entrepreneurs with primary education had a higher n-ach compared to those with higher education. For example, the

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[14] Positive correlation between variables NACH and PROD89 (r=0.2973, p=0.004), FATUR89 (r=0.2113, p=0.044) and COMPLEX (r=0.1886, p=0.073).

mean score of n-ach for those with primary education was 4.19 compared with 3.74 for those with O-Level equivalent.

Table 6.12: Personality Traits and Level of Education of Entrepreneurs in Small Firms

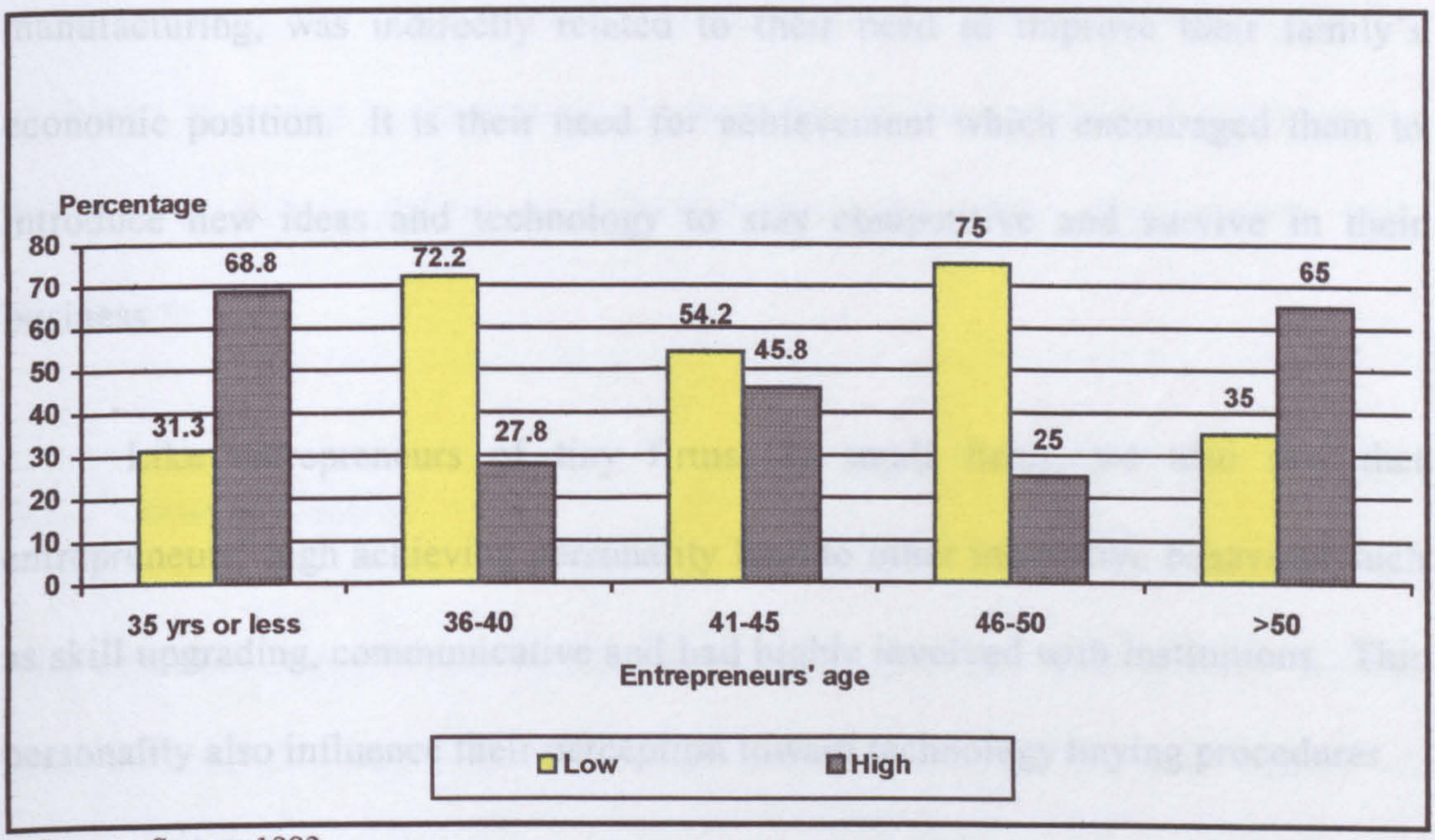
Education	No of Entrepreneurs	Need of achievement (Mean)	Standard Deviation	F-Statistic [Significance Level]
No formal education	3	3.6111	0.7743	4.3284 [0.0013]***
Primary education	29	4.1868	0.4908	
Lower secondary	28	3.7143	0.3818	
O-level	21	3.7421	0.3226	
A-level	10	3.9167	0.4374	
College/ University	15	3.9833	0.5253	

Source: Survey 1993
Note: The values represent mean of scores for each personality traits
( ) standard deviation
[ ] significance level
*** significant at 95% confidence level

The relationship between entrepreneurs' n-ach and their age is presented in **Figure 6.3**. Among entrepreneurs in small firms, there were two age groups which seemed to have a high percentage of achievers; those who were aged 35 years or lower (68.8%), and those who were 50 years or older (65%). One reason why young entrepreneurs were innovative was their higher levels of education. For example, 53.1 per cent of them had A-Level or higher education. With their educational background, these entrepreneurs would have better employment opportunities, the fact that they chose to be self employed as small scale producers suggests that they were determined to be independent and optimistic

about their economic future. This high achievement attitude led them to be innovative.

Figure 6.3: Need of Achievement and Age of Entrepreneurs in <u>Small Firms</u>



Source: Survey 1993
Note: Chi-square statistics=12.98911, df=4, sig=0.01133

For entrepreneurs who were more than 50 years old, there is hardly any evidence suggesting that their attitude was influenced by their educational background. The fact that the majority of them (85.1%) had only primary education, indicates that education was not a factor motivating them to be high achievers. We believe that it is their social and economic background which influenced their n-ach. The majority of them (76.9%) had previously worked in other economic activities prior to establishing their current business. We assume that their previous work experience influenced their n-ach behaviour, by encouraging them to search for better alternatives. Furthermore, these

entrepreneurs, being in the later stage of their life cycle, would be likely to have bigger families to support. Compared to the younger ones, they would have greater need to improve their economic standing. For this reason, we assume that their shift away from their previous economic activities into small scale manufacturing, was indirectly related to their need to improve their family's economic position. It is their need for achievement which encouraged them to introduce new ideas and technology to stay competitive and survive in their business.

Like entrepreneurs of tiny firms, in small firms, we also saw that entrepreneurs' high achieving personality lead to other innovative behaviour such as skill upgrading, communicative and had highly involved with institutions. This personality also influence their perception toward technology buying procedures.

Entrepreneurs' n-ach was correlated with their interest to upgrade their knowledge and skill by attending business courses. (**Appendix VI** shows a positive correlation between variable NACH and COURSE ($r=0.2433$, $p=0.012$)). In other words entrepreneurs with high n-ach had attended more courses related to their business compared to those with low n-ach . Sixty per cent of high-achievers had attended at least one business course, compared to only 26.9 per cent of low achievers.

We also found a correlation between entrepreneurs' n-ach and their communication behaviour, institutional involvement and perception of the procedures of buying an innovation. This is shown by the variable NACH's positive correlation with variables COMMU ($r=0.3259$, $p=0.001$) and INST

(r=0.2066, p=0.034) and negative correlation with the variable BUY (r=-0.1843, p=0.059). High achieving entrepreneurs tended to be more communicative or have higher institutional involvement. This would give them an early advantage in information on innovation compared to the low achievers. Being communicative also, the high achieving entrepreneurs would be less likely to face problems in buying an innovation. In fact, few of them perceived searching and negotiating with suppliers as "major problems which they cannot solve themselves".

6.2.2 Locus of Control

The literature suggests that entrepreneurs are individuals who possess "internal locus of control". They believe that they are in control of their own destiny. In contrast, individuals with "external locus of control" are thought to have limited entrepreneurial qualities because they believe that events are independent of behaviour, and are instead, the results of such forces as fate, luck and supernatural forces. Individuals who possess internal locus of control have greater chances of becoming entrepreneurs because they have greater ability to master and manipulate their environment. Below, we consider whether these assumptions were borne out by our findings.

6.2.2.1 Locus of Control Among Entrepreneurs in Tiny Firms

Based on the logistic regression equation, locus of control did not appear to be a determinant of innovativeness in tiny firms (**Table 6.2**). Indeed, a closer

examination of the results shows that the proportion of innovative entrepreneurs with external locus of control was higher than that of those who were non-innovative. One explanation for this could be the strong influence of non-quantifiable factors such as culture and religion. All the entrepreneurs in this study were Malays and Muslims. Muslims are brought up to believe in the concept of *tawakal*; believing that God influences all aspects of their daily life, including their business activities.

An analysis of locus of control of entrepreneurs in relations to other factors showed the following facts. Entrepreneurs with previous work experience had a tendency to have internal locus of control, compared to entrepreneurs without any previous work experience. The mean of locus of control of entrepreneurs with previous work experience was 3.8416 while the mean of entrepreneurs without work experience was 3.6389[15]. As mentioned in the previous section, there was a positive correlation between n-ach and locus of control. Entrepreneurs who were higher achievers also had internal locus of control. Entrepreneurs' locus of control also had a positive correlation with their attitude toward risk ($r=0.2001$, $p=0.057$) suggesting that entrepreneurs with internal locus of control are more prepared to take risk.

6.2.2.2 Locus of Control Among Entrepreneurs in Small Firms

While the locus of control was not a determining factor in tiny firms, it was a significant determinant of innovativeness in small firms. The logistic regression

[15] t-value=-2.32, df=89, significance=0.023

function in **Table 6.3** shows that the coefficient of variable locus of control (LOC) has a positive sign, suggesting that those with internal locus of control have a higher tendency to innovate compared to those with external locus of control.

Entrepreneurs' locus of control was measured by a 5 point Likert scale with point 1 indicating the extreme of external locus of control and point 5 indicating the extreme of internal locus of control (see **Chapter Five**). Since the majority of the entrepreneurs in this study obtained an average score of more than 3, this shows the majority of them tended to have internal locus of control.

Distribution of the entrepreneurs' locus of control showed that their median[16] score was 3.857. For analytical purposes, further analysis was undertaken of the relationship of entrepreneurs' locus of control with other factors and entrepreneurs' innovativeness. The researcher classified the entrepreneurs into two categories, based on the value of the median as a cut off point. Entrepreneurs who had a score above the median were classified as having internal locus of control, while those who scored equal to or lower than the median were regarding as having external locus of control. Based on this classification, 68.4 per cent of innovative entrepreneurs and only 42.9 per cent of non-innovative entrepreneurs had internal locus of control.

Like need for achievement, we found that there was no trend between entrepreneurs' locus of control with their background. We found that entrepreneurs' locus of control did not correlate with their age and education. We

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[16] In this study, we used median as the cut-off point because we considered the status of entrepreneurs locus of control in relation to other entrepreneurs.

could not conclude that young or more highly educated entrepreneurs had a higher tendency to have internal locus of control. In fact, based on entrepreneurs' level of education, entrepreneurs with primary education tended to have internal locus of control, compared to those with higher education. As **Table 6.13** shows, those with primary education had a mean score of 4.1 compared to 3.8 for those with O-Level education. This result suggest that education does not influence entrepreneurs' locus of control.

Table 6.13: Locus of Control and Level of Education Among Entrepreneurs in Small Firms

Educational Level	No. of entrepreneurs	LOCUS OF CONTROL		F-Statistic [Significance level]
		Mean	Standard deviation	
No formal education	3	3.6190	0.7047	2.3733*** [0.0444]
Primary education	29	4.0591	0.3996	
Lower secondary	28	3.6837	0.4336	
O-level	21	3.8163	0.3069	
A-level	10	3.9571	0.5431	
College/ University	15	3.8381	0.5736	

Source: Survey 1993
Note: The values represent mean scores for each personality trait
[ ] significance level
*** Significant at 95% confidence level

Our study shows that entrepreneurs' locus of control was influenced by the number of years in their previous work. Entrepreneurs who had longer experience in their previous work tended to have internal rather than external locus of control. This is indicated by the existence of a positive correlation between variable LOC and PREXP ($r=0.1431$, $p=0.143$). It is reasonable to think that those with longer work experience can develop their internal locus of control, because they develop confidence over the cause of their work experience.

This study found relationships between entrepreneurs' locus of control and other factors that determine their innovativeness, such as degree of financing problems and perception of buying procedure[17]. Those with internal locus of control had a greater tendency had fewer financing problems, and perceived the procedure of buying an innovation as less problematic, than those with external locus of control.

6.2.3 Attitude Toward Risks

In Chapter Four, we hypothesised that entrepreneurs' attitude toward risk would be a significant determinant of their innovativeness; risk-taking entrepreneurs would have a higher tendency to be innovative, compared to risk-averse ones. This study supports the hypothesis that entrepreneurs' attitude toward risk can influence their innovativeness. The logistic regression functions in **Tables 6.1**. and **6.2** show that the coefficient of the variable attitude towards risk (RISKS) has a positive value, indicating that risk takers tend to be more innovative than the risk averse. Risk taking entrepreneurs are always looking for ways of improving their firms' performance; adopting technological innovation is one way of doing this.

In the case of tiny firms, there was a relationship between entrepreneurs' attitude towards risk and their back ground such as age, education, years of managing current business and other personality traits such as n-ach and locus of

[17] In small firms LOC was negatively correlated with variable FINANCE (r=-0.2382, p=0.014) and variable BUY (r=-0.2142, p=0.027)

control[18]. Our results indicated that risk takers were younger, had higher levels of education, were less experienced in managing their current business, high achievers and had internal locus of control.

Our survey results indicated that attitude toward risk of entrepreneurs of tiny firms influence their communicative behaviour, skill upgrading behaviour, their involvement with institutions and their perception toward machine that they considered to buy. Risk takers are individuals who have high communicative behaviour (r=0.3575, p=0.001, had higher frequency of attending courses to upgrade their skill (r=0.2887, p=0.006), had greater institutional involvement (r=2632, p=0.012) and had a positive perception toward the machine that they intended to adopt (r=0.2670, p=0.011). This further explain why risk takers entrepreneurs were more innovative than risk adverse entrepreneurs.

6.3 Skill Upgrading

To stay competitive and survive in the business, entrepreneurs need to upgrade their entrepreneurial skill and keep abreast of recent developments. There are various ways that entrepreneurs can do this; one way is by attending courses which are related to their business. By attending business courses, entrepreneurs can develop their business contacts and improve their access to knowledge and information regarding technological innovations. We believe that skill upgrading behaviour of entrepreneurs had causal relationship with their innovative behaviour. Therefore, this study hypothesised that entrepreneurs who upgrade

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[18] In tiny firms, RISKS was negatively correlated with AGE (r=0.2365, p=0.024) and EDU (r=0.1619, p=0.125) and MANAGE (r=-0.2255, p=0.032). RISKS is positively correlated with NACH (r=0.2765, p=0.008) and LOC (r=0.2001, p=0.057)

their skill through attending courses would be more likely to be innovative than those who never attended courses.

Based on the logistic regression function in **Tables 6.1** and **6.2**, entrepreneurs' skill-upgrading behaviour (attending courses) is a significant predictor of innovativeness. There is a positive relationship between the skill upgrading variable (COURSE) and innovativeness indicating that entrepreneurs who upgraded their skills by attending courses, tended to be more innovative than those who never (or seldom) attended courses.

The majority of non-innovative entrepreneurs in tiny (60.8 %) and small firms (67.3%) claimed they had never attended business courses **(Table 6.14).** The results also show that there is a higher percentage of entrepreneurs from tiny firms than from small firms had attended courses. One reason for this could be that the majority of entrepreneurs from tiny firms received assistance from KEMAS, a government agency directly involved with community development in the rural areas. Those who received assistance from KEMAS would have better opportunities of attending courses organised by this institution, because their courses are mostly conducted locally.

Table 6.14: The Distribution of Entrepreneurs by the Number of Times Attending Courses Based on Level Of Innovativeness

Frequency of Attending Courses	TINY FIRMS				SMALL FIRMS			
	Non-Innovative		Innovative		Non-Innovative		Innovative	
	No.	%	No.	%	No.	%	No	%
Never attended courses	31	60.8	15	37.5	33	67.3	27	47.4
1-3 times	18	35.3	22	55.0	14	28.6	16	28.1
4 times or more	2	3.9	3	7.5	2	4.1	14	24.6
Total	51	100.0	40	100.0	49	100.0	57	100.0

Source: Survey 1993

Note: Tiny firms: Chi-square=4.90725, df=2, significance=0.08598
Small firms: Chi-square=5.19247, df=2, significance=0.07455

Table 6.15 shows the different types of courses attended by the innovative and non-innovative entrepreneurs. Among the innovative entrepreneurs in both tiny and small firms, the most popular course was production management. Forty-six per cent of entrepreneurs from tiny firms and 33.3 per cent from small firms claimed to have attended such a course. Among non-innovative entrepreneurs of tiny firms, the most popular course was production (23.5%). In the case of small firms, the most popular course attended was entrepreneurship.

Table 6.15: Types of Course Attended by Entrepreneurs Based on Firm Categories

Courses Attended	TINY FIRMS				SMALL FIRMS			
	NON-INNOVATIVE		INNOVATIVE		NON-INNOVATIVE		INNOVATIVE	
	No.	%	No.	%	No	%	No	%
Entrepreneurship	10	19.6	6	15.0	9	18.4	10	17.5
Organisational management	1	2.0	3	7.5	4	8.2	10	17.5
Financial management	5	9.8	8	20.0	5	10.2	12	21.1
Marketing	2	3.9	1	2.5	4	8.2	9	15.8
Production management/ Processing technique	12	23.5	22	55.0	8	16.4	19	33.3
Food analysis/ quality analysis	2	3.9	7	17.5	1	2.0	8	14.0
Motivation	1	2.0	1	2.5	-	-	2	3.5
Packaging	1	2.0	3	7.5	-	-	4	7.1
Others	-	-	-	-	-	-	3	5.2
Not attending courses	31	60.8	15	37.5	33	67.3	27	47.4
Total number of respondents	51	-	40	-	49	-	57	-

Note: The total of percentage columns were more than 100% due to multiple answers

There is a distinction between the types of courses attended by the innovative and non-innovative entrepreneurs. A higher percentage of non-innovative entrepreneurs attended courses on entrepreneurship, reflecting their need for basic skills necessary for initiating and developing their business. On the other hand, the higher percentage of innovative entrepreneurs attending courses on production indicates that they recognised the importance of having skill in production management and appropriate techniques of production in operating their business. It is likely that entrepreneurs who attended production related courses would have more opportunity of being exposed to new techniques of production which may be appropriate to their firms. By attending courses, the entrepreneurs can acquire more knowledge and learn new techniques which help them to minimise risk associated with innovation. The results show that course attendance has played an important role in entrepreneurship development by increasing entrepreneurs' willingness to take risk and developing an inner locus of control.

Table 6.14 shows that 60.8 per cent of non-innovative entrepreneurs and 37.5 per cent of innovative entrepreneurs in tiny firms claimed they had never attended any business courses. In small firms, the proportion of entrepreneurs who had never attended any courses was relatively higher (67.3% of non-innovative and 47.4% of innovative). Among the most commonly cited reasons for their unwillingness to attend courses were that they saw such courses as "irrelevant" to their business needs, did not need courses, and had no time.

As mentioned in the earlier sections, the entrepreneurs' tendency to upgrade their knowledge and skill was influenced by their level of education and personality traits (such as n-ach). We also found that their tendency to upgrade knowledge and skill was influenced by their communicative behaviour and institutional involvement[19]. This suggested that the channels of communication used by the entrepreneurs, such as business associations or expos and institutions, play an important role in providing information about courses relevant to the entrepreneurs.

6.4 Knowledge About Innovation

It is believed that entrepreneurs may adopt a technological innovation after they have extensive understanding of it, as such understanding is one of ways to reduce the risks involved in technological innovation. In Chapter Four, we hypothesised that entrepreneurs who seek extensive knowledge about innovation are more likely to adopt technological innovation. However, in both tiny and small firms, the variable KNOW in the logistic regression equations (**Tables 6.1 and 6.2**), does not explain the dependent variable which measures innovativeness, suggesting that we should reject the hypothesis.

Entrepreneurs' knowledge of innovation was not a determinant factor for their innovativeness. The majority of surveyed entrepreneurs (86.3% of non-innovative and 85.0% of innovative entrepreneurs in tiny firms; 93.9% of non-

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[19] Variable COURSE is positively correlated with variable COMMU(for tiny firms: r=0.5105, p=0.0001; for small firms: r=0.3724, p=0.0001) and variable INST (for tiny firms: r=0.9002, p=0.0001; for small firms: r=0.8581, p=0.0001)

innovative and 85.2% of innovative entrepreneurs in small firms) claimed that they had conducted a detailed study of the machine which they were considering buying, before making the decision whether or not to adopt the new technology.

We found that entrepreneurs used various methods of studying innovation; some referred to their suppliers while others referred to government agencies such as MARDI and MARA. The majority of innovative entrepreneurs claimed they relied on information provided by suppliers, from whom they learned to operate the machine. Suppliers also provide after sales services, guarantees and a trial period. These were the factors that tended to encourage entrepreneurs to adopt innovations. Some entrepreneurs also learned about an innovation from other firms, and perceived the feasibility of adopting it by observing the advantages brought by it to other firms. Following Rogers' (1983) classification, non-innovative entrepreneurs are laggard in the innovation diffusion process. They will adopt an innovation only after witnessing the success of other firms which have already adopted it.

Although innovative entrepreneurs regarded suppliers and non-innovative entrepreneurs regarded other firms as their main references when they conducted detailed study about the innovation, the majority indicated that they first became aware of the innovation from government institutions. These institutions did not provide machine; they only recommended the appropriate machines that can be adopted by the entrepreneurs. The entrepreneurs will then contacted the suppliers who will provide detailed information on the innovation. It appears that the

suppliers have an important role to play; they provide the necessary information to enable the entrepreneurs to make their decision.

6.5 Summary

In this chapter, we have discussed the relationship between entrepreneurs' characteristics and their innovative behaviour. We can summarise the results as follows. In tiny firms, we found four characteristics which had causal influence on entrepreneurs' decision to innovate, namely entrepreneurs' level of education, need for achievement, attitude towards risk and skill-upgrading behaviour. In the case of small firms, there were six characteristics which had causal influence entrepreneurs' technological innovation decisions. These characteristics were; entrepreneurs' level of education, previous work experience, need for achievement, locus of control, attitude towards risk, and skill-upgrading behaviour. We presume the relationship of entrepreneurs' age, their experience of managing the existing business (in both small and tiny firms), and sex (in tiny firms) with their innovative behaviour were just correlation.

CHAPTER SEVEN

THE INFLUENCE OF COMMUNICATION, PERCEPTION, INNOVATION AND ENVIRONMENT ON DECISIONS-MAKING

7. Introduction

In the previous chapter we discussed entrepreneurs' characteristics and their influence on innovativeness. In this chapter, we focus our discussion on entrepreneurs' communication, perception of the procedures of buying an innovation, perception of the characteristics of the innovation, institutional involvement, competition and the objective characteristics of the innovation. In our hypotheses, we assumed that all these factors would have an influence on the propensity to innovate. To confirm the hypotheses we used the logistic regression functions presented in **Tables 6.1** and **6.2**. However, for clarity, we shall present the parts of these two tables which are relevant to our discussion in this chapter, in **Tables 7.1** and **7.2** respectively.

Table 7.1: The coefficient of selected independent variables in Logistic Regression Equation for Tiny Firms

Factors	Independent variables	B	Standard Error	Wald statistics	Significance Level
Communication	COMMU	1.541	.637	5.857	0.0155***
Perception of buying procedures	BUY	-2.371	1.413	2.816	0.0933**
Perception of the innovations	MAC	2.477	1.452	2.910	0.0880***
Obj. Characteristics of the innovation:	MA-COST	-0.184	0.119	2.415	0.1091*
Environmental factors:					
a) Competitive intensity:	COMB(1)	0.176	0.576	0.094	0.7595
	COMM(1)	-2.856	2.132	1.521	0.1932
b) Institutional involvement:	INST	3.954	2.076	3.457	0.0612**
	ASSIS(1)	1.792	.616	8.475	0.0036*
Constant:	constant	12.676	28.823	.223	0.636

Source: Adapted from **Tables 6.1**

Note:

*** Significant at 95% confidence level

** Significant at 90% confidence level

* Significant at 85% confidence level

Table 7.2: The coefficient of selected independent variables in Logistic Regression Equation for Small Firms

Factors	Independent Variables	B	Standard Error	Wald statistics	Significance Level
Communication	COMMU	1.117	.7344	2.315	0.1281*
Perception of buying procedures	BUY	-4.071	2.111	3.719	0.0538**
Perception of the innovations	MAC	1.044	1.743	0.359	0.549
Obj. Characteristics of the innovation:	MA-COST	-0.053	0.020	6.848	0.0089***
Environmental factors:					
a) Competitive intensity:	COMB(1)	.866	.769	1.269	0.2600
	COMM(1)	-1.138	.959	1.407	0.2355
b) Institutional involvement:	INST	2.016	1.042	3.747	0.0529**
	ASSIS(1)	4.198	1.727	5.907	0.0151**
Constant:	constant	17.522	14.985	1.367	0.2423

Source: Adapted from **Tables 6.2**

Note: *** Significant at 95% confidence level

** Significant at 90% confidence level

* Significant at 85% confidence level

7.1 Communication

Entrepreneurs' decisions to adopt technological innovation were very much influenced by their communicative behaviour. We analysed entrepreneurs' communicative behaviour by their usage of communication channels, such as membership of business associations, subscribing to business magazines, attending business seminars and expos. Our hypothesis was that the more communicative the entrepreneurs, the more likely that they would innovate. The rationale for this was the belief that entrepreneurs who have more communicative behaviour, have better access to information on innovation, which would give them an advantage, by reducing the perceived risk and uncertainty involved in adoption of innovation. Hence, we predict that communicative behaviour of entrepreneurs has a cause-and -effect relationship with their innovative behaviour.

Tables 7.1 and **7.2** show that entrepreneurs' communicative behaviour was a significant predictor of their innovativeness, for both tiny and small firms. Entrepreneurs with higher levels of communicative behaviour had a greater tendency to innovate, suggesting that innovation decisions are favourably influenced by communication.

As indicated above, we had assumed that involvement in business associations, attending seminars or expos and subscribing to business magazines can improve entrepreneurs' access to information, and that communicative entrepreneurs can use these communication channels to learn about innovation, improve their production efficiency and exchange ideas and problems. These assumptions would appear to be borne out by our findings.

However, the majority of entrepreneurs surveyed did not use any communication channels. Only 36.3 per cent of tiny firms and 40.6 per cent of small firms used at least one of the communication channels. This implies that entrepreneurs from small firms are more communicative compared to those in tiny firms. This study also found that a higher percentage of innovative entrepreneurs (49.1% of those in small firms and 45.0% of those in tiny firms) used at least one of the above channels of communication compared to non-innovative entrepreneurs (28.6% of small firms and 29.4% of tiny firms). The most popular channel of communication for both small (45.3%) and tiny firms (23.1%) was attending business expo or trade fairs. Other communication channels were less popular. The preference of most entrepreneurs for expos or trade fairs may be explained in terms of the opportunities they offer to gather more first-hand information from suppliers, producers and institutions present at the expo.

Although, communicative behaviour of entrepreneurs in tiny firms, had causal influence on their innovative behaviour, it also been influenced by other determining factors. Our results show that entrepreneurs' level of education, skill upgrading, n-ach and attitude towards risk influenced their communicative behaviour[1]. Entrepreneurs who showed more communicative behaviour, had higher levels of education, had upgraded their skill (through attending courses), and were higher achievers and risk takers.

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[1] Variable COMMU is positively correlated with variable EDU (r=0.3518, p=0.001), COURSE (r=0.5105, p=0.00001), NACH (r=0.2740, p=0.009) and RISKS (r=0.3575, p=0.001).

In the case of small firms, we found that entrepreneurs' education, age, sex, n-ach, skill upgrading, and firm size all had a significant influence on their communicative behaviour (**Table 7.3**)

Table 7.3: The Determinants of Communicative Behaviour of Entrepreneurs in Small Firms.

Factors	Independent variables	B	Standard Error	t-statistic	Significance Level
Entrepreneurs' characteristics					
a) Demographic characteristics:	EDU	0.0898	0.0484	1.743	0.0846**
	SEX (1)	0.5250	0.2913	1.802	0.0747**
	AGE	0.0314	0.0180	1.743	0.0846**
	MANAGE	-0.0053	0.0260	-0.205	0.8377
b) Personality traits:	NACH	0.9389	0.3209	2.940	0.0041***
	LOC	0.4093	0.3384	1.210	0.2294
	RISKS	0.2942	0.2214	1.329	0.1871
c) Skill upgrading:	COURSE	0.9443	0.2596	3.754	0.0003***
Organisational characteristics:					
a) Firms' size	SIZE	0.0385	0.0131	2.940	0.0041***
b) Firms' structure:	CEN-R	0.0749	0.3759	0.199	0.8424
c) Firms' age	YESB-R	0.3557	0.3378	0.105	0.9163
CONSTANT		-5.3378	2.0075	-2.659	0.0092***

Note:
F-statistics=4.83701
Significant F = 0.00001
Multiple R = 0.60120
R -square = 0.36144
Adj. R square = 0.28672
Standard error =1.20552
** significant at α=0.10
*** significant at α=0.05

Entrepreneurs with higher level of education and skill upgrading tended to be more communicative. The knowledge and skill that these entrepreneurs acquired through education, enabled them to develop confidence to communicate well. In small firms, the male entrepreneurs were more communicative compared to their female counterparts. However, this does not mean that female entrepreneurs are unaware of the importance of these communication channels.

As most of the female entrepreneurs were married, it is reasonable to think that they were constrained by domestic responsibilities, which explains why their communication level was lower compared to that of male entrepreneurs. Female entrepreneurs tend to rely on government institutions as a source of information.

Our results show that older entrepreneurs were more communicative than younger ones. As our earlier results have shown, older entrepreneurs had longer experience managing their current business compared to younger entrepreneurs. There is reason to believe that they had already established a communication network through the usage of these communication channels.

Among the entrepreneurs' personality traits, only their n-ach was significant related to their communicative behaviour. Higher achieving entrepreneurs appeared to value the importance of information to improve their firms performances.

Firm size also influenced entrepreneurs' communicative behaviour; entrepreneurs of bigger firms were more communicative compared to those from smaller firms. Bigger firms usually have more financial and human resources, which enables them to be more communicative compared to smaller firms.

7.2 Entrepreneurs' Perception of the Buying Procedure

The entrepreneurs in this study bought their technological innovation from suppliers. Purchase of a technological innovation involved various stages, and the procedures involved may have influenced entrepreneurs' decision to innovate. Those procedures include finding the right suppliers and negotiating with them.

Technology buying procedure often involves legal matters, such as signing contracts. As part of their buying process, the entrepreneurs have to leave their firms for a certain period, which means they have to delegate their responsibilities to their subordinates.

We hypothesised that entrepreneurs' perception of the technology-buying procedure would influence their decision to innovate. If entrepreneurs perceive that they may face difficulties in the process of buying innovation, they are less likely to innovate. Based on the logistic regression functions in **Tables 7.1** and **7.2,** we support the hypothesis that entrepreneurs who perceive that they face problems in the process of buying technological innovation are unlikely to innovate (The coefficient of variable BUY is negative). Hence, we believe that this factor had a causal influence on entrepreneurs' innovative behaviour. A detailed analysis of the types of problems in the buying procedure which have a significant influence on entrepreneurs' innovativeness is presented in **Table 7.4.**

From **Table 7.4** we can see that there was no significant difference between non-innovative and innovative entrepreneurs in terms of their perception of finding suppliers, long absence from their firms and delegating work responsibilities while they were away. Both innovative and non-innovative entrepreneurs regarded these buying procedures as only minor problems.

Table 7.4: The Percentage Distribution of Entrepreneurs' Perception of Problem Related to Innovation Buying Procedure

Innovation Buying Procedure	Firms' Level of Innovativeness	TINY FIRMS				SMALL FIRMS			
		Degree of Problems			Chi-square Test (Significance Level)	Degree of Problems			Chi-square Test (Significance Level)
		0	1	2		0	1	2	
A) Finding suppliers	Non-innovative	70.6	25.5	4.0	1.73092	67.3	28.6	4.1	1.5115
	Innovative	80.0	17.5	2.5	(0.63008)	73.7	19.3	7.0	(0.4697)
B) Delegating responsibilities	Non-innovative	66.7	29.4	4.0	1.54193	46.9	51.0	2.0	1.7203
	Innovative	62.5	32.5	5.0	(0.67263)	59.6	38.6	1.8	(0.4231)
C) Dealing with legal matters	Non-innovative	35.3	41.2	23.6	8.95211	34.7	51.0	14.3	7.5270
	Innovative	65.0	27.5	7.5	(0.02993)***	61.4	29.8	8.8	(0.0232)***
D) Negotiating with suppliers	Non-innovative	52.9	39.2	7.9	2.70993	34.7	63.3	2.0	11.9550
	Innovative	67.5	30.0	1.1	(0.43854)	64.9	29.8	5.3	(0.00025)***
E) Long absence from firms	Non-innovative	60.8	37.5	2.0	3.71573	30.6	65.3	4.1	22.8458
	Innovative	47.5	42.5	10.0	(0.29384)	43.9	49.1	7.0	(0.2410)
F) Getting after sales services	Non-innovative	52.9	35.3	11.7	0.33932	55.1	32.7	12.2	1.6815
	Innovative	47.5	37.5	15.0	(0.95247)	57.9	36.0	5.3	(0.04313)***

Source: Survey 1993

Note: *** Significant at 95% confidence level.

Indication of degree of problem

0 - No problem at all

1 - Minor problem that can be solved by entrepreneurs themselves

2 - Serious problem that can be solved with some external assistance

We found that both innovative and non-innovative entrepreneurs in tiny firms faced similar problems regarding negotiations with suppliers and getting after sales service. In the case of small firms, in contrast, we found that there was a significant difference between innovative and non-innovative entrepreneurs: the non-innovative entrepreneurs faced more serious problems than the innovative ones. One reason why the non-innovative entrepreneurs perceived that they had some problems with negotiating with suppliers and getting after sales service is because their lack of experience in buying innovation. Due to this lack of experience, they have fewer business contacts, which prevents them from establishing a close relationship with suppliers..

The non-innovative and innovative entrepreneurs in both tiny and small firms had different perceptions of dealing with legal matters in the procedure of buying innovations. Legal matters were seen as more of a problem by those who had not innovated. This is probably due to their low level of education; they may find it difficult to interpret or fully understand matters that they perceive to have legal implications.

There is a positive correlation between entrepreneurs' perception of the procedures of buying an innovation and their financing problems[2]. The entrepreneurs who perceived that they had a financial problem also perceived that they would have problems in purchasing new machinery. In the case of tiny firms, we found a negative correlation between the entrepreneurs' perception of buying procedures and their institutional involvement ($r=-0.1886$, $p=0.073$). This

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[2]For tiny firms: $r=0.2366$ and $p=0.024$; for small firms: $r=0.3078$ and $p=0.001$

reflected that those with higher intensity of institutional involvement experienced or anticipated fewer problems in dealing with the procedures of buying the innovation. The discussion of the correlation of these two variables is further elaborated in section 7.5.2.1.

7.3 Entrepreneurs' Perception of the Characteristics of Innovation.

As we can recall, there are five stages in an innovation decision process (see **Chapter Four**). At the evaluation stage, entrepreneurs' perception of a particular innovation would influence their adoption decision. It is reasonable to think that those who have a positive perception of the innovation are more likely to adopt it compared to those who perceive otherwise. This study hypothesised that the characteristics of the innovation as perceived by the entrepreneurs had causal influence on their innovation decision. Entrepreneurs who perceive that an innovation will improve their economic position, is simple to operate, is less risky and is compatible with their existing processing techniques will be more willing to adopt such innovation, while some entrepreneurs may adopt a particular innovation due to the prestige associated with it.

In the case of tiny firms, entrepreneurs' perception of the characteristics of the innovation had a significant influence on their decision to innovate (**Table 7.1**). However, in small firms, there was no relationship between entrepreneurs' perception of the innovation and their decision to innovate (**Table 7.2**).

7.3.1 The Perception of Entrepreneurs in Tiny Firms

The result in **Table 7.5** shows that there was no significant difference between the perceptions of innovative and non-innovative entrepreneurs, with regard to the innovation's economic advantage, compatibility, prestige and simplicity. The majority of both innovative and non-innovative entrepreneurs had a positive perception of these aspects of the innovation. It appears that the entrepreneurs in tiny firms were favourably disposed to innovation, in that they perceived it as beneficial in terms of increase in sales, cost reduction and improvement of product quality. They did not perceive that the new technology would affect their existing methods of production or employee work schedule, or that it was technically sophisticated or difficult to operate. Nor did the majority of entrepreneurs believe that introducing an innovation would improve the prestige of their firms.

The non-innovative entrepreneurs may have had positive perceptions of the economic advantage, compatibility and simplicity of an innovation; however, their perception of the possible risk involved with the introduction of an innovation might influence their decision[3]. To the non-innovative entrepreneurs, the machines they were considering were relatively expensive. New technology may not in itself seem costly (less than RM5,000), but to many who had to rely on external sources of financing, such a purchase would be risky to their current financial position.

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[3] **Table 7.5** shows that at 95 per cent confidence level, the mean score of non-innovative entrepreneurs (3.25) are higher than the innovative ones (2.76)

Table 7.5: Mean Score[4] of Entrepreneurs Perception of the Characteristics of Innovation Based on Level of Innovativeness in tiny firms

Characteristics of Innovation	Firms' Level of Innovativeness		t-statistics [significance level]
	Non-innovative	Innovative	
A) Economic advantages	3.500 (0.579)	3.5563 (0.530)	-0.48 [0.631]
B) Compatibility	3.7320 (0.485)	3.7417 (0.462)	-0.10 [0.924]
C) Prestige	2.9281 (0.767)	2.9583 (0.641)	0.20 [0.244]
D) Riskiness	3.2549 (0.583)	2.7667 (0.848)	3.11*** [0.003]
E) Simplicity	3.9804 (0.574)	4.0875 (0.451)	-0.97 [0.336]

Source: Survey 1993
Note: *** Significant at 95% confidence level.
( ) standard deviation
[ ] significance level

Entrepreneurs' perception of an innovation was influenced by its cost. **Table 7.6** shows that cost of innovation is positively correlated with economic advantage of and prestige associated with the innovation. This shows that entrepreneurs tended to equate expensive innovation with better economic advantage. Entrepreneurs perceived that they would gain more economic advantages by adopting more expensive innovation. They believed that expensive technology would provide better quality output and improve production efficiency. Expensive innovations were also perceived to be prestigious. The negative correlation between entrepreneurs' perception of innovation compatibility and the

[4] The perceptions of entrepreneurs were measured by 5 point Likert scale. Except for characteristic (C), the value "1" represented the extreme negative, while the value "5" represented the extreme positive of the perception. If the value of the score is above "3", it shows that the respondent had a positive perception toward a particular characteristic of the innovation. For characteristic (C), the value of "1" represented the extreme positive, while the value "5" represented the extreme negative. If the value score was above "3", the respondent had a negative perception of this characteristic of the innovation.

cost of innovation (**Table 7.6**) shows that more expensive technology was seen as likely to be incompatible with existing methods of production.

Table 7.6: Correlation Coefficient of Entrepreneurs Perception of Innovation and Cost of Innovation in Tiny Firms

Perception of the characteristic of the innovation	Correlation Coefficient	Significant level
A) Economic advantages	0.2052	0.051 **
B) Compatibility	-0.2003	0.057**
C) Prestige	0.1886	0.073**
D) Risk involvement	0.1042	0.326
E) Simplicity	-0.452	0.671

Source: Survey 1993
Note: ** Significant at α=0.10

Entrepreneurs' perception of the innovation were very much affected by their knowledge of the innovation[5]. Entrepreneurs who conducted detailed study of the innovation before adopting it were more likely to have a positive perception of it. By accumulating more information on the innovation, they were able to reduce the perceived risk involved with it. As we have discussed earlier, the majority of entrepreneurs obtained information on innovation through suppliers and other firms which had introduced similar innovation. With adequate information on a particular innovation, the entrepreneurs are able to make a more informed judgement which then influences their decision to adopt the innovation.

[5] Means and standard deviation of MAC of those who conducted detailed study on innovation and those who did not conduct detailed study on innovation respectively are 3.2702 (0.406) and 3.090 (0.286); t-statistics=2.03, df=89, significance level=0.045

7.3.2 The Perception of Entrepreneurs in Small Firms

In the case of small firms, entrepreneurs' perception of innovation was not statistically significant as a predictor of entrepreneurs' decision to adopt or reject a technological innovation. (**Table 7.2**) This suggested that innovative and non-innovative entrepreneurs had similar perceptions of innovation. The majority of the entrepreneurs in this study perceived that the innovation that they considered adopting had some economic advantages. The majority of innovative entrepreneurs admitted that the machine they had bought was capable of producing better quality products. By innovating, they were able to increase their profit and penetrate the market more easily. The majority of non-innovative entrepreneurs also had similar perceptions of the economic advantages they might receive if they adopted the considered innovation.

The majority of innovative entrepreneurs claimed that the innovation that they had introduced did not pose any serious incompatibilities with their existing technique. Those who had not innovated, also perceived their considered innovation as being easily adaptable to their existing techniques of production. Although a small percentage of the entrepreneurs perceived that they would have to make some changes in their work routine, these changes were not seen as major problems. To the majority of entrepreneurs, the innovations that they had introduced or intended to introduce, were not only compatible but also simple to use. These innovations could be easily operated by their existing employees. Non-innovative entrepreneurs and innovative entrepreneurs had a similar perception of the risks involved with innovation adoption. They did not perceive that innovation

had incurred or would incur high risk. The prestige of having the innovation was not the important criterion in adoption decisions. The technology under consideration might not necessarily be the latest in the market. To entrepreneurs in small firms, the two most important criteria were compatibility and economic advantages.

Statistically, this study could not show that innovative and non-innovative entrepreneurs had different perceptions toward their considered innovation. However, close examination of the entrepreneurs' perceptions of each criterion of the innovation characteristics showed that the absolute percentage of innovative entrepreneurs who had a positive perception toward the innovation was relatively higher compared to that of non-innovative entrepreneurs. We can deduce that the innovative entrepreneurs tend to have a more positive perception towards innovation compared to non-innovative entrepreneurs. However, some entrepreneurs had negative or neutral perceptions toward their innovation. This indicated there were variations in the perception of the considered innovation among the entrepreneurs in this study. What were the factors that affected these variations in their perception? This study hypothesised that the entrepreneurs' education, their communicative behaviour, the objective characteristics of the innovation, the entrepreneurs' perception of the buying procedures and their institutional involvement determined their perception of a considered innovation.

The entrepreneurs' educational level was related to their perception of the simplicity of the innovation (**Table 7.7**). The entrepreneurs with higher educational level had greater ability to learn new and complex tasks. Given an

equal level of exposure to a technological innovation, entrepreneurs with higher levels of education would understand the function and the capabilities of the innovation faster compared to those with lower education. This would explain their greater tendency to perceive the innovation they considered adopting as simple to operate.

Entrepreneurs' personality, particularly their n-ach, also influenced their perception of the economic advantages, compatibility, simplicity and the prestige of the innovation. High achieving entrepreneurs had a more favourable attitude toward changes and believed the innovation could bring success to their firms. These entrepreneurs felt the importance of having the innovation. Their personality led them to believe that they could handle any tasks that would lead to the development of their firms, which explains why they perceived innovations as simple to operate and compatible with their firms' existing technique of production.

The entrepreneurs' locus of control and attitude toward risks determined their perceptions of the risks of the innovation. Entrepreneurs with internal locus of control believed they could manage changes in their firms or risks in the adoption of a technological innovation. They tended to perceive innovation as being relatively low-risk. Entrepreneurs with higher propensity to take risks were more willing to take chances, and perceived adoption of an innovation in this light. This attitude led them to perceive the considered innovation to be of low risk. Entrepreneurs who had carried out detailed study into the innovation they were considering, tended to be knowledgeable about it, and their increased

knowledge about the innovation made them more likely to perceive it as having economic advantages.

Table 7.7: The Determinants of Entrepreneurs' Perception of the Characteristics of the Innovation (Small Firms).

Independent variables	Dependent variables				
	Economic advantage	Compa-tibility	Simplicity	Prestige	Perceived Risks
The characteristics of the entrepreneurs:					
a) Educational level [EDU]	-	-	0.0317 (2.009)***	-	-
b) Personality traits - Need for achievement [NACH]	0.1972 (1.542)*	0.2071 (2.041)***	0.4839 (2.953)***	0.3759 (2.146)***	-
- Locus of control [LOC]	-	-	0.0822 (0.562)		-0.3083 (-1.495)*
- Attitude toward risks [RISKS]	-	-	-0.1300 (-1.359)	-	-0.2352 (-1.526)*
c) Skill upgrading: [COURSE]	-	-	-	0.2003 (1.3880)	
d) Knowledge of the innovation [KNOW(1)]	0.2421 (1.613)*	0.0721 (0.598)	0.1712 (1.252)	0.0625 (0.396)	0.0373 (0.170)
Organisational characteristics:					
a) Firms' size (SIZE)	0.0102 (1.691)**	0.0041 (0.823)	0.0027 (0.449)	0.0066 (0.3645)	-0.178 (-1.841)**
b) Financial problem [FIN-R]	-0.2020 (-1.830)**	-	-0.0098 (-0.088)	-	0.3199 (1.873)**
c) Firms' age [YESB-R]	-	-	-	0.0634 (0.473)	
d) Mismatching of labour forces [MISMATCH]	-	-0.1044 (-2.39)***	-	-	0.1935 (2.351)***
Communication [COMMU]	0.0743 (1.513)*	-	-	0.0050 (0.093)	-0.0163 (-0.217)
Perception of buying procedures [BUY]	-	-	-0.3546 (-1.041)	0.1639 (1.073)	0.1309 (0.603)
Objective Characteristics of the innovation: [MA-COST]	0.0032 (1.681)**	-0.0003 (-0.312)	0.0010 (1.009)	-0.0015 (-1.235)	0.0009 (0.510)
Environmental Factors: *a) Institutional involvement* [INST]	0.0372 (1.022)	0.0495 (1.770)**	-0.0419 (-1.174)	-	0.1334 (2.339)***
Constant:	3.0512 (5.623)***	3.2357 (8.304)***	2.3903 (3.181)***	0.5840 (0.070)	1.8119 (1.676)**
F-statistic	2.431***	2.373***	2.67***	2.255***	3.095***
Multiple R	0.42175	0.35464	0.50631	0.43803	0.49573
R-square	0.18934	0.12577	0.25635	0.19187	0.24575

Source: Survey 1993

Note: [ ] indicates variable name
( ) t-statistics
* Significant at α =0.15,
** Significant at α =0.10
*** Significant at α =0.05

Besides personal characteristics, organisational characteristics (such as firm size, financial problems, mismatching of labour force) can also influence innovation decisions. Firms' size had a bearing on entrepreneurs' perception of the economic advantages of the innovation and the risks of adopting it. Entrepreneurs from bigger firms tended to have a positive perception of the innovations' characteristics, and did not perceive technological innovation as risky. The explanation presumably lies in the ability of bigger firms to conduct feasibility and comparative studies on the considered innovation. Entrepreneurs from bigger firms have better access to information which enables them to evaluate the economic advantage or possible risks involved in adopting innovation. But may be it is more profitable for them anyway because of scale economics.

Firms' financing problems also determined their entrepreneurs' perception of the economic advantages and risks of adopting the innovation. The results in **Table** 7.7 show a negative coefficient suggesting that firms with fewer financing problems perceived the considered innovation as being more economically beneficial or less risky. Firms which do not face financing problems are not only financially secure but they also have the resources to conduct research on the considered innovation. Firms which are financially secure do not have to spend additional time searching for loans to finance their considered innovation. This leads them to develop a more positive perception of the economic advantages of adopting the innovation.

Entrepreneurs who perceive that an innovation will result in mismatching are more likely to reject adoption. This brings to the fore the issue of compatibility and risk associated with the introduction of technology. Those who perceive that innovation would not result in mismatching are more likely to think that the considered innovation is compatible with their existing production techniques, and therefore less risky.

Through communication, entrepreneurs would learn more about an innovation. This study showed that entrepreneurs' communicative behaviour had a bearing on their perception of the economic advantage of the innovation. As we have mentioned, communicative entrepreneurs have wider business contacts; thus, they tend to have better access to information regarding the economic advantages of the innovation.

The characteristics of the innovation also influenced entrepreneurs' perceptions of its economic advantages. Many entrepreneurs tended to equate cost with quality. They believe that expensive innovations would produce high quality products, thus enabling them to increase production, improve their economic performance and market share. This partly explains why entrepreneurs considering introducing more expensive innovation tended to perceive that the innovation would generate greater economic advantages.

The entrepreneurs' institutional involvement appeared to influence their perception of the compatibility and risks of the innovation. Our results show that entrepreneurs with higher institutional involvement tended to perceive the innovation under consideration as compatible to their firms' existing technique of

production. They also perceived that the innovation had low risks. The results suggest that institutions have an important role to play in shaping entrepreneurs' perceptions about innovation. The institutions provide the entrepreneurs with relevant information and advisory services on various aspects, including technological innovation. Some agencies even assist small firms to conduct pre-feasibility studies. Through their institutional involvement, the entrepreneurs can improve their knowledge of technology, thus explaining their positive attitude towards the economic advantages resulting from the adoption of technological innovation.

7.4 The Objective Characteristics of Innovation

This study hypothesised that the cost of adopting innovation had a direct effect on entrepreneurs' decision to innovate. If the cost of purchase and installation of the innovation was perceived as high, entrepreneurs might regard the innovation as not feasible, and abandon the idea. Based on **Tables 7.1** and **7.2**, we support the hypothesis that there is a negative relationship between the cost of innovation and entrepreneurs' decision to adopt technology.

7.4.1 The Objective Characteristics of Innovation Adopted in Tiny Firms

The majority (70.0%) of the innovative entrepreneurs in tiny firms adopted an innovation costing less than RM10,000. The cost of innovation was very much affected by the aim of the entrepreneurs to innovate. As **Table 7.8** shows, the majority of these entrepreneurs innovated due to government assistance.

However, government assistance was only a catalyst to innovation; the real reason behind innovation was the desire to replace old machines and manual methods of production. The results in **Table 7.8** show that the cost of innovation was relatively lower for those who innovated because of their need to replace old machines and manual methods. On the average, they spent RM7,200 to replace old machines and RM7,500 to replace manual methods. The cost of innovation was much higher (RM23,000) in cases where it was introduced to produce new products. Normally, the introduction of new products obliged the entrepreneurs to acquire more than one machine, perhaps an entire production line.

Table 7.8: Mean Cost of Innovation Based on Entrepreneurs Reasons for Innovating (Tiny Firms).

Entrepreneurs' reasons for innovation adoption	**No. of entre-preneurs**	**Means (Standard Deviation)**	**F-statistics [Significance level]**	**Duncan's test of significant difference*** **
A) Replaced old machines with up to date machines	7	7.1971 (7.456)	4.5464 [0.0055]***	A,C A,E
B) Replaced manual methods	10	7.4600 (6.039)		B,C B,E
C) Produced new product/s	4	23,200 (15,904)		CA,CB CD
D) Received government assistance	22	10,8455 (13,816)		D,C D,E
E) Others	2	20,500 (19,500)		EA,EB ED

Source: Survey 1993

Note: *** Significant at α=0.05

The cost of innovation is also influenced by entrepreneurs' skill upgrading behaviour, n-ach, knowledge of innovation and institutional involvement. According to **Table 7.9**, entrepreneurs who had upgraded their skill through attending courses, who were high achievers, had more knowledge of innovation

and greater institutional involvement more likely to adopt more expensive innovation. It seems to us that entrepreneurs with these characteristics are well-equipped with the knowledge of the technology they are considering introducing. The benefits must have been seen to outweigh the cost of the considered innovation, to justify the high expenditure.

Table 7.9: Means of Cost of Innovation Based on Entrepreneurs' Characteristics (Tiny Firms)

Entrepreneurs Characteristics	Category	No. of entrepreneur	Mean	Standard Deviation	t-statistics (Sig. level)
Attending business courses	No	46	7.8130	11.857	-1.83
	Yes	45	16.7240	30.531	[0.073]**
Need of achievement	Low	54	8.3404	11.251	-1.67
	High	37	17.8811	33.516	[0.103]*
Conducted detailed study on innovation	No	13	6.1615	7.053	2.06
	Yes	78	13.2292	24.966	[0.044]***
Involvement with institutes/agencies	No	17	5.1471	4.940	-2.71
	Yes	74	13.8443	25.565	[0.008]***

Source: Survey 1993

Note: *** Significant at α=0.05
** Significant at α=0.10
* Significant at α=0.15

7.4.2 The Objective Characteristics of Innovation Adopted in Small Firms

The majority (48.1%) of small firms adopted innovation valued between RM10,000 to RM50,000. Thirteen per cent of these entrepreneurs even claimed to have spent RM50,000 or more.

In the case of small firms, entrepreneurs' personality traits (locus of control and attitude toward risk), skill upgrading, firm complexity, access to government

assistance and aim of innovation had a significant and positive influence on the cost of innovation adopted (**Table 7.10**). Entrepreneurs with internal locus of control or those with high propensity to take risk, were more favourably inclined towards higher cost innovation. Probably, they believed that the innovation would improve their competitiveness, produce better quality products, increase production and reduce cost.

Table 7.10: The Determinants of Cost of Innovation in Small Firms.

Factors	Independent variables	B	S.E	t-statistic	Significant
Entrepreneurs' characteristics					
a) Demographic	EDU	0.0767	0.7228	0.106	0.9156
characteristics:	AGE	0.0767	0.7228	1.106	0.9156
b) Personality traits:	NACH	6.3521	13.943	0.456	0.6498
	LOC	34.4943	13.835	2.493	0.0144***
	RISKS	21.1482	9.3187	2.269	0.0256***
c) Skill upgrading:	COURSE	11.2227	7.4829	1.500	0.1371*
Organisational characteristics:					
a) Firms' size	SIZE	0.7179	0.6203	1.157	0.2501
b) Firms' structure:	COMPLEX	6.6780	3.2099	2.080	0.0403***
Communication	COMMU	5.8897	4.9088	1.200	0.2333
Institutional	INST	2.1647	5.998	0.361	0.7190
involvement	ASSIS (1)	23.3926	15.092	1.550	0.1301*
Aim of innovation	OLDMAC(1)	-33.6865	15.9739	-2.109	0.0377***
	MANUAL(1)	-9.0422	14.0165	-0.645	0.5205
CONSTANT		-192.358	81.6225	-2.357	0.0206***

Note: F-statistics=3.82108
Significant F = 0.0001
Multiple R = 0.59213
R -square = 0.35062
Adj. R square = 0.25886
Standard error =49.48991
** Significant at α=0.10
*** Significant at α=0.05

The cost of innovation was not related to firms' size; however, there was a relationship with firms' level of complexity. As presented in **Table 7.10**, a positive coefficient of variable COMPLEX indicates that firms with a higher level of complexity tended to adopt more costly innovation. Such firms had a greater number of professional workers; therefore, they were capable of adopting innovation of a higher technical level, which would tend to be higher cost.

Another factor influencing the cost of the considered innovation was the entrepreneurs' aim in innovating. As in the case of tiny firms, the majority of entrepreneurs in small firms innovated with the objective of replacing old machines or manual methods, and their average cost of innovation was relatively lower compared to those who innovated to produce new products.

7.5 Environmental factors

7.5.1 Competitive Intensity

In Chapter Four, we hypothesised that small and tiny firms which considered that large firms as their main competitors would have a tendency to innovate due to the pressure they receive from large firms. However, according to our survey results (**Tables 7.1** and **7.2**) "competitive intensity" did not have a significant influence on innovativeness. What this result indicates is that, regardless of the size of the competitor, firms have equal tendency to innovate.

Although the majority of tiny (60.4%) and small (51.9%) firms indicated their main competitors were large firms (**Table 7.11**), we could not find statistically significant effects of "competitive intensity" on the decision to

innovate. Where firms faced competition, mainly from bigger firms, innovative ability was not significantly different from that of firms which faced competition mainly from small firms. It may be that we could not find a good proxy for competitive intensity. Although big firms may in principle be competitors, in practice, small firms may be producing more similar products. Later, in **section 8.7**, we will see that firms with lower profitability (in the case of small firms) show a higher tendency to innovate; it may be that this variable has captured the effect of competitive intensity.

Table 7.11: Distribution of Firms Based on Their Main Competitors.

Size of main Competitors	TINY FIRMS				SMALL FIRMS			
	Non-Innovative		Innovative		Non-Innovative		Innovative	
	No.	%	No.	%	No	%	No	%
Large firms	33	64.7	22	55.0	31	63.3	24	42.1
Medium firms	5	9.8	9	22.5	11	22.4	17	29.8
Small firms	13	25.5	9	22.5	7	14.3	16	28.1
Total	51	100.0	40	100.0	49	100.0	57	100.0

Source: Survey 1993

Note: Tiny firms: Pearson chi-square=2.78110, df=2, significance level=0.24894

Small firms: Pearson chi-square=3.12378, df=2, significance level=0.17716

7.5.2 Institutional Involvement

Discussion in **Chapter Two** have highlighted the importance of institutional involvement in developing entrepreneurial skill, providing R&D facilities, and providing advisory services to small producers. We hypothesised that institutional involvement had causal influence on entrepreneurs' decision to innovate. Our

study reveals that institutional involvement is a significant determinant of innovation decision. (**Tables 7.1 and 7.2**)

Table 7.12 shows the percentage distribution of entrepreneurs who had consulted at least one institution during the five years previous to the date of this study. Our results show that 68.1 per cent of tiny firms and 69 per cent of small firms had consulted at least one institution, on one occasion. MARDI, MARA and KEMAS were the most popular institutions visited frequently by entrepreneurs from small and tiny firms.

(a) **Malaysian Agricultural Research & Development Institute (MARDI)**

MARDI was consulted by 26.4 per cent of entrepreneurs from tiny firms and 41.5 per cent from small firms. Their main purposes in these visits were to obtain advice on appropriate processing methods and quality control. Entrepreneurs in the bakery business, tomato and chilli sauce making used MARDI as their main source of information on production techniques. In fact, MARDI has a bakery factory which operates daily and uses this factory as a laboratory for its course participants. The factory is considered to represent a model which can be appropriately adapted by small and medium scale producers. Entrepreneurs who produced noodles, spices and drinks used MARDI to obtain advice on quality control and product analysis. For new entrepreneurs or entrepreneurs who wanted to innovate, the majority consulted MARDI to obtain information on appropriate machinery for their production.

Table 7.12: Percentage Distribution of Firms Based on Their Number of Consultations With Selected Institutions

INSTITUTIONS	Frequency of Consultation	TINY FIRMS		SMALL FIRMS		PURPOSE OF CONSULTATIONS
		Non-Innovative	Innovative	Non-Innovative	Innovative	
MARDI	5 or less	13.7	22.5	18.4	33.3	Processing method Quality control Product analysis Appropriate machines
	> 5	9.8	7.5	14.3	15.8	
MARA	5 or less	23.5	12.5	16.3	12.3	Management Loan Marketing
	> 5	2.0	12.5	6.1	8.8	
KEMAS	5 or less	29.4	20.0	8.2	3.5	Machine assistance Processing methods
	> 5	2.0	2.5	2.0	3.5	
Agriculture Department, RISDA	5 or less	2.0	5.0	-	-	Processing methods
	> 5	-	-	-	-	
Ministry of Youth and sport	5 or less	-	2.5	-	-	Loan
	> 5	-	-	-	-	
Others (LPP,MIDF,SIRIM)	5 or less	4.0	2.5	-	3.5	Loan, product analysis, Appropriate machine
	> 5	-	-	4.1	1.7	

Source: Survey 1993

Note: the percentage was calculated based on total number of firms in each category

As we have discussed in Chapter Two, MARDI is actively involved in organising training programmes related to production, quality, packaging and food analysis for small scale producers (**Table 7.13)** Twenty-six per cent of tiny firms and 17.9 per cent of small firms had previously attended courses organised by MARDI. The majority of the entrepreneurs had attended courses related to food processing techniques.

Table 7.13: Percentage Distribution of Previous Participants of MARDI's Training Programme

COURSES	TINY FIRMS		SMALL FIRMS		DURATION OF COURSES
	Non-Innovative	Innovative	Non-Innovative	Innovative	
Production Management	4.0	5.0	4.1	1.8	1 week 1 month
Processing techniques	9.8	20.0	4.1	14.0	3-5 days 1-2 weeks
Packaging	2.0	-	2.0	3.5	1 week
Food analysis and Quality Control	4.0	10.0	2.0	5.3	3 days

Source: Survey 1993.

(b) ***Majlis Amanah Rakyat Malaysia*** **(MARA)**

After MARDI, MARA is the next most popular institution consulted by the respondents. Twenty-three per cent of entrepreneurs from small firms and 25.3 per cent of tiny firms claimed to have consulted MARA for advisory services or loans, or to discuss management problems. Some of them visited MARA to obtain advice on marketing. Among small firms, the most popular courses were marketing and entrepreneurship. In the case of tiny firms, the most popular courses are entrepreneurship and financial management. This reflects the

overriding concern of entrepreneurs in small and tiny firms to improve their entrepreneurial skill. Furthermore, MARA is well-known for its entrepreneurship training programmes.

Table 7.14: Percentage Distribution of Previous Participants of MARA's Training Programme

TYPES OF COURSES	TINY FIRMS		SMALL FIRMS		DURATION OF COURSES
	Non-Innovative	Innovative	Non-Innovative	Innovative	
Entrepreneurship	13.7	5.0	10.2	8.8	1-2 weeks 1 month
Management/ Organisational management	2.0	12.5	4.1	8.8	5 days 1-2 weeks
Production management	-	7.5	4.1	3.5	3 days -2 weeks
Financial management	4.0	12.5	-	7.0	3 days -2 weeks
Marketing	2.0	-	4.1	12.3	2 days
Processing technique	2.0	5.0	2.0	1.7	3 days-1 week
Motivation	-	2.5	-	1.7	1 day
Export	-	2.5	-	-	1 week

Source: Survey 1993

(c) *Kemajuan Masyarakat* (KEMAS)

As we have mentioned, KEMAS is more concerned with improving the socio-economic position of rural communities. It is popular among rural producers. Twenty-seven per cent of tiny firms and 8.5 per cent of small firms had consulted KEMAS. KEMAS is more popular among tiny firms compared to small firms because it mainly caters for tiny firms in the rural areas. The majority of entrepreneurs who consulted KEMAS did so to obtain machines. Twenty per cent

of innovative entrepreneurs in small firms in this study admitted they adopted technological innovation because of the assistance they received from this institution. Besides providing machines, KEMAS also provide advisory services to rural producers.

(d) Private institutions

Besides government institutions, small scale entrepreneurs also receive assistance from private institutions. However, their involvement is very limited. Part of the reason for the limited involvement of private institutions is their high consultancy and training costs. None of the entrepreneurs in this study had consulted private institutions for any advisory services. Nevertheless, a small percentage of the entrepreneurs had attended courses organised by private institutions. Only 11.0 per cent of entrepreneurs from tiny firms and 12.3 per cent of entrepreneurs from small firms had attended production management, processing techniques, financial management and motivation courses organised by private institutions.

7.5.2.1 The Determinants of Institutional Involvement in Tiny Firms

Entrepreneurs' degree of involvement with institutions was related to their age, level of education, their n-ach, attitude toward risks, communicative behaviour and perception of buying procedure[6]. Our results show that young, better

[6] The entrepreneurs' institutional involvement negatively correlated with entrepreneur's age ($r = -0.1919$, $p=0.068$) and perception of buying procedure ($r=-0.1886$, $p=0.073$). However, it is positively correlated with entrepreneur's education ($r=0.2735$, $p=0.009$), need of achievement ($r=0.3538$, $p=0.001$), attitude towards risk ($r=0.2632$, $p=0.012$), and communicative behaviour ($r=0.5058$, $p=0.0001$).

educated, high achievers and risk takers have a stronger tendency to be involved with institutions.

The negative correlation between the variables INST and BUY ($r=-0.1886$, $p=0.073$) shows that entrepreneurs with greater degree of involvement with institutions saw purchasing as less problematic than others. Entrepreneurs who are involved with institutions will have fewer problems finding and negotiating with suppliers because the institutions usually have a list of suppliers to which small firms can refer. Such services reduce the cost of searching for suppliers. Moreover, since these suppliers have an interest in maintaining a good reputation with government institutions, the entrepreneurs would be likely to receive good service from suppliers referred through these sources.

Thirty five per cent of the entrepreneurs had not consulted any institution during the five years before this study was conducted. Sixty-three cent of non-innovative entrepreneurs and 60.0 per cent of innovative entrepreneurs stated that they did not have any reasons to refer to any institutions, because they did not have any problems that required their assistance. For innovative entrepreneurs who did not refer to any institutions, their main sources of information on innovation were suppliers and firms that had already adopted the innovation. In the case of non-innovative entrepreneurs, most of them were the entrepreneurs of relatively newly-established firms, less than seven years old (67.4%).

7.5.2.2 The Determinants of Institutional Involvement In Small Firms

In the case of small firms, entrepreneurs' education, sex, age, n-ach, skill-upgrading behaviour, knowledge of the innovation, firm size and communication behaviour, were influential. The effect of these factors on institutional involvement is shown in the regression function exhibited in **Table 7.15.**

Table 7.15: The Determinants of Institutional Involvement of Entrepreneurs in Small Firms

Factors	Independent variables	B	Standard Error	t-statistic	Significance Level
Entrepreneurs' characteristics					
a) Demographic characteristics:	EDU	0.0831	0.0340	2.462	0.0158***
	SEX (1)	-0.3572	0.2083	-1.735	0.0872**
	AGE	-0.0195	0.0129	-1.531	0.1312*
b) Personality traits:	NACH	0.2890	0.1875	1.5257	0.1334*
	RISKS	-0.0398	0.1523	-0.369	0.7580
c) Skill upgrading:	COURSE	1.0310	0.0638	14.932	0.0001***
d) knowledge on the innovation	KNOW(1)	0.6274	0.2210	2.793	0.0055***
Organisational characteristics:					
a) Firms' size	SIZE	-0.0151	0.0113	-1.456	0.1414*
b) Firms' structure:	COMPLEX	0.0534	0.0527	1.051	0.2954
c) mismatching of labour force	MISMATCH	0.0798	0.0834	0.876	0.3532
Communication	COMMU	0.3998	0.0727	5.521	0.0001***
CONSTANT		-0.0134	1.3367	-0.008	0.9865

Note:
F-statistics= 38.37542
Significant F = 0.00001
Multiple R = 0.92135
R -square = 0.84424
Adj. R square = 0.82223
Standard error = 0.83009
* significant at α=0.15
** significant at α=0.10
*** significant at α=0.05

Among the entrepreneurs' personal demographic characteristic, their level of education, sex, and age influenced their institutional involvement intensity. Entrepreneurs with higher levels of education, younger people and females had a higher intensity of institutional involvement. Young entrepreneurs and those with higher levels of education perceived the importance of knowledge acquisition to accommodate process changes in their firms. Knowledge acquisition could be obtained through institutional involvement. Being less communicative, female entrepreneurs required assistance from institutions for knowledge, skill and information acquisition, in order to be competitive with their male counterparts.

Success was the main objective of high achieving entrepreneurs. Such entrepreneurs would always search for opportunities and assistance, as long as it could improve their business performance. *Bumiputera* firms tend to rely heavily on government assistance, which explains their high involvement with institutions providing support to small scale industries. This partly explains why the entrepreneurs with higher need for achievement had higher institutional involvement.

The entrepreneurs' frequency of attending courses was related to their institutional involvement. The higher the frequency of attending courses, the move involved they were with institutions, especially the institutions that organised the courses. Through attending courses, they had the opportunity of meeting experts from these institutions and receiving various assistance and services provided by such institutions.

The intensity of entrepreneurs' institutional involvement was influenced by their need to search for information on the innovation they considered adopting. These entrepreneurs recognised the importance of these institutions as sources of technological information. It is reasonable to think that entrepreneurs will increase their institutional involvement to obtain further information about the considered innovation.

Firms' size was also a significantly related with entrepreneurs' institutional involvement. The negative coefficient of size of firm (SIZE) suggested that that smaller firms had a higher institutional involvement. Compared to large firms, smaller firms tend to face more development constraints, in terms of inability to obtain institutional finance and upgrade their level of technology, management and production efficiency. Consequently, many of them tend to rely heavily on external assistance.

The entrepreneurs' communicative behaviour influenced their intensity of institutional involvement. Communicative entrepreneurs have a higher institutional involvement because they have better information and exposure to the kinds of assistance provided by government agencies. These entrepreneurs have better opportunities of establishing links with government agencies through their involvement in seminars and expos. This partly explains why communicative entrepreneurs had higher institutional involvement.

7.5.3 Government Assistance

Some entrepreneurs received government assistance to introduce new techniques and manage change associated with their introduction. The types of assistance received by the entrepreneurs depended on the institutions providing the assistance. Some institutions provided financial assistance and others provided machines. Twenty four per cent of entrepreneurs in tiny firms and 10.4 per cent of entrepreneurs of small firms reported having received government assistance. Based on firms' level of innovativeness, 45.0 per cent of innovative entrepreneurs in tiny and 26.3 per cent of innovative entrepreneurs in small firms received government assistance.

This study showed that government assistance is a significant determinant of entrepreneurs' innovativeness. Assistance received from the government helps to speed up the rate of technological innovation in small and tiny firms. The majority of the entrepreneurs who received government assistance admitted that the innovation process would have been delayed without government assistance. Government agencies that had provided assistance to the entrepreneurs in this study were KEMAS, MARA, LPP, Ministry of Rural Development, Ministry of Youth and Sports and Ministry of Agriculture. Of these institutions, the most popular one was KEMAS because it caters for tiny firms and small firms in rural areas. As shown in **Table 7.16,** fifteen entrepreneurs in tiny firms and 3 entrepreneurs in small firms had received assistance in the form of machines from KEMAS. The majority of them had received assistance worth from RM5,000 to RM10,000. Four firms producing bean curd had received machines worth from

RM7,500 to RM15,000. One firm producing tomato and chilli sauce received a machine worth RM9,000. Three firms which produced chips received machinery worth more than RM20,000 from this agency.

Table 7.16: Number of Entrepreneurs Who Received Government Assistance Based on the Cost of Machines and Agencies Providing the Assistance.

Government agencies	Cost of the machine				
	<RM5,000	RM5,000 TO RM9,999	RM10,000 TO RM14,999	RM15,000 TO RM19,999	>=RM20,000
Ministry of rural development	- (2)				1 (1)
KEMAS	3 (1)	9 (1)	2 -	1 -	- (3)
MIDF					1 (2)
LPP	2 -				
MARA	1 -			1 -	- (2)
Ministry of youth and sport		1 -		- (1)	
Ministry of Agriculture	- (1)			- (1)	

Source: Survey 1993.
Note: The value without a bracket is the number of tiny firms and the value in a bracket is the number of small firms

Other agencies tended to provide financial assistance to assist the entrepreneurs to buy machines. For example, *Lembaga Pertubuhan Peladang* (LPP) provided assistance to finance two entrepreneurs to purchase machines worth RM1,500 and RM3,000. MARA provided financing to two entrepreneurs in tiny firms to purchase machines worth RM3,000 and RM19,300 . MARA also provided financing to two entrepreneurs in small firms to purchase machines that were worth more than RM20,000. The Ministry of Rural Development had

provided financing to two entrepreneurs in small firms to purchase machines that cost less than RM5,000. This Ministry also provided financing to one entrepreneur in a tiny firm who produced cooking oil and one entrepreneur in a small firm who produced cordial drinks, to purchase machinery worth more than RM20,000. Malaysian Industrial Development Finance (MIDF) provided financing to one entrepreneur in a tiny firm and two entrepreneurs in small firms.

7.6 Summary

In this chapter, we have discussed the influence on entrepreneurs innovation decisions, of communicative behaviour, their perception of buying procedures, the perceived and the objective characteristic of the innovation and environmental factors. We found that those with more communicative behaviour had a higher tendency to be innovative. Their communicative behaviour was demonstrated by their involvement with business associations, attending business expos or seminars. These communication channels linked entrepreneurs with sources of information.

The entrepreneurs' perception of buying procedures was one of the factors that influenced their decision to innovate. Among the procedures that non-innovative entrepreneurs perceived as problematic, were negotiating with suppliers and dealing with legal matters. They did not consider finding suppliers and being absent from their firms as major problems.

The majority of the entrepreneurs from tiny and small firms had positive perceptions of the innovations under consideration, seeing them as economically

beneficial, simple to use and compatible with their existing methods of production. However, there were differences in entrepreneurs' perception of the innovation related to their educational level, personality traits, knowledge of the innovation, firms' size, financing problems, the cost of the innovation and institutional involvement.

The cost of innovation not only influenced the entrepreneurs' perception of the innovation, but also their decision to innovate. This study showed that entrepreneurs were more likely to innovate when the cost of innovation was lower. The cost of innovation adopted or under consideration by the entrepreneurs in the study was related to their personality traits, their skill upgrading behaviour, firm's structure, receipt of government assistance, and the aim in innovating.

The majority of tiny and small firms considered larger firms as their main competitors. However, this study showed that the intensity of the competition from larger firms did not influence tiny and small firms to adopt technological innovations.

A relationship between entrepreneurs' innovativeness and their institutional involvement can be seen from this study, with innovative entrepreneurs making more use of institutional assistance. The main institutions with which respondents were involved were MARDI, MARA and KEMAS. A small percentage of entrepreneurs had received financial assistance or machines from government institutions. Such assistance enabled the entrepreneurs to innovate at an early stage, and to introduce more costly equipment than might otherwise have been the case.

CHAPTER EIGHT

THE INFLUENCE OF FIRMS' CHARACTERISTICS ON THE ADOPTION OF TECHNOLOGICAL INNOVATION

8. Introduction

In the previous chapter, we discussed the influence of entrepreneurs' communication behaviour and perception on technological innovation adoption decisions, as well as the impact of objective characteristics of the innovation in question, and environmental factors such as the availability of government assistance. Another important factor which we believe may influence entrepreneurs' innovation adoption decision is the characteristics of the firm, such as its size, structure, performance, stage in the life-cycle, financing and labour requirement. In this chapter, therefore, we will be guided by this question: what are the characteristics of innovative and non-innovative firms?

8.1 Analysis

Characteristics of firms can act as catalysts or barriers in their innovation decision process. We hypothesised the following characteristics of firms as determining factors for firms to be technologically innovative. In both tiny and

small firms, we proposed that, size[1], structure, mismatch between existing and required labour force, problem of financing, firms' life cycle, their economic performance before the decision to innovate would have causal influence on innovation decision. The significance of each factor was examined by using logistic regression functions as presented in **Tables 6.1** and **6.2.** For clarity and convenience, we shall present the parts of these two tables which are relevant to our discussion in this chapter, in **Tables 8.1** and **8.2** respectively

Table 8.1 : The Coefficients of Tiny Firms' Organisational Characteristics in Logistic Regression Function

Organisational characteristics	Independent variables	B	Standard error	Wald statistics	Significance level
a) Firms' structure:	FORMAL	1.343	2.458	0.299	0.5848
	CENTRAL	0.079	0.062	1.646	0.1996
	COMPLEX	1.418	2.930	0.234	0.6283
b) Financial problems:	FINANCE	-3.996	1.482	2.383	0.1178*
c) Firms' age:	YESB	-1.828	1.128	2.627	0.0965**
d) Performance:	FATURN89	-0.067	0.766	.008	0.9302
	ROI89	0.692	0.950	0.532	0.4659
	PROD89	-0.420	0.154	4.672	0.0301***
f) Mismatching of labour forces	MISMATCH	0.567	0.341	2.345	0.1382*
Constant:	constant	12.676	28.823	.223	0.636

Source: **Adapted from Table 6.1.**

Note:

(1) *** Significant at 95% confidence level
** Significant at 90% confidence level
* Significant at 85% confidence level

[1] **The independent variable SIZE is only included in logistic regression function for small firms. (See Table 6.2)**

Table 8.2: The Coefficients of Small Firms' Organisational Characteristics in Logistic Regression Function

Organisational Characteristics	Independent Variables	B	Standard Error	Wald statistics	Significance Level
a) Firms' size	SIZE	0.379	0.135	7.946	0.0048***
b) Firms' structure:	FORMAL	-.4675	1.243	0.141	0.7069
	CEN-R	-4.769	2.946	2.620	0.1055**
	COM-R	2.209	1.252	3.111	0.0778**
c) Financial problems:	FIN-R	-4.803	2.282	4.431	0.0353***
d) Firms' age	YESB-R	-0.637	1.877	0.115	0.7344
e) Performance:	FATURN89	.427	0.209	4.199	0.0404***
	ROI89	-1.399	0.626	4.996	0.0254***
	PROD89	.361	.133	7.347	0.0067***
f) Mismatching of labour force	MISMATCH	0.138	0.121	1.319	0.2507
Constant:	constant	17.522	14.985	1.367	0.2423

Source: **Adapted from Table 6.2.**

Note: *** Significant at 95% confidence level

** Significant at 90% confidence level

* Significant at 85% confidence level

8.2 Firms' Size

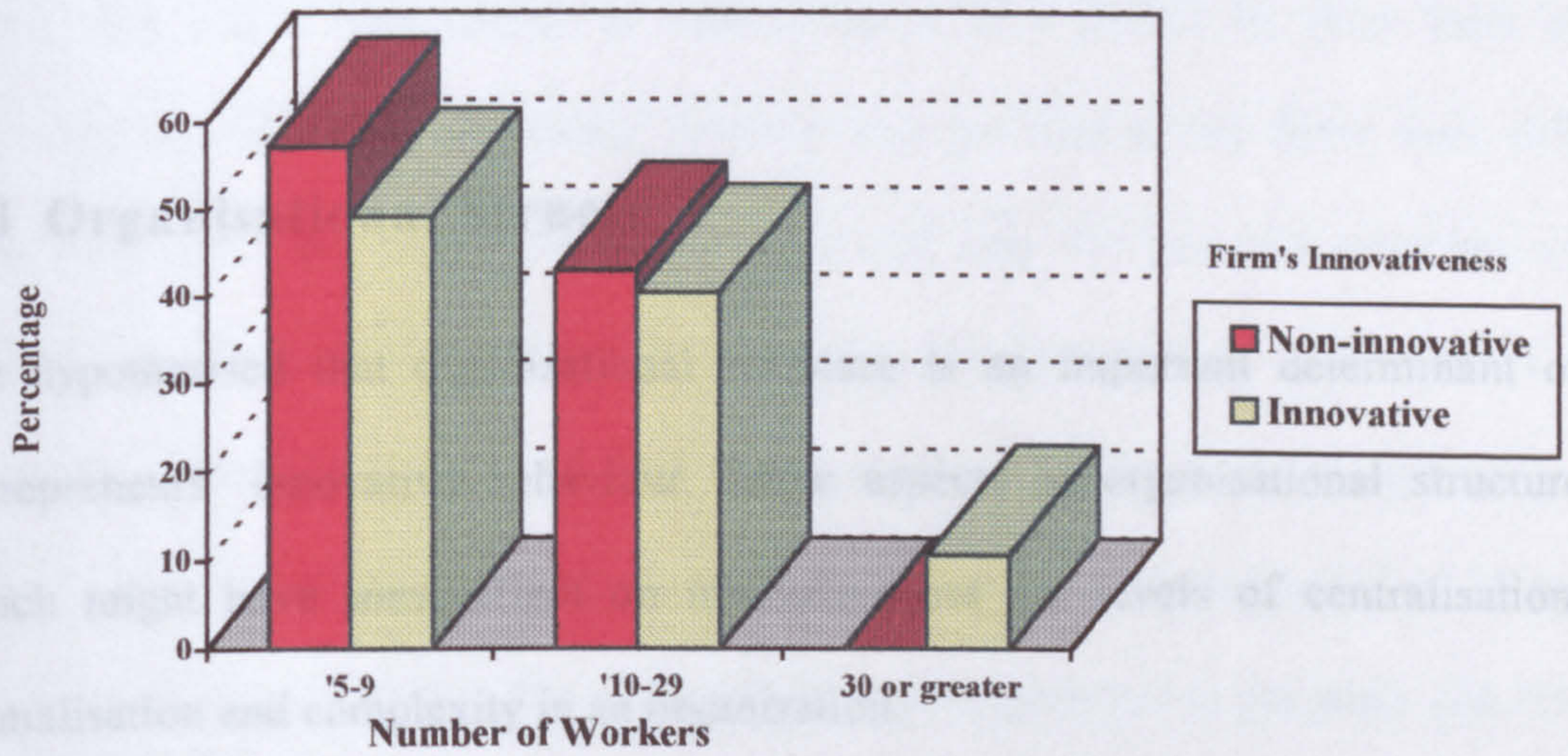
This analysis only applies to small firms, where variation in sizes[2] was more prevalent. We did not conduct a separate study on tiny firms because such firms were homogenous (all having less than 5 workers). This study shows that firms size is a significant determinant of technological innovation among small firms. A positive coefficient of the variable SIZE, suggests that larger firms are more likely to be more innovative than smaller ones (**Table 8.2**).

The distribution of firms based on their number of full time workers and firms' innovativeness can be observed in **Figure 8.1**. As we can see from the

[2] In this study, we define small firms, as those firms with 5 workers or more.

chart, the largest firms surveyed had a larger proportion of innovative than non-innovative firms; in smaller firms, the reverse was the case.

Figure 8-1: Firms Size by Level of Innovativeness



Source: Survey 1993
Note: chi-square=5.50812, df=2, significant level=0.06367

The results show that firm size was correlated positively with firms' levels of complexity (r=0.4216, p=0.0001). However, it was negatively correlated with levels of centralisation (r=-0.1580, p=0.106) and the intensity of financing problems (r=-0.1730, p=0.076). In other words, bigger firms tended to have more skilled workers and fewer financing problems compared to their smaller counterparts. As we have mentioned, they also had a lower level of centralisation, indicating that decisions were made by more than one individual (usually a committee). From this result, we can tentatively conclude that larger firms have more resources and practice a more sophisticated management style. With these resources, they have better capacity to innovate, compared to smaller

firms which have less resources and fewer skilled workers. For a given innovation, a bigger firm has an economic advantage over smaller ones (for a given type of innovation, the cost of innovation for larger firms is relatively less than for smaller ones).

8.3 Organisational Structure

We hypothesised that organisational structure is an important determinant of entrepreneurs' innovative behaviour. Some aspects of organisational structure which might have some effect on innovativeness are levels of centralisation, formalisation and complexity in an organisation.

Contradictory to the research hypothesis, the research findings showed that in tiny industries, their organisational structure did not have any effect on their innovativeness. **Table 8.1** indicated that none of the three variables, CENTRAL (firms' centralisation), FORMAL (firms' formalisation), and COMPLEX (firms' complexity) was able to predict tiny firms' entrepreneurs' innovativeness. For small firms (**Table 8.2**), their level of formalisation (FORMAL) was also non-significant in explaining the dependent variable. However, the firm's level of centralisation (CEN-R) and complexity (COM-R)[3] had a significant influence on the adoption of technological innovation.

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[3] Due to the strong correlation, firms' level of centralisation and complexity were measured in term of their relation to firms' size. As mentioned in **Chapter Five**, variables CEN-R and COM-R respectively refer to firms' relative level of centralisation and complexity for a particular size of firms. The calculation for CEN-R is shown in **Chapter five**, section 5.8.2 and the calculation for COM-R is as follow:

COM-R = COMPLEX / E (COMPLEX)

8.3.1 Centralisation

The main reason why the three factors (centralisation, complexity and formalisation) did not have any significant influence on innovation decisions in tiny firms is because the structure of these firms was homogenous. Being tiny firms, they had a high degree of centralisation as reflected by their form of organisation and equity ownership. Seventy-nine per cent of the firms were sole proprietors, 16.5 per cent were partnerships and only 4.4 per cent were private limited companies. Regarding equity ownership, 74.7 per cent of entrepreneurs in the study owned 100 per cent of their firms' equity, 15.4 per cent owned between 50 to 75 per cent of the firms' equity and only 9.9 per cent owned less than 25 per cent of their firms' equity. The majority of the entrepreneurs in the study (74.7%) were the founders of their firms and they considered themselves as the final decision makers on any innovation for their firms.

In small firms, firms' level of centralisation was a significant determinant of firms' innovativeness. A negative coefficient of the variable CEN-R (**Table 8.2**) indicates that firms with a low level of centralisation in relation to their size had a greater tendency to be innovative. For a particular firm's size, a low degree of centralisation means more people were given autonomy in the decision

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where: $E(COMPLEX) = a + bSIZE$

a and b are the estimates of the coefficients of regression function of

$$COMPLEX = \alpha + \beta SIZE + \varepsilon$$

If the value of these particular variables were more than one, it indicated that the firm had higher level of complexity or centralisation than expected for its size.

making process; thus, decision makers had wider access to information on the innovation they were considering adopting.

8.3.2 Complexity

As we can recall, complexity is defined by the number of professional, technical and managerial (inclusive of the entrepreneurs) workers in an organisation. Tiny firms were mostly managed single-handedly by the entrepreneur; the majority (93.4%) did not have any technical workers.

In the case of small firms, we found that there was some variation in the relative level of complexity, which influenced firms' innovativeness. The results show that the variable COM-R had a significant influence on firms' decision to innovate (**Table 8.2**), i.e. firms with a high degree of complexity relative to other firms of the same size had a greater tendency to be innovative. This is understandable, as firms with more professional, technical and managerial workers in relation to their size will be more able to assimilate innovation. We can tentatively conclude that firms with a high relative level of complexity have a greater tendency to be innovative, compared to less complex firms.

8.3.3 Formalisation

Formalisation measures the degree of formality within an organisation. Tiny firms tend to have low level of formalisation compared to larger ones, because of the size and the number of employees. Our results show that the level of formalisation among the firms surveyed, was low in both tiny and small firms.

8.3.3.1 Formalisation in Tiny Firms

Regardless of whether the firms were categorised as innovative or not, they had an almost equal degree of formalisation. In **Table 8.3**, we can see that only in descriptions **E** and **G**, is there a significant difference in mean score; however, their mode of formalisation is the same. We can make several observations about the result. *First*, entrepreneurs perceived their relationship with their employees as informal. *Second*, entrepreneurs often shared firms' problems with their employees, although they did not encourage their employees to reveal their personal problems. *Third*, entrepreneurs were willing to accept reasonable suggestions given by their employees, although the final decisions were made by certain individuals, normally the entrepreneurs themselves and their assistants, through an informal meeting. *Fourth*, employees only participated in the decision process on issues related to them; however, they were not given a formal report on their performance. *Fifth*, there is a significant difference in the level of formalisation between innovative and non-innovative firms in terms of conducting feasibility studies on the considered innovation being considered for adoption (description **E**). Innovative firms were more formalised; they formed special committees to conduct detailed pre-feasibility studies of innovation. *Sixth*, there was a significant difference in the level of formalisation between innovative and non-innovative firms regarding employee performance appraisal, the level of formalisation in this respect being relatively higher in innovative firms (description **G** in **Table 8.3**)

Table 8.3 : Level of Formalisation in Tiny Firms

Description	1	2	3	4	5	Means	t-statistics
A) Workers' opinions or suggestions are seldom accepted by the management	31.4 (40.0)	39.2 (27.5)	23.5 (30.0)	3.9 (2.5)	2.0 (0.0)	2.0588 (1.950)	0.55 [0.580]
B) Decisions can be made only through meeting and discussion by management	21.6 (17.5)	11.0 (15.0)	27.5 (25.0)	29.4 (27.5)	9.8 (15.0)	2.9412 (3.075)	-0.48 [0.631]
C) Employees take part in decision making on their affairs only	3.9 (5.0)	17.6 (15.0)	39.2 (42.9)	31.4 (35.0)	7.8 (2.5)	3.2157 (3.150)	0.33 [0.740]
D) Employees are encouraged to reveal their personal problem to superiors	11.8 (7.5)	33.3 (32.5)	35.3 (30.0)	15.7 (17.5)	3.9 (12.5)	2.667 (2.950)	-1.25 [0.216]
E) Working committee was formed to conduct feasibility study on the machine	27.5 (17.5)	17.4 (15.0)	35.3 (27.5)	15.7 (25.0)	3.9 (15.0)	2.5098 (3.050)	-2.06 [0.042]***
F) Only certain groups of individuals make decisions for the firm	7.8 (5.0)	7.0 (7.5)	27.5 (20.0)	39.2 (55.0)	17.6 (12.5)	3.5098 (3.625)	-0.51 (0.608)
G) Employees are given formal report on their performance	35.3 (15.0)	39.2 (42.5)	17.6 (22.5)	3.9 (15.0)	3.9 (5.0)	2.0196 (2.525)	-2.27 [0.026]***
H) Superiors delegate their work to sub-ordinates	13.7 (5.0)	27.5 (22.5)	29.4 (40.0)	23.5 (30.0)	5.9 (2.5)	2.8039 (3.025)	-1.00 [0.318]
I) Superiors share problems with sub-ordinates	21.6 (17.5)	25.5 (17.5)	35.3 (42.5)	13.7 (15.0)	3.9 (7.5)	2.5294 (2.775)	-1.04 [0.302]
J) Relationship between superior and sub-ordinates is informal	13.7 (20.0)	15.7 (22.5)	9.8 (5.0)	33.3 (37.5)	27.5 (15.0)	3.4510 (3.050)	1.34 [0.184]

Source: Survey 1993

Notes: *** Significant at 95% confidence level

The first values are the information on non-innovative firms.

Values in brackets ( ) are information on innovative firms

Values in brackets [ ] are two tailed significance level

Indications of the scores are:

1- Not true all the time
2- Not true most of the time
3-Sometimes true
4-True most of the time
5-True all the time

Highest % in innovative and non-innovative firms

Highest % in innovative firms

Highest % in non-innovative firms

8.3.3.2 Formalisation in Small Firms

The study shows that the level of formalisation did not have a significant influence on small firms' innovativeness. This is due to the low variation between small scale firms in this study. The majority of them had low levels of formalisation. Regardless of whether the firms were innovative or not, they had almost equal levels of formalisation. **Table 8.4** shows that only in descriptions F, G and H were there significant differences in mean score but firms' mode of formalisation was similar.

In terms of the relationship between employer and employee, the majority of entrepreneurs claimed they had an informal relationship with their employees; they shared firms' problems with their employees, and welcomed any suggestion made by them. In most cases, employees were not given formal reports on their performance. In situations where the entrepreneurs could not perform, they delegated their work to their subordinates. Employees were also encouraged to reveal their personal problems to their employer.

There was a significant difference in degree of formalisation between innovative and non-innovative small firms relating to decision making (description **F**), employee performance appraisals (description **G**), and delegation of responsibility (description **H**). There was some degree of formalisation in the decision making process in innovative small firms. Only certain individuals (normally, the entrepreneurs, business partners and major shareholders) were involved in the decision-making process. Decisions were usually made through formal meeting and discussion. Regarding employee performance, innovative

firms had a greater tendency to give formal reports on their employees' performance. There was also more delegation of work in innovative compared to non-innovative firms.

Table 8.4: Level of Formalisation in Small Firms

Descriptions	1	2	3	4	5	Means	t-statistics
A) Workers' opinions or suggestions are seldom accepted by the management	**34.7 (40.4)**	18.4 (21.1)	32.7 (31.6)	12.2 (5.3)	2.0 (1.8)	2.285 (2.0702)	1.01 [0.313]
B) Decisions can only be made through meeting and discussion by management	18.4 (10.5)	6.1 (15.8)	28.6 (28.1)	**30.6 (33.3)**	16.3 (12.3)	3.204 (3.2105)	-0.03 [0.970]
C) Employees take part in decision making on their affairs only	4.1 (8.8)	12.2 (22.8)	**40.8 (31.6)**	36.7 (31.6)	6.1 (5.3)	3.286 (3.0175)	1.38 [0.170]
D) Employees are encouraged to reveal their personal problem to superiors	4.1 (15.8)	24.5 (12.3)	**40.8 (29.8)**	20.4 (26.3)	10.2 (15.8)	3.082 (3.1407)	-0.26 [0.794]
E) Working committee was formed to conduct feasibility study on the machine	26.3 (20.4)	12.3 (10.2)	15.8 (30.6)	**28.1 (30.6)**	17.5 (8.2)	2.9825 (2.959)	-0.09 [0.930]
F) Only certain groups of individuals make decisions for the firm	14.3 (5.8)	4.1 (3.5)	18.4 (19.3)	**46.4 (38.6)**	16.3 (33.3)	3.469 (3.9123)	-1.97** [0.052]
G) Employees are given formal report on their performance	14.3 (12.3)	24.5 (14.0)	**38.8 (42.1)**	20.4 (14.0)	2.0 (17.5)	2.714 (3.1053)	-1.77** [0.079]
H) Superiors delegates their work to sub-ordinates	8.2 (7.0)	14.3 (8.8)	**51.0 (40.4)**	24.5 (33.3)	2.0 (10.5)	2.979 (3.3158)	-1.80** [0.075]
I) Superior share problems with sub-ordinates	12.2 (5.3)	12.2 (19.3)	**36.7 (28.1)**	26.5 (24.6)	12.2 (22.8)	3.143 (3.4035)	-1.13 [0.261]
J) Relationship between superior and sub-ordinates was informal	20.6 (7.0)	14.3 (14.0)	**26.5 (24.6)**	**20.4 (31.6)**	18.4 (22.8)	3.023 (3.492)	-1.28 [0.204]

Source: Survey 1993

Notes: ** Significant at 90.0% confidence level
The first values are the information on non-innovative firms.
Values in brackets ( ) information on innovative firms,
Values in parentheses [ ] are two tailed significance level
Indications of the scores are:
1- Not true all the time
2- Not true most of the time
3-Sometimes true
4-True most of the time
5-True all the time

Highest % in innovative and non-innovative firms

Highest % in non-innovative firms

Highest % in innovative firms

8.4 Mismatching of Existing and Required Labour Force

Adoption of technological innovation may lead to mismatching of the existing and required labour force when entrepreneurs have to hire new employees to operate the new technology, and reshuffle their existing employees or work arrangement, resulting in some being transferred, made redundant, or needing to be retrained. This study hypothesised that mismatching in the labour force is one of the barriers to introduction of technological innovation. Entrepreneurs may abandon the idea of adopting a technological innovation if they think that mismatching may result.

The logistic regression equation in **Table 8.1** shows that the variable MISMATCH is a significant predictor of technology adoption in tiny firms. We can infer from this result that mismatch between of existing and required labour force can have a significant influence on entrepreneurs' decision to adopt or reject a considered innovation. Based on our hypothesis, the coefficient of the variable MISMATCH should have a negative sign; however, our results do not support this hypothesis. A positive and significant coefficient of the MISMATCH variable suggest that entrepreneurs who perceived the possibility of a mismatch in their labour force, are more likely to adopt technology. Thirty-seven percent of innovative entrepreneurs and 35.3 per cent of non-innovative entrepreneurs perceived that a mismatch would exist resulting from technological innovation.

In the case of small firms, the logistic regression coefficient of the variable MISMATCH, was not significantly related to firms' decision to adopt (or reject) technological innovation (**Table 8.2**). As in the case of tiny firms, the coefficient has a positive sign suggesting that the percentage of innovative entrepreneurs who

experienced mismatch is higher (59.6%) compared to non-innovative entrepreneurs (40.8%).

The main reason why there is a relatively higher percentage of innovative entrepreneurs who perceived a mismatch of labour force was due the difference in their experience; the innovative entrepreneurs had actually experienced such a mismatch, while the non-innovative entrepreneurs were relying on their perception. They had not seriously considered innovation and so, perhaps, did not know or failed to realise the extent of the possible mismatch. The fact that they did not adopt innovation, even though they did not foresee the problem of a mismatch, suggest that labour mismatch was not an important factor influencing their decision.

Among innovative entrepreneurs, 37.5 per cent of tiny firms and 59.6 per cent of small firms had experienced mismatch when they first adopted the innovation. Some of them continued to innovate despite a mismatch, due to the presence of government assistance. An analysis of the types of mismatching revealed the following results: Twenty-three per cent of small firms and 14.0 per cent of tiny firms admitted that none of their employees had the required skill to operate the new technology; 76.5 per cent of small firms and 46.0 per cent of tiny firms indicated that they had to retrain their employees; 44.1 per cent of small firms and 30.0 per cent of tiny firms had to recruit new employees; 5.9 per cent of small firms and 4.0 per cent of tiny firms faced redundancy problems; and 17.6 per cent of small firms and 10.0 per cent of tiny firms admitted that some of their employees had to be transferred to other work.

Although some innovative entrepreneurs experienced mismatch and some non-innovative entrepreneurs perceived that mismatch might occur, almost all felt that mismatch between required and existing labour force was not a problem that would inhibit them from adopting an innovation. Mismatch was not a problem because of the simplicity of their organisational structure and the types of technological innovation under consideration. In such small firms, transferring of employees, recruiting new employees and provide training would not involve physical expansion or creation of additional departments. The nature of the technological innovation that firms adopted or intended to adopt was not so technically sophisticated that only highly qualified skilled workers could handle it. By undergoing some training and slight adjustment to their usual work routines, the innovation could be easily assimilated.

Statistically the data on tiny firms may show the coefficient of MISMATCH to be related to innovativeness in tiny firms; however, due to various evidence discussed above, we concluded that the mismatch factor is not a determining factor in technological innovation.

8.5 Financing

This study hypothesised that financing problems would be a determinant of technological innovation. Entrepreneurs who face financing problem are more likely to reject technological innovation compared to those without the problem. Although entrepreneurs may have felt the need to innovate, they might even abandon the idea due to lack of finance. This study shows that the variable

FINANCE had a significant influence on small and tiny firms' decision to adopt or reject innovation. (**Table 8.1** and **8.2**) The negative coefficient of the FINANCE variable in the logistic regression of tiny firms, and FIN-R[4] variable in the logistic regression of small firms, suggests that entrepreneurs with more severe financial problems are less likely to innovate.

This study measured financing problem based on the difficulties entrepreneurs faced when trying to obtain finance form commercial financial institutions. The entrepreneurs faced many difficulties when obtaining finance, of which the major ones were related to access, providing collateral, preparation of a feasibility study or the investment plan, and high interest rate. These problems usually caused entrepreneurs to abandon their idea of seeking financial assistance from formal institutions. The percentage distribution of entrepreneurs based on the degree of problems mentioned above is exhibited in **Table 8.5**.

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[4] Firms' problems in obtaining financing from financial institution were strongly correlated with firms' size (see Chapter Five). Smaller firms had more serious financing problems than larger firms. We can conclude that firms' financing problems may not be the major factor determining their innovative behaviour; instead it is firms' size. The financial problem may just be a spurious factor, the effect of which on firms' innovative behaviour may reflect firms' size. Bearing this in mind, we examine firms' financing problems in relation to their size to predict firms' innovativeness in our multivariate analysis. The variable FIN-R in the logistic regression function (**Table 8.2**) indicated the firms' financing problem intensity with respect to size. The calculation for FIN-R is as follow:

$$\text{FIN-R} = \text{FINANCE} / E(\text{FINANCE})$$

where: $E(\text{FINANCE}) = a + b\text{SIZE}$

a and b are the estimates of the coefficients of regression function of

$$\text{FINANCE} = \alpha + \beta\text{SIZE} + \varepsilon$$

A value of FIN-R above "1" indicated that for a particular size of firm, the severity of financing problem was greater than expected. Conversely, a firm with a FIN-R of "1 and below" is considered as having low financing problem intensity in relation to size.

Based on the results presented in **Table 8.5**, the problem of financing was more prevalent among tiny firms compared to small firms. The majority of entrepreneurs in this study faced difficulties obtaining financing; however, the severity of the problem was greater for non-innovative entrepreneurs.

In the case of tiny firms, the majority of entrepreneurs (21.6 per cent of non-innovative and 10.0 per cent of innovative) felt that they had or would have serious problems getting their loans approved. Due to this lack of confidence, many of them were discouraged from seeking loans from formal institutions. Providing the feasibility studies or investment plans required by financial institutions was not a major problem for the majority of entrepreneurs in the study. Providing collateral was considered a major problem by 47.1 per cent of non-innovative entrepreneurs and 40.0 per cent of innovative entrepreneurs. Access to financial institutions and high interest rates were considered as major problems for non-innovative entrepreneurs; however, such was not the case for innovative entrepreneurs. Access to financial institutions was a major problem for a larger percentage of the non-innovative entrepreneurs, because they lacked exposure to the facilities offered by various commercial banks to small scale entrepreneurs. The high interest rate charged by financial institutions also imposed a heavy financial burden on entrepreneurs. In fact 45.1 per cent of non-innovative and 30.0 per cent of innovative entrepreneurs regarded interest rates as their main problem. Some also believed that the charging of interest conflicted with their religious principles (interest is considered an example of *riba*, or usury, which is forbidden in Islam).

8.5: Percentage Distribution of Entrepreneurs Based on Financing Problems in Tiny and Small Firms

Problems Description	Level of Innovativeness	TINY FIRMS				SMALL FIRMS			
		Degree of Problems			chi-square Test [Significance .Level]	Degree of Problems			chi-square Test [Significance Level]
		1	2	3		1	2	3	
A) Getting loan approved	Non-innovative	29.4	49.0	21.6	2.19504	65.3	26.5	8.1	5.4555
	Innovative	35.0	55.0	10.0	[0.33370]	70.1	28.1	1.8	[0.3628]
B) Providing feasibility study	Non-innovative	64.7	29.4	5.9	1.33266	77.7	20.4	2.0	12.061***
	Innovative	75.0	22.5	2.5	[0.51359]	91.2	8.8	-	[0.0169]
C) Providing collateral	Non-innovative	52.9	31.4	15.7	0.76271	69.4	18.4	12.2	13.5780***
	Innovative	60.6	30.0	10.0	0.68294	87.7	10.5	1.8	[0.0301]
D) Access	Non-innovative	43.1	45.1	11.8	7.87112***	67.4	26.5	6.1	9.9962**
	Innovative	72.5	22.5	5.0	[0.01953]	82.4	15.8	1.8	[0.0753]
E) High interest rate	Non-innovative	54.9	5.9	39.2	2.23634	55.1	20.4	24.4	10.0586**
	Innovative	70.0	5.0	25.0	[0.32688]	79.0	10.5	10.5	[0.0736]

Source: Survey 1993

Note: *** Significant at 95% confidence level
** Significant at 90% confidence level

Indication of degree of problem

1 - No problems or minor problem that can be solved by entrepreneurs themselves
2 - Serious problem that can be solved with some external assistance
3 - Very serious problem that can not be solved

For small firms, the majority both innovative and non-innovative firms regarded getting their loan approved, providing feasibility study on firms' future investment plan, providing collateral, approaching financial institutions and interest rates as minor problems which they could solve. However, there were some differences between the two. A higher percentage of innovative compared to non-innovative firms considered financing as minor problems (see column 1 in degree of problem, **Table 8.5**, for small firms). On the other hand, a considerably higher percentage of non-innovative than innovative firms regarded financing as their major problem (columns 2 and 3 in **Table 8.5**).

As mentioned above, the majority of entrepreneurs in this study felt that it was difficult to get approval for a loan from a financial institution. Therefore, commercial financial institutions were not the source of financing in either tiny or small firms. The majority relied on informal sources (such as their own funds, relatives, friends). This study showed that only two entrepreneurs in tiny firms and five entrepreneurs from small firms had obtained financing from a commercial bank to finance their innovation.

Among tiny firms that had innovated, 37.1 per cent had used their own funds, 51.5 per cent had used finance from government institutions, 8.6 had borrowed from their family and only 2.8 per cent had obtained financing from a commercial bank. Of the small firms that had innovated, 68.4 per cent (39 entrepreneurs) had used their own funds, 3.5 per cent had used family resources, 8.8 per cent had borrowed from a financial institution and 19.3 per cent had applied to government agencies to finance their innovation. These results suggest

that tiny firms tend to rely on government agencies to finance their innovation, whereas, small firms tend to be financially self-reliant.

Among tiny and small firms which had not innovated but intended to do so in the near future, the majority (50.0% of tiny firms and 62.9% of small firms) of them claimed they would use their own funds, rather than seeking external assistance. Considering the high cost of technological innovation, personal funds may not be sufficient; these entrepreneurs may have to resort to external sources. In any event, their choice will be constrained by the funds available. In fact, other than the appropriateness of the machine, its cost in relation to the finance available was given as a reason why a particular machine was chosen. If the cost of innovation is too high, entrepreneurs may have to abandon the idea of innovating. The results suggest that high cost of innovation would affect entrepreneurs' ability to finance the innovation themselves[5]. 43.2 per cent of non-innovative entrepreneurs admitted they did not innovate because of financing problems and the innovation they had considered introducing was too expensive for them to finance it themselves. A brief glance at **Figure 8.2** shows that entrepreneurs who relied on informal sources tended to be constrained in their innovation. For example, entrepreneurs who relied on personal funds, for the most part spent no more than RM5,000. Those who obtained finance from government institutions, on the whole innovated at a cost of RM5,000 to RM10,000.

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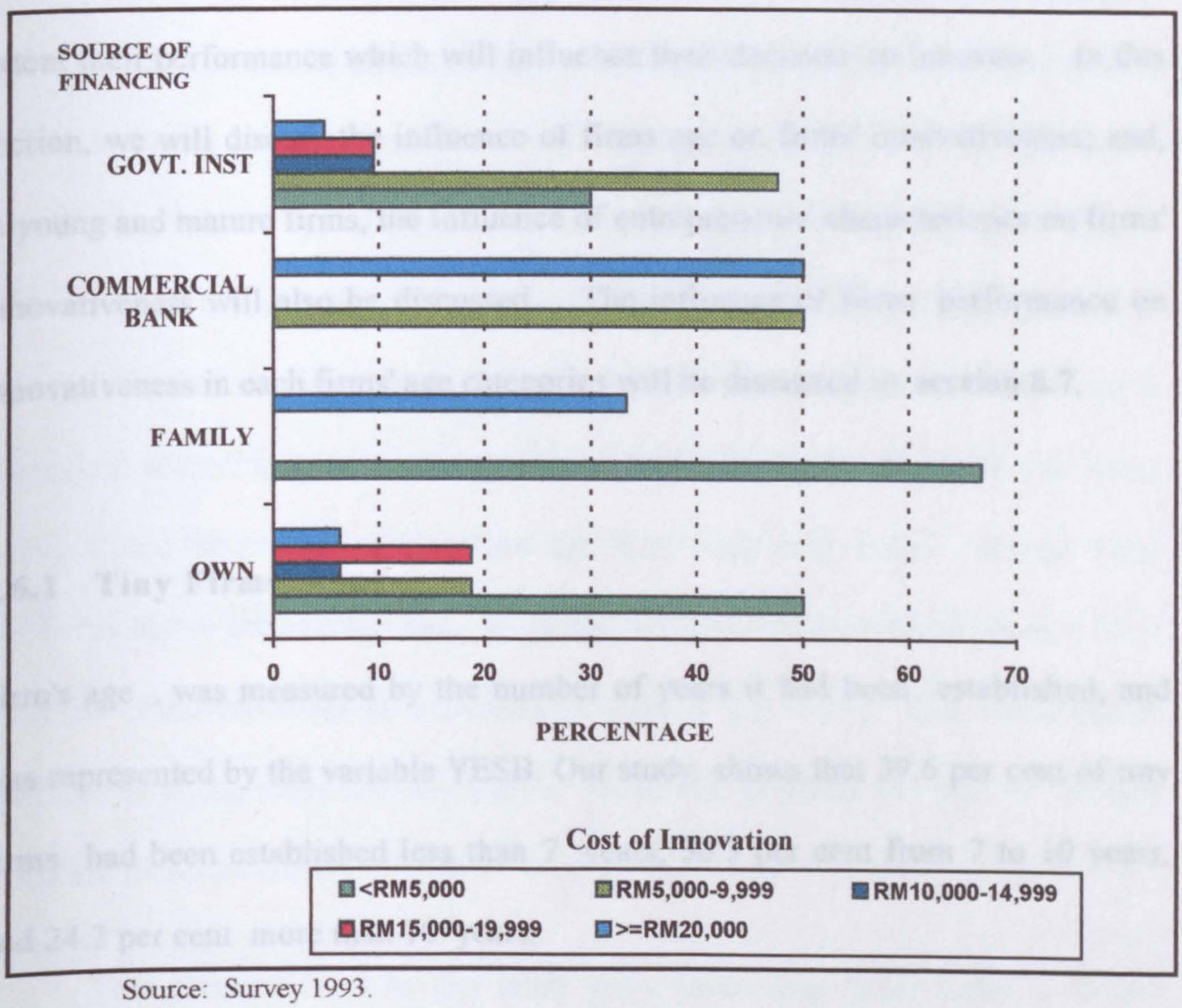
[5] There is a positive correlation between the cost of innovation and financing problem faced by the entrepreneurs (For tiny firms: r=0.1697, p=0.0108; for small firms: r=0.1785, p=0.067).

Figure 8-2: The Percentage Distribution of Tiny Firms by Their Source of Financing and Cost of Innovation



Source: Survey 1993.

8.6 Firms' Age

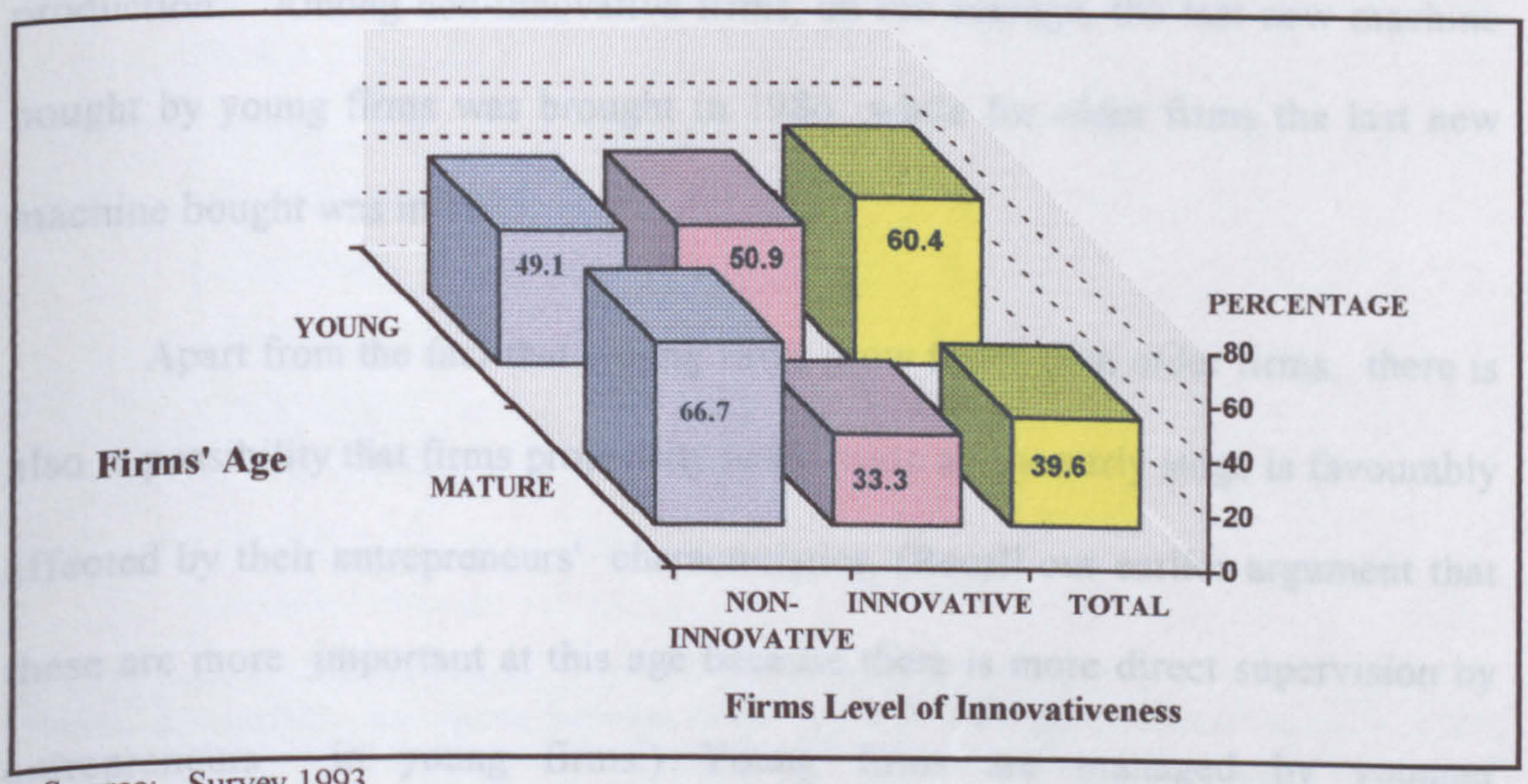
We hypothesised that firm's age can influence their level of innovativeness. Younger firms need to grow fast; therefore they have more need to invest in the latest machinery than older firms which had already got machinery (not the latest). This leads them to be more innovative - in our sense - than older firms. It is worth recalling that the management style of young firms is more entrepreneurial or individualistic and there is more likely to be direct supervision by entrepreneurs. Hence, we also hypothesised for young firms, entrepreneurs'

characteristics are expected to play an important role in determining new technology adoption decisions; while for firms at the mature stage it is to a larger extent their performance which will influence their decision to innovate. In this section, we will discuss the influence of firms age on firms' innovativeness; and, in young and mature firms, the influence of entrepreneurs' characteristics on firms' innovativeness will also be discussed. The influence of firms' performance on innovativeness in each firms' age categories will be discussed in **section 8.7**.

8.6.1 Tiny Firms' Age

Firm's age was measured by the number of years it had been established, and was represented by the variable YESB. Our study shows that 39.6 per cent of tiny firms had been established less than 7 years, 36.3 per cent from 7 to 10 years, and 24.2 per cent more than 10 years.

Figure 8-3: Tiny Firms' Age and Level of Innovativeness



Source: Survey 1993
Note: Chi-square=2.72838, df=1, significance=0.09858

Other than Based on a logistic regression function as exhibited in **Table 8.1**, the research finding showed that firms' age was a significant determinant of technological innovation in tiny firms. The negative coefficient of the variable YESB indicates that younger firms were more innovative than mature firms. This finding implied that if firms are recently set up, therefore, they need to grow fast and there is a greater need to invest in the latest machinery than there is in firms which had already got machinery. For discussion purposes, firms' age is classified according to two categories as follows: (a) 'young firms' are firms younger than the average of tiny firms' age (8.73 years old), and (b) mature firms are firms above the average age. Bivariate analysis between firms age and their level of innovativeness as exhibited in **Figure 8.3** shows that the majority (50.9%) of young firms are innovative, while the majority (66.7%) of mature firms are non-innovative.

That younger firms in this study grow faster than older firms is further shown from analysis of firms' age and the last time they bought a machine for production. Among non-innovative firms, on the average, the last new machine bought by young firms was brought in 1986 while for older firms the last new machine bought was in 1983.

Apart from the fact that young firms grow faster than older firms, there is also a possibility that firms propensity to innovate at the early stage is favourably affected by their entrepreneurs' characteristics. (Recall our earlier argument that these are more important at this age because there is more direct supervision by entrepreneurs in young firms.) Young firms are managed by younger

entrepreneurs[6] ; and, these young entrepreneurs, compared to older entrepreneurs usually have higher level of education and are higher achievers (as has been mentioned in **Chapter Six**).

The influence of the entrepreneurs' characteristics on firms' decision to innovate among young firms is further explained in **Table 8.6**. This table shows that among young firms, the entrepreneurs who: were younger, had higher level of education, and had upgraded their skill and knowledge, were higher achievers and had higher propensity to take risk, had a greater tendency to innovate. The characteristics of the entrepreneurs have less influence on firms' innovativeness in mature firms. (see **Table 8.6**). Firms innovate at the mature stage of their life cycle due to other factors, such as government assistance. In fact, 50.0 of entrepreneurs from mature firms innovated because they received financial assistance from the government. Had it not been for this assistance, we doubt whether they would have taken the step of introducing new techniques.

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[6] There is a positive correlation between firms' age and their entrepreneurs' age ($r=0.1787$, $p=0.090$). This indicated that compared to mature firms, young firms are managed by younger entrepreneurs.

Table 8-6: Percentage Distribution of Tiny Firms Based on Firms' Age, Entrepreneurs' Characteristics and Level of Innovativeness

Firms' age	Entrepreneurs' characteristics	Firms' level of innovativeness	No. of firms	Mean	Standard deviation	t-statistics [Sig. level]
Young firms	**Age** (years)	Non-innovative	27	41.370	8.513	1.79** [0.080]
		Innovative	28	37.026	9.026	
	Skill Upgrading (no. of courses)	Non-innovative	27	0.593	1.248	-2.43*** [0.018]
		Innovative	28	1.464	1.401	
	Level of education (years)	Non-innovative	27	8.789	2.752	-1.67** [0.100]
		Innovative	28	10.000	3.339	
	Previous Work Experience (years)	Non-innovative	27	5.963	7.346	0.13 [0.898]
		Innovative	28	5.714	6.954	
	Need for achievement (score)	Non-innovative	27	3.713	0.406	1.73** [0.091]
		Innovative	28	3.892	0.125	
	Locus of control (score)	Non-innovative	27	3.757	0.413	-0.43 [0.666]
		Innovative	28	3.811	0.513	
	Attitude toward risks(score)	Non-innovative	27	3.302	0.541	-2.33*** [0.024]
		Innovative	28	3.655	0.579	
Mature firms	**Age** (years)	Non-innovative	24	41.292	7.049	0.77 [0.448]
		Innovative	12	39.333	7.536	
	Skill Upgrading (no. of courses)	Non-innovative	24	0.751	0.944	0.82 [0.420]
		Innovative	12	0.500	0.674	
	Level of education (years)	Non-innovative	24	8.750	2.400	-0.18 [0.856]
		Innovative	12	8.917	2.906	
	Previous Work Experience (years)	Non-innovative	24	6.208	6.840	0.65 [0.564]
		Innovative	12	4.917	4.889	
	Need for achievement (score)	Non-innovative	24	3.757	0.470	0.52 [0.598]
		Innovative	12	3.674	0.426	
	Locus of control (score)	Non-innovative	24	3.779	0.345	1.36 [0.183]
		Innovative	12	3.619	0.313	
	Attitude toward risks (score)	Non-innovative	24	3.285	0.512	-0.28 [0.782]
		Innovative	12	3.347	0.680	

Source: Survey 1993

Note : *** Significant at 95% confidence level

** Significant at 90% confidence level

8.6.2 Small Firms' Age

Our study shows that 54.7 per cent of small firms had been established less than 10 years, 34.9 per cent had been established between 10 to 19 years, and 3.4 per cent had been established more than 20 years. In our analysis of small firms, compared to tiny firms, we adopted a slightly different approach; we measured small firms' age by their years of establishment in relation to their size[7], as represented by the variable YESB-R. We assume that firms with their YESB-R value less than or equal to 1 are young firms while firms with their YESB-R value greater than 1 are mature firms.

The logistic regression function (**Table 8.2**) indicated that firms' age was not a significant determinant of innovativeness in small firms. What this result suggests is that firms had equal tendency to innovate, regardless of their age. Small firms innovated at the young age to stay competitive and they did so by improving production efficiency. The majority claimed they innovated to replace old machines and manual methods, rather than introducing new products. Firms which innovated at the mature stage, did so to increase their market share, business expansion or diversification. It is reasonable to think that firms at this

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[7]Due to the strong correlation between years of establishment and firm size, as a way to avoid collinearity, firms' age can be measured according to firm size. It is named as variable YESB-R. The value of YESB-R was calculated as follow:

$$\text{YESB-R} = \text{YESB} / E(\text{YESB})$$

where: $E(\text{YESB}) = a + b\text{SIZE}$

a and b are the estimates of the coefficients of regression function of

$$\text{YESB} = \alpha + \beta\text{SIZE} + \varepsilon$$

For a particular size of firm, a score of "less than 1" for the variable YESB-R indicates that the firm is at its younger age. Alternatively if the firm has a score of "1 or higher" for the variable YESB-R, indicates that the firm is the mature stage of its life-cycle.

stage will introduce new machinery to produce new products. Referring back to our hypothesis, it may be that the innovations which we are looking at, which involve modest improvements in process technology, would not much tend to upset organisational routines and would therefore not fall foul of conservatism in older firms.

Unlike tiny firms, in small firms, we found that the influence of entrepreneurs' characteristics on firms' innovativeness exist in both stages of firms' life cycle. However, the influence become less significant as firms mature. This indicated that in small firms, their entrepreneurs' involvement in managing the firms is more intense in their early age. As exhibited in Table 8.7, entrepreneurs' skill upgrading behaviour, their previous work experience and their locus of control influence firms to innovate in the young age. At this stage, entrepreneurs with previous work experience, or who had upgraded their skill, or who had internal locus of control had a greater tendency to be innovative. For mature firms, only the entrepreneurs' skill upgrading behaviour influence their level of innovativeness.

Table 8-7: Percentage Distribution of Small Firms Based on Firms' Age, Entrepreneurs' Characteristics and Level of Innovativeness

Firms' age	Entrepreneurs' characteristics	Firms' level of innovativeness	No. of firms	Mean	Standard deviation	t-statistics [Sig. level]
Young Firms	**Age** (years)	Non-innovative	23	39.826	7.649	1.09 [0.281]
		Innovative	43	37.489	8.656	
	Skill Upgrading (no. of courses)	Non-innovative	23	0.600	0.914	-1.65** [0.104]
		Innovative	43	1.062	1.318	
	Level of education (years)	Non-innovative	23	10.174	2.640	-1.03 [0.307]
		Innovative	43	10.977	3.609	
	Previous Work Experience (years)	Non-innovative	23	2.826	4.303	-3.20** [0.002]
		Innovative	43	7.749	8.183	
	Need for achievement (score)	Non-innovative	23	3.794	0.396	-1.29 [0.202]
		Innovative	43	3.952	0.512	
	Locus of control (score)	Non-innovative	23	3.698	0.397	-2.41*** [0.021]
		Innovative	43	4.051	0.518	
	Attitude toward risks(score)	Non-innovative	23	3.601	0.434	-0.90 [0.371]
		Innovative	43	3.713	0.502	
Mature Firms	**Age** (years)	Non-innovative	26	45.807	8.523	-0.02 [0.986]
		Innovative	14	45.857	8.796	
	Skill Upgrading (no. of courses)	Non-innovative	26	0.4231	0.809	-2.05** [0.056]
		Innovative	14	1.3571	1.598	
	Level of education (years)	Non-innovative	26	7.961	3.000	-0.53 [0.599]
		Innovative	14	8.571	4.219	
	Previous Work Experience (years)	Non-innovative	26	5.077	6.468	0.46 [0.650]
		Innovative	14	6.071	6.742	
	Need for achievement (score)	Non-innovative	26	3.836	0.484	-1.42 [0.163]
		Innovative	14	4.059	0.451	
	Locus of control (score)	Non-innovative	26	3.783	0.433	-1.30 [0.200]
		Innovative	14	3.934	0.461	
	Attitude toward risks (score)	Non-innovative	26	3.500	0.527	0.53 [0.596]
		Innovative	14	3.381	0.888	

Source: Survey 1993

Note : *** Significant at 95% confidence level

** Significant at 90% confidence level

8.7 Firms' Performance

In our conceptual framework, we proposed that firm's performance is a significant determinant of innovativeness for small and tiny firms. This study measured performance by fixed asset turnover, return on investment and productivity of labour for 1989 . As indicated by the logistic regression function, in the case of tiny firms, the productivity of labour (PROD89) had a significant influence on firms' decision to innovate. (Table 8.1) The negative coefficient suggested that firms with low labour productivity had a greater tendency to innovate. However, firms' fixed asset turnover (FATURN89) and return on investment (ROI89) were not statistically significant in influencing firms' innovativeness.

One of the reasons why tiny firms with low labour productivity innovate is to increase value added and production. In fact, 45.7 per cent of innovative entrepreneurs admitted that their aim in introducing the innovation was to replace their usual manual methods.

In the case of small firms, as shown by the logistic regression function, all the three indicators of firm performance (FATURN89, ROI89, PROD89) had a significant influence on firms' innovativeness. (Table 8.2) The positive coefficient of the variable FATURN89 and PROD89, suggested that firms with higher level of fixed asset turnover and labour productivity had a greater tendency to adopt technological innovation. However, firms with low return on investment had a greater tendency to innovate, as suggested by the negative coefficient of the variable ROI89.

Fixed asset turnover measures the turnover of plant and equipment. If a firm has a high fixed asset turnover, it means that this firm has higher sales value in relation to its investment on plant and equipment. Productivity of labour, on the other hand, measures the value added contributed by each labour in the firm. Thus, firms with higher productivity of labour are those with higher value added with respect to their number of workers. If a firm has high values of fixed asset turnover and labour productivity, this suggests that they have high quality of management and effective use of resources (such as plant, equipment and labour). It also indicates that the firm is efficient and able to accumulate funds and wealth. These firms have adequate financial and human resources to innovate. This explains why such firms have a greater tendency to innovate, compared to those with lower fixed asset turnover and labour productivity.

Generally, firms with high returns on investment are efficient. However, this study showed an inconclusive result. It shows that it was the less efficient firms (those with low returns on investments) rather than the efficient ones which innovated. There is reason to believe that the less efficient firms innovated to stay competitive and improve.

In the following paragraphs we shall also analyse the influence of performance on innovativeness at various stages of firms' age. The purpose of this analysis is to test the hypothesis that their performance has a significant influence on their innovativeness in mature firms and not in young firms. We believe that mature firms have a more professional and administrative style of management;

hence, firms' performance is believed to be a factor which at this stage influences small firms to adopt new technology.

In the case of tiny firms, we found that firms' performance did not influence technological innovation decisions in young firms, as reflected by in Table 8.8. In mature firms, we found that only firms' labour productivity influenced entrepreneurs' decision to adopt technological innovation. The other two factors which measured firms' performance (fixed asset turnover and return on investment) were not significant determinants. What this result suggests, is that mature firms with low labour productivity have a higher tendency to innovate, compared to those with higher productivity. This is consistent with our 'satisficing' hypothesis.

Table 8-8: Tiny Firms' Fixed Asset Turnover, Return on Investment, Productivity, Based on Firms' Age and Level of Innovativeness

Firms' age	Firms' performance	Firms' level of innovativeness	No. of firms	Mean	Standard deviation	t-statistics [Sig. level]
Young firms	Fixed asset turnover	Non-innovative	27	4.226	4.587	-0.69 [0.489]
		Innovative	28	5.831	11.021	
	Return on investment	Non-innovative	27	3.160	3.127	-0.12 [0.98]
		Innovative	28	3.334	7.127	
	Productivity of Labour	Non-innovative	27	11.061	12.876	-0.28 [0.784]
		Innovative	28	12.053	13.803	
Mature firms	Fixed asset turnover	Non-innovative	24	4.797	4.718	0.16 [0.873]
		Innovative	12	4.518	5.120	
	Return on investment	Non-innovative	24	2.396	1.616	-1.29 [0.223]
		Innovative	12	4.456	5.430	
	Productivity of Labour	Non-innovative	24	12.933	10.707	1.93** [0.081]
		Innovative	12	7.245	2.956	

Source: Survey 1993.

Note: *** Significant at 95% confidence level.
** Significant at 90% confidence level.

This study shows that tiny firms' performance at the early stage of their life cycle did not influence technological innovation decisions. As we can recall, it was the entrepreneurs' characteristics such as their age, levels of education, n-ach and their propensity to take risks which had a significant influence on their decision to innovate at this stage.

For small firms, the situation was slightly different. The results of the survey failed to support the hypothesis that in mature firms, their performance influences their innovativeness more than in young firms. Firms' performance had a significant influence on innovation decision both in young and mature firms (**Table 8.9**) As shown in **Table 8.9**, small firms which innovated at the young age were those with a low return on investment. Among mature firms, we found that firms' labour productivity had some influence on firms' innovativeness. Unlike mature tiny firms, mature small firms have a greater tendency to innovate when their labour productivity is higher. Thus for small firms we find no support for our satisficing assumption which treats innovation as 'defensive' in motivation. It may be that we can explain this result in terms of firms' history. A small firm which is relatively old (for its size category) may well have grown from being a tiny firm, which would suggest that it is relatively dynamic compared to an older tiny firm which clearly has not grown much. Relatively dynamic firms are more likely to have maximising entrepreneurs.

Table 8-9: Small Firms' Fixed Asset Turnover, Return on Investment, and Productivity based on Firms' Age and Level of Innovativeness

Firms' age	Firms' performance	Firms' level of innovativeness	No. of firms	Mean	Standard deviation	t-statistics [Sig. level]
Young firms	Fixed asset turnover	Non-innovative	23	5.255	3.827	0.45 [0.653]
		Innovative	43	4.469	7.838	
	Return on investment	Non-innovative	23	3.805	2.378	1.51* [0.135]
		Innovative	43	2.692	3.062	
	Productivity of Labour	Non-innovative	23	5.330	6.968	-0.16 [0.295]
		Innovative	43	9.182	16.679	
Mature firms	Fixed asset turnover	Non-innovative	26	4.004	4.135	-0.81 [0.429]
		Innovative	14	6.384	10.544	
	Return on investment	Non-innovative	26	2.707	3.393	-0.59 [0.557]
		Innovative	14	3.351	3.745	
	Productivity of Labour	Non-innovative	26	7.216	7.094	-1.80** [0.082]
		Innovative	14	13.83	12.238	

Source: Survey 1993

Note: ** significant at 90 per cent confidence level

* significant at 85 per cent confidence level

8.8 Summary

In this chapter, we have discussed the influence of firms' characteristics in relation to their ability to adopt a technological innovation. We can summarise the results as follows. In tiny firms, there were three characteristics which influence their level of innovativeness, namely, financing problem, age and productivity of labour. In the case of small firms, there were seven characteristics which influenced their level of innovativeness. The characteristics were, firms' size, level of centralisation, level of complexity, financing problems, fixed asset turnover, return on investment and productivity of labour.

CHAPTER NINE

TECHNOLOGICAL INNOVATION IN TINY AND SMALL SCALE FOOD PROCESSING INDUSTRY: DISCUSSION, DIRECTIONS FOR FURTHER RESEARCH AND POLICY IMPLICATIONS

9. Introduction

In Chapter Six, Seven and Eight, we identified factors that encouraged or constrained innovation by influencing the entrepreneurs in tiny and small firms. As we have already discussed in those chapters, some factors such as the entrepreneurs' age and level of education influenced entrepreneurs in both tiny and small firms to innovate, while some factors influenced only entrepreneurs in tiny firms and some factors influenced only those in small firms. Even if the same factors affected the entrepreneurs in both tiny and small firms, the intensity and the direction of the effect may be different. The aims of this chapter are a) to summarise briefly the factors that influence the entrepreneurs in tiny and small firms to innovate and b) to highlight the important issues regarding these determining factors. The discussion of this chapter will answer the research questions of this study: What factors influence both tiny and small firms? How, and Why? Is there any distinction in factors affecting tiny and small firms? Why do such factors influence only one group and not the other? At the end of the chapter we will propose some recommendations for future researche. Also, we will discuss the policy implications of our findings.

This study hypothesised that among the characteristics of the entrepreneurs from tiny and small firms, their personal demographic details, personality traits, knowledge and skill upgrading and knowledge about the innovation would have significant influence on their decision to adopt a technological innovation. Firms' characteristics such as their structure, financial problems, age, performances and mismatch of existing and required labour force were also assumed likely to have significant effects on the decision to innovate. In addition, it was suggested that the entrepreneurs' perception of the buying situation and of the characteristics of the innovation, the objective characteristics of the innovation, communication and environmental factors such as competitive intensity and institutional involvement, would influence firms' innovativeness.

Figures 9.1 and 9.2 showed the significant factors that influence tiny and small firms respectively to innovate, based on the analysis discussed in Chapters Six to Eight. As exhibited in these figures, we have been able to support most of the hypotheses that were put forward in this study. We support the hypothesis that the entrepreneurs' personal demographics, personality traits and skill upgrading have significant influence on their decision to adopt a technological innovation. However, we fail to support the hypothesis that the entrepreneurs' knowledge about the innovation is a determining factor that influences their decision to adopt the innovation. We found no evidence that the entrepreneurs with more knowledge about an innovation are more inclined to adopt it.

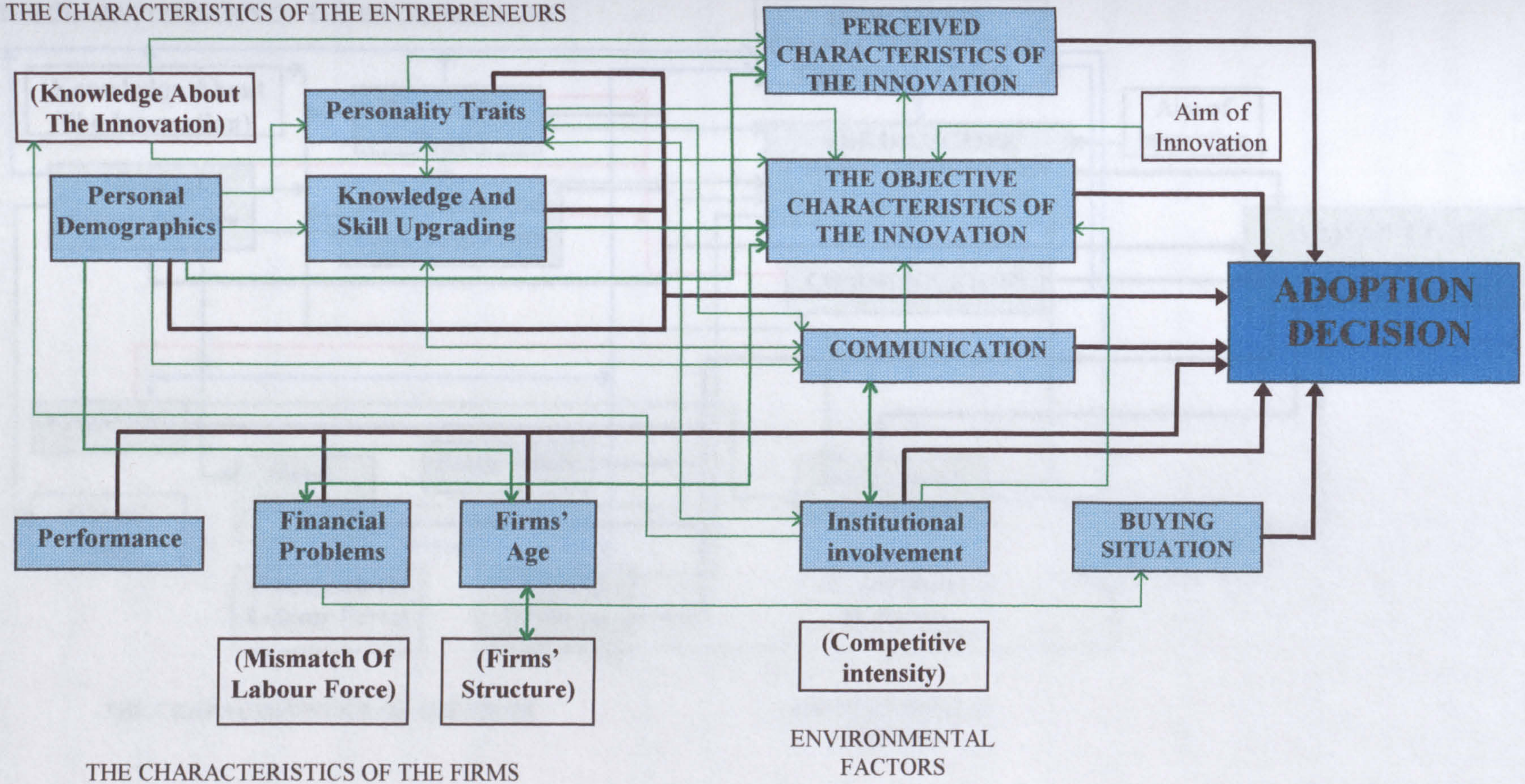
As exhibited in **Figures 9.1 and 9.2**, this study supported the hypothesis that firms' performances and financing problems have significant influence on

firms' ability to adopt a technological innovation. Firms' structure and size appeared to influence small but not tiny firms. Firms' age was found to influence tiny firms but not small firms. However, we were unable to show mismatching of existing and required labour force as significant factors that affect firms' decision to adopt a technological innovation.

We also found support for the hypothesis that communication, the entrepreneurs' perception of buying procedures and the objective characteristics of the innovation are significant determinants of adoption decision of tiny and small firms. However analysis of the influence of the entrepreneurs' perception of the innovation suggested that it has significant influence only in tiny firms. We failed to find such influence in small firms.

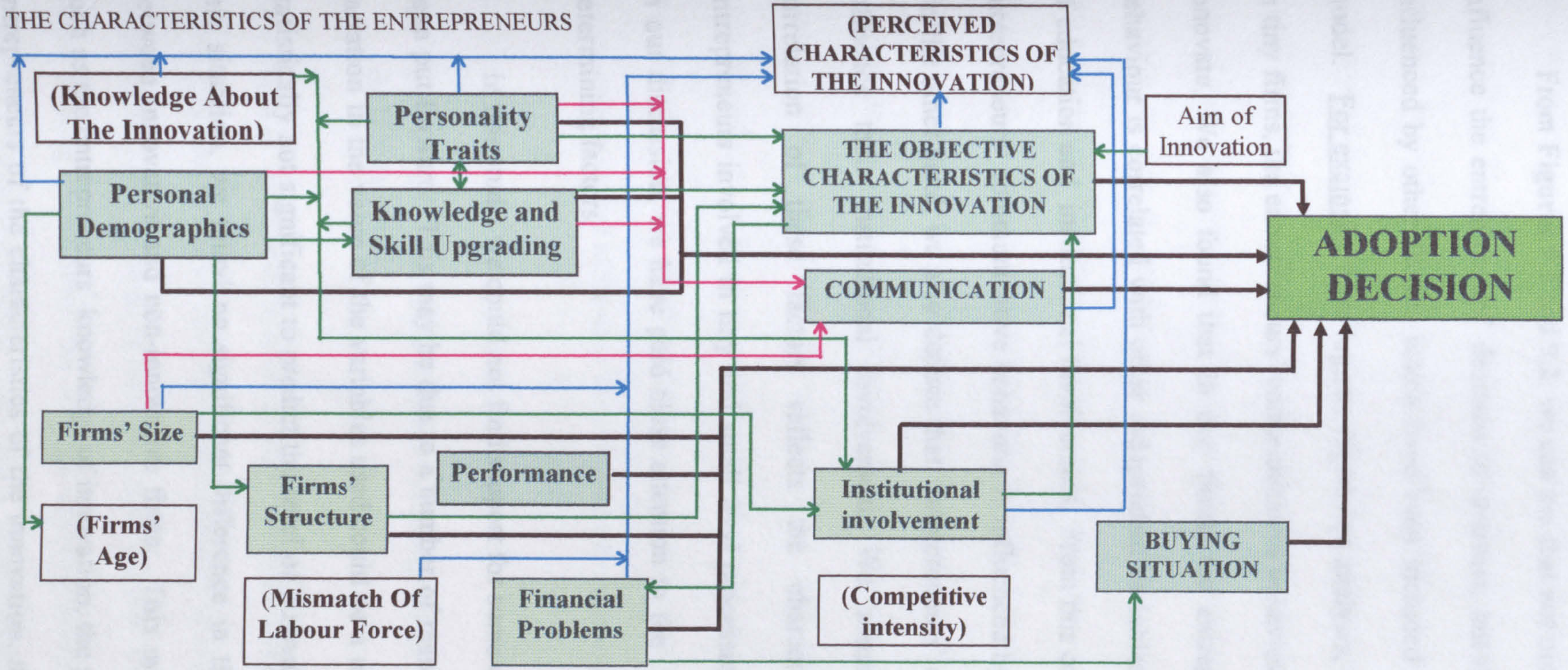
Analysis of the influence of external factors on firms' decision to adopt a technological innovation, supported the hypothesis that the entrepreneurs' institutional involvement plays a significant role in such decisions. However, using size of main competitors as an indicator of competitive intensity, we did not find evidence that competitive intensity has a significant influence on firms' innovativeness.

Figure 9.1: The Determining Factors Of A Technological Innovation Adoption Decision Among Tiny Firms



Source: Survey 1993
Note: ▭ Significant Factors
( ) Non-significant Factors

Figure 9.2: The Determining Factors Of A Technological Innovation Adoption Decision Among Small Firms



Source: Survey 1993
Note: ▭ Significant Factors
( ) Non-significant Factors

From **Figures 9.1 and 9.2**, we can see that not only the determining factors influence the entrepreneurs' decision to innovate, but they also influence or are influenced by other factors which have been included in the adoption decision model. For example, from logistic regression analysis, this study has shown that in tiny firms, the entrepreneurs' communicative behaviour affects their decision to innovate. We also found that in tiny firms, the entrepreneurs' communicative behaviour is correlated with other independent variables. Among them are level of education and institutional involvement. From this correlation we deduce that entrepreneurs' communicative behaviour is influenced by their level of education. On the other hand, we also deduce that entrepreneurs' communicative behaviour influence their institutional involvement. We assume that the pattern of correlation of these factors reflects the characteristics of *Bumiputera* entrepreneurs involved in tiny and small food processing industries in Malaysia. In our discussion, we have paid close attention to the interrelations among the determining factors.

In this study, we could not find support for some of the hypotheses that had been put forward. This may be due to a number of reasons. *Firstly*, low level of variation in the value of the variables used could be a reason why a variable was statistically not significant to predict the level of innovativeness among firms. In this situation, we found no significant difference in the value of the variables between innovative and non-innovative firms. This may explain why variables such as the entrepreneurs' knowledge of innovation, the perception of small firms' entrepreneurs of the characteristics of the innovation, the structure of tiny firms

and mismatch of the existing and required labour force did not have significant influence on firms' innovativeness. *Secondly*, in some cases, the variable used appears on reflection not to be a good proxy to represent the hypothesised determining factors. This explains why we could not support the hypothesis that firms' competitive intensity influences their level of innovativeness. We used the size of main competitors as a proxy for competitive intensity. We suspect that this variable is not a good proxy because of its inability to predict firms' innovativeness. However, based on other variables such as firms' performance, there is an indication of a relationship between firms' competitive intensity and innovativeness. *Lastly*, we suspect that we had put forward a hypothesis which appears not to have much relevance for a particular set of respondents. This explains why in tiny firms, the entrepreneurs' locus of control was not found to have significant influence on their tendency to be innovative. In a set of respondents strongly governed by religion, locus of control is not a determining personality trait that influences their decision to innovate.

9.1 Level Of Innovativeness Among Tiny And Small Firms: A Discussion

We found a difference in level of innovativeness between tiny and small firms. The higher percentage of innovative entrepreneurs in small firms compared to tiny firms implied that the level of innovativeness of small firms is greater than in tiny firms. Among small firms, the level of innovativeness also varied according to firms' size. Relatively larger firms had a higher level of innovativeness. The

positive correlation between firms' size and level of innovativeness found in this study confirms previous studies that showed firms' size can be used as a predictor in studies of technological innovation adoption. Bigger firms tend to have a more sophisticated management style, a larger number of skilled workers and higher accumulated funds and resources. For a given cost of an innovation, bigger firms have higher capacity to adopt, compared to smaller firms.

The correlation between firms' level of innovativeness and their size can not, however, be interpreted to mean that tiny and small firms innovate for different reasons. This study found no distinction between tiny and small firms in terms of their aim or purpose in introducing innovation. Their main aim of innovation was merely to replace their previous manual methods of production or to replace old machines with new ones which might be expected to be more efficient, shorten the production cycle and at the same time increase product quality. Only a few entrepreneurs in this study reported introducing technological innovation due to producing new products. The aim of the entrepreneurs in innovating largely determines the cost of innovation (**refer to Figures 9.1 and 9.2**). We found (see Chapter 7, Section 7.4) the cost of innovation is relatively lower if the entrepreneurs want to replace the manual method or old machines than if they want to produce a new product. For this reason, the findings of this study support the hypothesis that entrepreneurs in tiny and small firms are more likely to adopt a technological innovation if the cost is low. Since the entrepreneurs have a greater tendency to adopt low cost innovation and their main aims in adopting the innovation are to replace manual method or old machines,

this give us an indication that they are only capable of adopting an **incremental** type of innovation.

Other than the aim of innovation, we found that the cost of innovation adopted or under consideration by the entrepreneurs in the study was determined by their personality traits (locus of control and attitude toward risks), their skill upgrading behaviour, firms' structure, and receipt of government assistance. The influence of these factors on the cost of innovation which entrepreneurs were able to introduce, suggests that these factors also influence the ability of firms to introduce incremental or radical type of innovation. We find that entrepreneurs with the potential to adopt radical innovation tend to be those who attach importance to upgrading their skill and knowledge, have internal locus of control and high propensity to take risk. In terms of firms' characteristics, those firms with more skilled workers and those receiving government assistance can more readily introduce a radical innovation. The influence of government assistance in determining the cost of innovation adopted by the entrepreneurs indicated that government assistance plays a very important role in the ability of tiny and small firms to adopt radical innovation.

9.1.1 Personal Demographic Factors

Personal demographic factors which we hypothesised to have significant influence on the entrepreneurs' decision to adopt a technological innovation were their age, sex, level of education and previous experience. The findings of this study support the hypothesis with respect to age and level of education. The

entrepreneurs' previous experience only had significant influence on the entrepreneurs in small firms. We made no definite prediction about the effect of experience in the current business, since the relevance arguments worked in both directions.

This study appears to show that younger entrepreneurs are more innovative than older entrepreneurs. This finding supports the view that younger entrepreneurs are more receptive to change and able to handle new or complicated tasks compared to older entrepreneurs, although the latter usually have longer experience in managing their current business. This evidence that younger entrepreneurs are capable of handling changes is further supported by our finding that younger entrepreneurs have a higher level of education and are more inclined to upgrade their skill through attending business courses. These characteristics further help them to be innovative.

In tiny firms, we found support for our prediction about the effect of entrepreneurs' sex. We believe that the effect was largely through the relationship of variable sex with entrepreneurs' level of education, their personality traits and the communicative behaviour. Male entrepreneurs were found to be more innovative than female entrepreneurs. It seems that male and female entrepreneurs in tiny firms had distinguishable characteristics which affect their level of innovativeness. Male entrepreneurs had a higher level of education and were higher achievers. They also were more mobile compared to their female counterparts. This enabled them to have wider business contacts and be more communicative. The size of firms managed by male entrepreneurs was relatively

larger; thus, they had the resources to carry out innovative activities (This variable was not included in the regression for tiny firms - all the more reason why sex should have pick up some of its effects). On the other hand, the nature of business conducted by female entrepreneurs was rather informal. Their initial idea in venturing into business was to contribute to the family income.

In the case of small firms, however, sex did not appear to affect their capability to be innovative. This may be connected with the fact that there were no significant differences between sexes in their personal characteristics. They were in the same age range, and had a similar level of education, experience, n-ach and attitude toward risk. There was also no significant difference in terms of type, size and structure of firms managed by female and male entrepreneurs. Nevertheless, like females in tiny firms, female entrepreneurs of small firms were also less communicative due to their limited mobility and domestic commitments. Lack of communication did not, however, hinder them from obtaining information and being innovative. Female entrepreneurs of small firms tended to compensate by relying on institutions as their source of information.

The entrepreneurs' level of education was among the determining factors that influenced their decision to adopt a technological innovation in both tiny and small firms. Higher levels of education made for a greater tendency to be innovative. As mentioned above, the level of education may help to explain why young entrepreneurs of tiny and small firms and male entrepreneurs in tiny firms had a greater tendency to be innovative.

The entrepreneurs' experience in managing the current business appear to influence innovativeness in both tiny and small firms. This study showed that less experienced or new entrepreneurs were more innovative than those who had longer experience in managing their current business. One possibility is that although new entrepreneurs had fewer years of experience in managing their business, they innovated in the early years of managing the business, presumably due to pressure from already established firms. Moreover, since the majority of the entrepreneurs were the founders of their firms, newness in the current business would be correlated with youth, thus, with the level of education. The entrepreneurs with less work experience tended to attend more courses compared to those with longer experience in their business. This implies that they perceived the importance of knowledge and skill upgrading in order to stay competitive with the established businesses. Having higher levels of education, skill and knowledge helped them to be innovative.

The entrepreneurs' previous work experience (in other jobs) appeared to influence innovativeness in small firms but did not appear to have a significant influence on tiny firms. The finding for tiny firms implies that previous work experience did not provide them with skill and knowledge that helped them to be innovative in their current business. In the case of the entrepreneurs in small firms, this study showed that those with more previous work experience were more inclined to be innovative. Unlike the case of tiny firms, we can deduce that their previous work experience provided them with knowledge and skill that could be used in their current business.

The difference in the effect of previous work experience on entrepreneurs in tiny and small firms can be explained in terms of two factors - the type and length of the previous work experience. Entrepreneurs who previously worked in firms producing the same type of product as those currently produced, had a greater tendency to be innovative. Those who previously owned small businesses, or worked at managerial level for their previous employers, also were more likely to be innovative. Length of previous work experience also affected the amount of skill and knowledge acquired, which was helpful in the current business. For example, some entrepreneurs who had previously worked as production workers for more than 8 years were capable of being innovative in their own current businesses. This suggested that their long years of experience enabled them to accumulate knowledge, skill and familiarity with the business environment, which could be applied to their current business.

9.1.2 Personality Traits

This study hypothesised three personality traits of the entrepreneurs as having significant influence on their decision to adopt a technological innovation. These were, n-ach, locus of control and attitude toward risk. Our findings support the hypothesis that entrepreneurs' n-ach and attitude toward risks has significant influence on their innovativeness. However, locus of control was found to have significant influence on the entrepreneurs in small firms, not in tiny firms. Higher achieving entrepreneurs are very determined to be successful in their business. Those with a high propensity to take risk are ever willing to accept challenges or

make changes in managing their business. This explains why entrepreneurs with these personality traits had a greater tendency to be innovative. Entrepreneurs with internal locus of control believe that the success of their firms is very much dependent on their own effort and hard work. This explains why this personality trait influenced small firms' innovativeness. However, a similar explanation could not be put forward for the entrepreneurs in tiny firms. We believed their religious value influenced their perception on their ability to control situation around them. We suspect that these values somewhat affected the way they answered the questions on locus of control.

In tiny firms, we found a relationship between entrepreneurs' personality and their level of education. This study showed that entrepreneurs with high levels of education were high achievers and risk takers. Based on previous studies which show that individuals' level of education affects their personality, we can also deduce from this study that the entrepreneurs' n-ach and attitude toward risk are affected by their level of education. From this correlation, we can see the importance of education in entrepreneurial development. It seems that formal education developed the personality of the entrepreneurs in tiny firms. However, in the case of small firms, there was no linear relationship between the entrepreneurs' level of education and their personality. Contrary to the case in tiny firms, we could not deduce that entrepreneurs with higher levels of education were also those who were higher achievers, had internal locus of control and were more prepared to take risk. In fact, this study showed that entrepreneurs with primary education were relatively higher achievers and tended to have internal locus of control. The most likely explanation seems to be that

only if they had such helpful personality traits would people with little education manage to reach the position of owning a small (tiny) firms. Considering the fact that the majority of the entrepreneurs with primary education had longer years of managing their current business or had previous work experience before venturing into their current business, we may infer that experience can also influence entrepreneurs' personality development. Hence, entrepreneurs with a low level of education also can be innovative provided that they have the right personality traits.

9.1.3 Knowledge And Skill Upgrading

As has been mentioned above, this study supports the hypothesis that entrepreneurs who upgrade their skills by attending business courses have a greater tendency to be innovative. This implies that courses attended by the entrepreneurs have some influence in developing their innovative behaviour. These courses are usually organised by various government or private agencies. Government agencies that organised courses attended by the entrepreneurs in this study were MARA and MARDI. Courses that were well attended by innovative entrepreneurs were production management, financial management and entrepreneurship. Lack of awareness was the main reason why the entrepreneurs did not attend courses. Courses can also act as meeting places for entrepreneurs to exchange experiences. Through attending business courses, information on the existence of technological innovation may be obtained and more information can be gained if the entrepreneurs interact with other entrepreneurs who have already introduced the innovation.

This study showed that the entrepreneurs with a higher level of education, and those who were communicative, attended more courses. From the number of courses attended by the entrepreneurs with higher levels of education, we can make two deductions. *First*, compared to the entrepreneurs with lower levels of education, the more educated entrepreneurs attached more importance to skill and knowledge, and *second*, courses offered to entrepreneurs of tiny and small firms are more conducive for those who have a certain minimum of academic qualification. The relationship between the entrepreneurs' communicative behaviour and number of courses indicates that communication channels used by them can create awareness among them about the courses.

9.1.4 Knowledge About The Innovation

The entrepreneurs' knowledge about the innovation did not have a significant influence on their decision to adopt a technological innovation. We failed to support the hypothesis that the greater knowledge about the innovation the entrepreneurs have, the more likely they are to adopt it. The entrepreneurs in this study claimed to have quite extensive knowledge about the innovation. We may recall that the respondents of this study were those who had already adopted or considered adopting a technological innovation in the last three years prior to the conduct of this study; hence, it is reasonable to believe that the two groups of entrepreneurs had similar levels of knowledge about the innovation. Other factors were more important in determining the entrepreneurs' decision to innovate.

9.1.5 Firms' Structure

We hypothesised that firms' level of formalisation, centralisation and complexity have significant influence on their ability to adopt a technological innovation. In tiny firms, we failed to support the above hypothesis. However, analysis of small firms, suggested that the level of centralisation and complexity had a significant influence on their innovativeness. As with tiny firms, we failed to support the hypothesis that firms' level of formalisation has a significant influence on their level of innovativeness.

Tiny firms were homogeneous in structure: highly centralised with low levels of complexity and formalisation. Since there was little variation in firms' structure, it is not surprising that we found no significant influence on firms' innovativeness. Since the firms were tiny, employers' relationships with employees were rather informal. They shared firms' problems and employees were encouraged to reveal their personal problems. Nevertheless, decision making was in the hands of the entrepreneurs who might act alone or with their business partners or with their assistants. This explained why firms' structure did not affect their innovativeness, but the decision to innovate was very much affected by decision makers' (entrepreneurs') personal characteristics.

In the case of small firms, firms with lower levels of centralisation and higher levels of complexity were more liable, other things equal, to be innovative. In firms with a low level of centralisation, these firms had wider access to information on the innovation. Firms with a high level of complexity have more skilled workers; thus, they have the ability to absorb a technological innovation.

This implies that availability of skilled workers is very important in determining whether firms innovate. As in tiny firms, small firms' level of formalisation did not influence significantly firms' ability to adopt a technological innovation. The entrepreneurs in general had relatively informal relationships with their workers, shared their problems and welcomed any suggestions made by them.

9.1.6 Labour

As mentioned above, more complex firms tend to be more innovative. This indicates the importance of skilled workers in order for a firm to introduce a technological innovation. In the situation where there is a lack of skilled workers to operate the considered innovation, mismatching between the existing and required labour force occurs. Consequently, it may be necessary to hire new workers, transfer existing workers, make some workers redundant, or introduce retraining. Entrepreneurs might abandon the idea of innovating if such mismatch causes them major problems. Considering this fact, we hypothesised that firms which do not foresee the likelihood of mismatching if they adopt an innovation will be more likely to adopt it. However, we were not able to support this hypothesis. We found that entrepreneurs willingness to innovate did not appear to be reduced still introduced by mismatch. It would appear that they considered mismatching as a minor problem which could be solved by training of the present employees and adoption of a new routine. Since mismatching was not seen as a major problem by entrepreneurs, at a glance we may think that tiny and small firms do not have a problem of lack of skilled workers, such as has been widely found to be the case in the previous studies of small scale industries in

Malaysia. Alternatively, it may be that tiny firms do not need skilled workers in order to innovate (the majority of tiny firms did not have skilled workers and yet some of them innovated). However, observation of the types of technological innovation (machinery) adopted by small and tiny firms revealed that the majority of them introduced relatively **simple** machinery costing less than RM10,000, which did not require highly skilled labour to operate. For this reason they faced little or no problem in terms of mismatching between their existing and required labour force. Tiny and small firms may face more serious problems of lack of skilled labour if they introduce a **radical type** of innovation. Hence, in the decision to adopt a radical type of innovation, we believe that mismatching of the existing and required labour force would be one of the determining factors.

9.1.7 Firms' Age And Performance

We support the hypothesis that firms' performance significantly affects their level of innovativeness. We used fixed asset turnover, productivity of labour and return on investment as indicators of firms' performance in this study. Nevertheless, in tiny firms we found that only productivity of labour had a significant influence on firms' level of innovativeness. Firms had a greater tendency to innovate if they had low labour productivity.

In small firms, fixed asset turnover, return on investment and productivity of labour all significantly influence firms' level of innovativeness. Firms with higher fixed asset turnover and productivity of labour showed a stronger tendency to adopt a technological innovation. On the other hand, firms which had low

return on investment also were more likely to innovate. High fixed asset turnover or high productivity of labour suggests that the firms in question used their resources efficiently and effectively. The availability of resources would make them better able to innovate. Firms which innovated when they had lower return on investment might be under more pressure to be innovative due to low net operating income.

It appear that productivity of labour had a different influence on small and tiny firms. Small firms tended to be more innovative, other things equal, when their productivity of labour was high, while tiny firms tended to be innovative when productivity of labour was low. If firms innovate more when their productivity of labour is low, this implies they innovate to survive; which implied that tend to be satisficers. Small firms' tendency to innovate more when the productivity of labour is high implies that they have some drive to improve their performance and efficiency when they are doing well, and are better placed to do so. This implies that they are maximisers.

A significant effect of firms' age in influencing firms' decision to adopt a technological innovation could only be seen in tiny firms. Younger firms had a greater tendency to be innovative than those at the mature stage which indicated that they need to grow fast by investing in the latest machinery. In contrast to tiny firms, firms' age had no significant influence on small firms' decision to innovate.

When firms innovate at a younger age, this would indicate that they want to increase their efficiency of production and market penetration; hence, they tend to be profit maximisers. Firms at this stage are usually managed by young

entrepreneurs who are more educated, have a higher need for achievement and have higher propensity to take risks. Firms which innovated at the later stage of their life cycle usually did so because of market saturation and static sales. In the case of tiny firms, where mature firms were less innovative compared to young firms, again, we can infer that their entrepreneurs were satisficing types, whose main objective was to survive and make some profit at a 'satisfactory' level. In situation where their firms' performance was not up to the level they considered 'satisfactory', these entrepreneurs were pressured to find means to improve their performance and the solution was to innovate. The situation is indicated in the finding of this study which showed that mature tiny firms tend to be innovative when they had low labour productivity. Government assistance also helps them to innovate at this stage.

9.1.8 Financing

Financing is one of the problems faced by tiny and small firms. Considering this fact we hypothesised that financing difficulty is one of the significant factors that determines firms' innovativeness. The findings of this study support this hypothesis. The majority of the entrepreneurs admitted that they had problems obtaining financing from formal financial institutions but the intensity of the problem was greater among non-innovative entrepreneurs. Problems in obtaining financing from formal institutions affected entrepreneurs' ability to innovate. Among problems faced by entrepreneurs in the process of applying for financial assistance from financial institutions were providing collateral, providing a

feasibility study on firms' investment plans and also debt service and repayment due to high interest rates. Both in tiny and small firms, company funds or entrepreneurs' personal savings were the main sources of financing for innovation. The next alternative source of financing was informal institutions, such as families and friends. If unable to find financing from informal institutions, entrepreneurs applied for financing assistance from government institutions. However, since the majority of the entrepreneurs perceived that they would have problems obtaining financing from commercial financial institutions, quite a large number of them did not even attempt to seek loans from these institutions, but preferred government institutions as their external source of financing.

The cost of the innovation influenced the intensity of the financing problem. High cost of innovation affected their chances of obtaining external financing. Therefore, entrepreneurs who considered introducing a more costly innovation perceived financing as a more serious problem. Since entrepreneurs tended to rely on their own funds to finance the innovation, this limited the kind of innovation they could introduce, and is one reason why tiny and small firms were generally able to adopt only incremental, rather than radical innovations. We found a positive correlation between the entrepreneurs' financing problems and their perception of the buying situation. In the case of small firms, the entrepreneurs' financing problems also influenced their perception of the characteristics of the innovation.

9.1.9 Perception of The Innovation

Entrepreneurs observe various characteristics of an innovation before making their decision to adopt or reject it. Among the characteristics that they observe are the innovation's economic advantages, its simplicity, its compatibility with the existing machinery, the prestige it might carry and the risks of adopting it. We hypothesised that the entrepreneurs' perceptions of the innovation affect their decision whether to adopt it.

The majority of the entrepreneurs had positive perceptions of the innovations they had already adopted or considered adopting. They believed that the innovation would bring economic advantages, was simple to operate and compatible with their existing production technique. They foresaw little risk in adopting the innovation. The entrepreneurs did not consider prestige as an important criterion in deciding on the appropriate innovation. Statistically, we found that there was a significant difference in perception between innovative and non-innovative entrepreneurs in tiny firms but not in small firms. Hence, for tiny firms, we support the hypothesis that entrepreneurs' perception of the innovation has significant influence on their decision to innovate, but, for small firms, failed to support the hypothesis. The significant difference of opinion between the two groups of entrepreneurs in tiny firms, is their perception of risk involved when adopting the innovation. Non-innovative entrepreneurs perceived the innovations they wanted to adopt as rather expensive, and since they would have to rely on external sources to finance the cost of innovation, they perceived the ventures as rather risky. This perception influenced their decision to reject or

postpone innovation. In the case of small firms, although statistically we could not show a difference in perception between innovative and non-innovative entrepreneurs, close examination shows that although the majority of both groups of entrepreneurs had positive perceptions, there were some variations, due to various factors. These factors are the entrepreneurs' level of education, their personality traits, their knowledge of the innovation, their firms' size, their financing ability, the perceived likelihood of mismatching of labour force, intensity of institutional involvement and the characteristics of the innovation.

9.1.10 Buying Situation

As has been mentioned above, our findings support the hypothesis that the entrepreneurs' perception of the procedures that they are required to go through in the process of buying new machine affects their decision to adopt the innovation. Entrepreneurs who perceive that they do not or will not have major problems in dealing with buying procedures are more likely to adopt the innovation. Most entrepreneurs did not see the search for suppliers as problematic, nor was obtaining after-sales service considered as a problem. However, quite a high percentage of non-innovative entrepreneurs anticipated they would have problems in dealing with suppliers and dealing with legal matters. Long absence from firms during the buying process was also perceived as a problem to some entrepreneurs. For small scale producers, long absence from firms would disrupt their firms' daily operation.

9.1.11 Communication And Access To Information

In the evaluation and trial stages of the innovation decision process, the entrepreneurs will accumulate knowledge before they decide to adopt or reject the innovation. We assumed that the amount of knowledge acquired would be dependent on the extent of search for information the entrepreneurs conducted, and their interaction with information sources. For example, information from research institutions, suppliers or other firms could be very important at these stages of innovation decision process. Hence we hypothesised that communication is among the determining factors that influence firms' level of innovativeness. Our findings supports the hypothesis.

9.1.11.1 Internal Communication

As has been mentioned earlier, the level of formalisation of tiny and small firms is low. The relationship between entrepreneurs and workers is informal; they share problems, and ideas or suggestions by workers are welcomed by the entrepreneurs. Considering the low level of formalisation between employer and employee, we could deduce the existence of a two-way flow of information or communication style. Although there is two-way communication, however, there is not much input from employees regarding technological innovation. In most situations, ideas and initiatives come from the entrepreneurs themselves.

9.1.11.2 External Communication

Various studies have shown that small firms rely heavily on external sources of information, rather than internal. This is presumably due to their lack of skilled

personnel. A similar situation was found in the tiny and small firms of this study.

(a) Communication Channels

This study supports the hypothesis that communicative entrepreneurs were more innovative. Communicative entrepreneurs have better access to external sources of information on technological innovation. Acquisition of more information would reduce the risk and uncertainty of adopting an innovation. Of the various communication channels used by the entrepreneurs in this study, the most popular were attending seminars and expos or trade fairs. Seminars and expos are the meeting ground for entrepreneurs and a good source of information. Entrepreneurs can widen their business contacts, and exchange ideas and experiences. Other forms of communication used by a small percentage of the entrepreneurs were business associations and subscribing to business magazines.

(i) Business Associations

In Malaysia, there are various business organisations which cater for small business or *Bumiputera* entrepreneurs, such as *Persatuan Pengilang Bumiputera* (Association for *Bumiputera* Manufacturers). Members of this association are provided regularly with the latest information on government policies, up-to-date technology in the local and foreign market, seminars, expos, and support programmes. During their meetings, members have the opportunity of exchanging ideas and sharing experiences with fellow members.

Based on the above functions of a business association, it seems to us that such associations are among the communication channels from which entrepreneurs would have information on the existence of technological innovation. Through business association membership, we believe interpersonal communication among entrepreneurs can be created. There is a strong possibility that through this form of interpersonal communication, entrepreneurs can obtain information on the existence of technological innovation or suppliers of the innovation, from entrepreneurs who have knowledge of, or experience of adopting it.

Occasionally, associations organise seminars or courses or provide information on seminars pertinent to their members' needs. Usually, representatives of relevant research or financial institutions are called to give talks during the seminars or courses. By holding such seminars or courses, business associations play a role in linking the entrepreneurs with external sources of information.

Based on the above explanation, we see the benefit of being a member of a business association as a way of obtaining information. Due to the importance of information in a technological adoption process we predicted that entrepreneurs who are members of a business association have a greater tendency to be innovative. However, this study shows that less than 30 per cent of all entrepreneurs surveyed were involved in a business association and we could not find a relationship between being a member of a business association and innovativeness.

The type of business association joined by these entrepreneurs is among the reasons why we could not see its relationship with innovativeness. The majority of them were members of an association formed on the basis of ethnicity or size of firms, regardless of products produced. Associations such as *Dewan Perniagaan Melayu*, or *Persatuan Pengilang Bumiputera* are formed on the basis of the ethnicity of the entrepreneurs, regardless of firms' size or product produced. Associations such as *Persatuan Pejaja Melayu, Kelantan* or *Persatuan peniaga kecil*, on the other hand, are formed based on size of firms (small or medium sized firms) and regions. Business associations formed on the basis of ethnicity, rather than size or products, normally carry out activities commonly needed by or relevant to that particular ethnic group. Committee members normally consist of the entrepreneurs of larger firms, and naturally, activities carried out are more relevant to bigger firms, such as on the issue of export or import. Business associations formed on the basis of size, not business sector, although their activities are relevant to small firms, have less relevance to firms' sector. Issues discussed in such associations are those commonly experienced by small scale producers, such as financing, management technique and marketing problems. Entrepreneurs who are members of a business association which has not much relevance to their business sector, will have less chance of obtaining information on technological innovation through interpersonal communication among members of the association.

A high percentage of the entrepreneurs in this study are not members of any business association, mainly because they were not aware of the existence of any business association relevant to their needs. The business associations

normally joined by the entrepreneurs in this study, such as *Dewan Perniaguan Melayu*, are centred in big cities. Their activities such as meetings, conducting seminars or courses are normally carried out in big cities. As non-members, entrepreneurs of small firms in small towns are not aware of such activities, although some of them would be relevant to their business. Thus, these entrepreneurs could not see the benefits of joining any business association.

(ii) Subscribing To Business Magazines

Communication between entrepreneurs and source of information could also be facilitated through publications such as business magazines. By subscribing to business magazines which are pertinent to their business, entrepreneurs can obtain beneficial information related to firms' improvement. Those who subscribe to business magazines usually have better access to external information so have greater tendency toward early awareness of any technological innovation. Thus, we believe that they would be likely to be more innovative. However, this communication channel was hardly used by the entrepreneurs in this study. Only a small percentage of them claimed that they subscribed to business magazines. Due to this small percentage, we could not find a relationship between subscription to business magazines and innovativeness. The main reason why only a small percentage of the entrepreneurs subscribed to business magazines was the limited number of business magazines available, relevant to their existing business. Most business magazines in the market are meant for

larger groups of readers involved in business, regardless of business sectors or firms' size.

(iii) *Attending Business Expos*

Occasionally, there are business expos organised by various business associations or government agencies to promote small and medium scale firms. Suppliers or distributors use these as opportunities to promote the latest innovations and processing techniques that are appropriate for small scale producers in the market. Some entrepreneurs also promote their products in these expos. Government agencies also participate in the expo as a way of informing visitors of various services available to assist small scale entrepreneurs. Hence, expos could be considered as a point of interpersonal contact between entrepreneurs and various sources of information. This explains why attending expos was the most popular of the four communication channels used by entrepreneurs in this study.

Despite the importance of attending expos, however, there were some entrepreneurs who had not attended any business expos in the last five years before this study was conducted. Agencies responsible for organising business expos usually hold them at Kuala Lumpur, only once a year, for a period of 5 days to one week. Since business expos pertinent to entrepreneurs of small firms are held only infrequently and the venue was usually far from their business premises, entrepreneurs of small firms were hardly aware of their existence. This was the main reason why these entrepreneurs did not attend the expos.

(iv) Attending Seminars

Seminars were a communication channel through which entrepreneurs might acquire knowledge from the experts and at the same time have the opportunity to meet other entrepreneurs to exchange ideas and experiences. Moreover, through seminars entrepreneurs would be able to widen their business contacts. The importance of attending seminars can be seen in this study, as our survey revealed a link between seminar attendance and innovativeness. However, a relatively large percentage of entrepreneurs had never attended a seminar, mainly due to lack of information. Usually, seminars are organised by business associations or agencies that are responsible for the development of small firms. The organisers seldom use media such as newspapers, which have wide circulation, to announce their seminars. As a result, only certain groups of entrepreneurs, such as those who are members of business associations and those who have greater institutional involvement, are aware of such seminars.

(b) Sources Of Information

This study showed that various external sources of information were used by the entrepreneurs to obtain knowledge about innovation and to obtain various forms of assistance. Among such external sources are (a) institutions, (b) suppliers and (c) other firms.

(i) Institutions

The institutions channel their information through various sources, among them, publications such as monthly magazines, manuals or pamphlets, and conducting

courses that would interest small scale producers. Some of these institutions also have advisory services and are available for entrepreneurs to visit for consultations. This study supports the hypothesis that the entrepreneurs' institutional involvement is one of the significant factors that determines their innovativeness. The majority of the entrepreneurs in this study admitted that they first learned about the innovation under consideration through institutions. MARDI was the main institution providing information to the entrepreneurs in this study. The degree of entrepreneurs' involvement with institutions depended on their personal characteristics, personality traits and communicative behaviour. Younger entrepreneurs, the more educated, the communicative, high achievers, and those with a higher propensity to take risks, were more involved with institutions.

(ii) Suppliers

Suppliers are the main information providers to the entrepreneurs about a technological innovation. Although the majority of the entrepreneurs admitted that they first learned about the innovation from institutions, they obtained detailed information about it from suppliers. The role of suppliers as information providers is very important in the evaluation and trial stages of the adoption decision process. The relationship between suppliers and entrepreneurs is very important in these two stages. As mentioned above, in the process of buying an innovation, one of the significant differences between innovative and non-innovative entrepreneurs was in the relationship with suppliers. If

entrepreneurs have already established a close relationship with suppliers, such problems can be resolved.

(iii) Other firms

This study has shown that other firms are also important sources from which entrepreneurs can obtain information about technological innovation. Firms which used other firms as their source of information indicated that they were late adopters or laggards in the innovation diffusion process. The compatibility of the innovation with existing procedures in other firms and the performance of these firms, motivated the entrepreneurs in this study to adopt the innovation.

9.1.11.3 The determinants of communicative behaviour

The entrepreneurs' communicative behaviour was very much affected by their personal demographic characteristics, need for achievement, skill upgrading behaviour and their firms' size. Highly educated, male, or older entrepreneurs tended be more communicative. Skill and knowledge obtained through education and experience led them to be more communicative. Male entrepreneurs were usually more mobile and this enabled them to be more communicative compared to their female counterparts. High achievers were more communicative than low achievers. They realised the importance of being communicative in order to be innovative and successful in their business.

The entrepreneurs who upgraded their skill and knowledge through attending business courses were more communicative than those who did not attend business courses. Through business courses, these entrepreneurs had the

opportunity to learn about the importance of business associations and other communication channels from which they could obtain information. This in turn, helped them to be innovative.

One characteristic of firms that had some effect on their entrepreneurs' communicative behaviour was firm's size. The entrepreneurs of larger firms were more communicative than those with smaller firms. Bigger firms usually are more efficient in managing their funds and resources. Thus they have greater capacity to use communication channels to obtain information from external sources.

9.1.12 Competition

Previous studies on technological innovation adoption have tended to show that one of the determining factors is the intensity of the competition. Considering this fact, we hypothesised that competitive intensity is one of the factors that influence tiny and small firms to innovate. In this study we measured firms' competitive intensity by the size of their main competitor. Based on this measurement, we were unable to support the above hypothesis. The implication is that firms which face competition from large firms have a similar level of innovativeness to firms which face competition from small firms. It seems that firms which perceive that their main competitors are large firms do not feel pressure from their competitors to innovate. Perhaps the greater competitive strength of large firms is balanced by greater distance in the market in terms of cross-elasticity of demand. It seems that size as a proxy for competition is

unsatisfactory. Considering the fact that tiny firms tended to innovate when they had low labour productivity and small firms tended to innovate when they had low return on investment, one interpretation is that these firms innovated in order to be competitive in the market. This would imply that competitive intensity does have significant influence on tiny and small firms' innovation behaviour.

9.1.13 Role of government agencies

Tiny and small firms had to rely on external sources to improve or examine their product qualities. Research institutions, especially MARDI, play a very important role in providing R & D facilities as well as providing advisory services to tiny and small producers in FPI. Other than MARDI, there are various government agencies such as MARA, KEMAS and MIDF which support the development of small scale industries. However, only three government agencies played an important role in providing assistance to the entrepreneurs in this study. These were MARDI, KEMAS and MARA. MARDI provided facilities for R & D, training and advisory services on techniques of production, packaging, quality control and food analysis. KEMAS provided machines to small producers in rural areas. Sometimes it also conducted training on production techniques. This institution is popular among tiny firms. MARA, on the other hand, provided training and advisory services on management, entrepreneurship and marketing. This institution also provided loans to small scale producers. This study showed that financial assistance provided by MARA and machines provided by KEMAS increase the ability of tiny and small firms to adopt a technological innovation. Dependence on MARA and KEMAS as their external sources of financing for a

technological adoption implied that the size of loan supplied was relatively small and the process of applying for the loan was simpler compared to applying for funding from other government agencies such as MIDF, or from commercial financial institutions. For radical (i.e. more expensive) types of innovation, the entrepreneurs could not rely on MARA or KEMAS for financial assistance.

9.1.14 Conclusion

There is a need for small scale food processing industries to adopt technological innovation to respond to changes in demand and to stay competitive. However, there are wide variations among them in innovative behaviour. The difference in behaviour appears to be due to the characteristics of the entrepreneurs, the characteristics of their firms, communication, the objective characteristics of the innovation, the entrepreneurs' perception of the characteristics of the innovation and of the buying procedures and their involvement with institutions.

9.2 Suggestions For Further Research

This study may be regarded as an exploratory one with the aim of identifying the significant factors that determine adoption of a technological innovation in tiny and small scale FPI in Malaysia. The factors included in this study affect different stages of the adoption decision process (refer to **Figure 4.1**) and we assumed in the hypothesis that these factors had equal importance in determining firms' final decision to adopt or reject the considered technological innovation. The technological innovations covered in this study were limited to *process*

innovation, which is defined as the adoption of new machinery for the production process. The firms' level of innovativeness was classified into only two categories, that is, innovative and non-innovative. For future research, we suggest that researchers take into account *product innovation* to measure firms' level of innovativeness. Possibly, researchers could develop a firms' *'level of innovativeness index'*, which covers both product and process innovation. We believe such an index, which would be continuous in nature (not dichotomous), would be a better measurement of firms' level of innovativeness.

The focus of the study was to address the *determinants of innovativeness of firms*. Hence, this study did not address the *process of innovation within firms* or *diffusion of an innovation over time*. We suggest that future research on innovation among small firms should focus on these two aspects.

Research on the process of innovation within firms investigates the nature of the innovation process; how and why innovations emerge, develop, grow and terminate are examined. Such work focuses on the sequence of activities in the development and implementation of innovations. It is longitudinal in nature and uses qualitative approaches to data gathering. The diffusion of an innovation refers to its spread through a population of potential adopters. The aim of this research is usually to explain or predict rates and patterns of innovation adoption over time. However, such research is limited to one innovation. The research we propose in this area would enable us to identify the characteristics of innovators, early adopters, early majority, late majority and laggards.

9.3 Policy Implications for Enhancing Technological Innovation

There is a need for tiny and small firms to improve their production efficiency, produce higher and more consistent output quality and be competitive. Improvement of production efficiency can be achieved when firms have the ability to adopt technological innovation within a conducive environment. To create such an environment, requires policy initiatives that will stimulate the growth of innovative firms. From this study, we could see the existence of: non-innovative firms which do not have the ability or inclination to adopt the considered innovation; firms which only had the ability to adopt an incremental type of innovation; and, some firms which were able to adopt more radical types of innovation[1]. Hence, the aim of policy initiatives should be to increase the capability to adopt technological innovation among tiny and small firms, including providing a conducive environment for (a) non-innovative firms to become innovative, and (b) promoting firms which have the potential to adopt radical rather than merely incremental innovation.

9.3.1 Encouraging Non-Innovative Firms To Become Innovative

To carry out technological innovation, SSIs require financing and skilled workers who have the basic education and training. They also must collect and analyse various kinds of information, such as changes in market environment and the trend of new technology. However, in this study we found that there are various factors which hinder technological innovation among non-innovative SSIs. The factors

[1] The fact that 13 per cent of small firms adopted a machine that cost more than RM50,000 (about £12,500) showed that some firms had the potential to adopt a more radical type of innovation.

are limited financial resources, low level of education and lack of training of the entrepreneurs and limited access to information. It is difficult for SSIs to take measures to upgrade the knowledge of their personnel, obtain financing for technological innovation and obtain maximum access to information. Hence, in order to encourage non-innovative firms to become innovative, policy recommendations should emphasise the following areas: (a) education, training and skill upgrading, (b) technology and management guidance and information services, and (c) strengthening financial support.

(a) Training And Skill Upgrading

As shown in this study, the majority of non-innovative entrepreneurs were less communicative and do not attend courses or send their employees for training to upgrade their skills. The main reasons for not attending courses are lack of information about the courses and the entrepreneurs' perception that the courses do not have much relevance to their needs. There are more than seven institutions which provide training for small firms. However, only MARA and MARDI provided training programmes that are relevant to the entrepreneurs of small scale FPI. In view of this, MARA, MARDI and other institutions responsible for providing training for SSIs should continually update their course modules according to current needs and improve ways of providing information on courses to potential entrepreneurs. Most of the courses offered by MARA and other institutions are basic courses for new entrepreneurs, such as entrepreneurship and book keeping courses which are conducted by university

professors. As a result, the courses are centred around theory, rather than practice. Hence, there is a deficiency of implementation by the entrepreneurs. It is recommended that innovative and successful entrepreneurs should also be included in designing course modules and conducting courses.

Female entrepreneurs in tiny firms should not be ignored, as the income from their business can be a major contribution to their family income. They should be provided with necessary support so that they can be as innovative as their male counterparts or as females in small firms. Their low level of innovativeness was due to a low level of education and lack of training. Their lack of knowledge and skill due to their low educational level can be made up through training and attending courses. Therefore courses or training provided by institutions should take into account constraints faced by female entrepreneurs.

There should be an improvement in institutions' methods of circulating the information to create awareness among entrepreneurs about courses offered by the training institutions. Most of the training institutions circulate their information by pamphlets which are only available to the entrepreneurs who make the effort to contact the institutions or obtain them through business associations. MARDI has made an effort to advertise its courses through the internet. However, only a small number of SSIs have this facility. Announcements about courses offered by institutions should be made in media of wider circulation, such as newspapers, radio and television.

(b) <u>Technical And Management Guidance And Information Services</u>

This study showed that MARA and MARDI play a very important role in technical and management guidance and information services to small scale entrepreneurs in SSIs. There is a need for other institutions, such as financial institutions, to provide services in these areas. These institutions should undertake on-the-spot communication and counselling guidance by experts to cultivate adoption of technological innovation by SSIs whose technological level is low and managerial ability is weak. This would result in reducing constraints faced by SSIs in the process of adopting the innovation. The technical guidance should be provided by MARDI and SIRIM, the management guidance should be provided by MARA and National Productivity Centre (NPC), while Malaysian Industrial Development Finance (MIDF), Credit Guarantee Corporation (CGC) and Development Bank should provide financial support. The strategy is to combine technical guidance and managerial guidance, and then examine how their advice can be put into practice with financial support.

The Division of Small and Medium-scale Industries in the Ministry of Trade and Industry (MITI) should act as a source of information for SSIs. This division could collect and supply related information at any time, according to the needs of SSIs. This division should play a role in identifying SSIs which have growth potential but have difficulty in collecting various kinds of information and then supplying the information they need. This division could act as a channel that links entrepreneurs with information providers, such as research institutions.

There are many institutions which have a role of providing assistance to SSIs (refer to **Appendix I**). However, based on this study, less than 45.0 per cent of small firms and less than 30.0 per cent of tiny firms used facilities or obtained assistance from these institutions. One of the main reasons for lack of institutional involvement is lack of information about the existence and the function of such institutions and inaccessibility of the institutions. Research by UKM (1990) showed that 77.7 per cent of the entrepreneurs knew about the existence of MARDI, 71 per cent knew about its functions while only 30 per cent received assistance from it. Hence, other than the Division of Small and Medium- scale Industries in MITI suggested above as information provider, there is a need to establish a mobile *Extension Service Unit* which can provide all types of information needed by small scale FPI. Currently, MARDI has a programme called *Extension and Advisory Service to Small Scale Food Industries* (MARDI 1993). However, this programme only provides advisory services to local food entrepreneurs, regarding improving processing technologies and product quality, through personal communication. The *Extension Service Unit* suggested, would be an extension of this programme by including information provision to entrepreneurs on other aspects needed by them, such as training and financial assistance, to enhance their ability to be innovative. The extension officer of this unit would approach entrepreneurs and provide them with the necessary information.

(c) <u>Strengthening Financial Support</u>

This study showed that the financing problem was one of the determining factors of firms' innovativeness. However, only a few of the entrepreneurs in this study were (and chose) able to obtain a loan from a financial institution although various loan schemes have been set up for SSIs. Among the schemes related to technological innovation of SSIs are (i) feasibility study schemes (ii) product development and design schemes and (iii) quality and productivity improvement schemes. The institutions participating in such schemes are the Development Bank, MIDF and Bank of Industry. The majority of *Bumiputera* small scale FPI do not apply for loans under these schemes, mainly due to lack of information about such schemes, strict conditions for eligibility (refer to **Appendix IX**) and the requirement that the firms support at least 50% of the cost of the project. Hence, in this study for technological innovation, small scale FPI are very much dependent on loans from MARA, or KEMAS, or on an overdraft from a commercial bank In view of the importance of MARA and KEMAS in providing loans for technological innovation, these institutions should increase the maximum loan provided to entrepreneurs and introduce a longer repayment period. This would encourage small scale FPI to modernise their production technique by adopting new technology.

9.3.2 Encouraging Small Firms to Adopt Radical Type of Innovation.

The majority of small scale FPI surveyed adopted an incremental type of innovation. However, there are small scale FPI which have the potential of adopting a radical type of innovation. As we have seen in this study, bigger firms

(firms with more than 30 workers) and firms with a higher level of complexity (those that do not have a problem of lack of skilled workers) are more innovative than small firms. We may infer that they have the potential to adopt a radical type of innovation. Hence, there is a need for policy initiatives which can encourage such firms to realise this potential. The nature of the research performed for this study means that our policy conclusion here, frankly, be more speculative and less clearly derived from our findings than those put forward so far.

We propose that financial and technical assistance should also be provided to these firms. The policy initiatives provided to these firms should encourage expansion through (a) increasing demand for their products and (b) providing financial and technical assistance.

(a) <u>Increasing The Demand for Tiny and Small Firms' Products</u>

We believe that the incentive for SSIs to innovate will increase where there is an increase in the demand for their product (We showed above that larger size of firms made for innovation; and presumably so does the need to expand capacity.). In the current situation, the majority of them market their product locally through distributors. They are very much dependent on distributors to promote their product. As a results, there is no significant increase in demand for their products. Demand for small firms' products could be increased through (a) government procurement, (b) umbrella concept (c) strengthening the inter-industry linkages and (d) export.

(i) Government Procurement

Utilising the public sector's purchasing power in promoting domestic industries is not entirely new, and the policy should be vigorously pursued with more specific guidelines to take full advantage of the potential in terms of technology acquisition and innovation. Government can influence demand through regulation and procurement. However, as was mentioned in Chapter Two, there is an indirect discrimination faced by SSIs related to government procurement policies which tend to favour large firms because of their competitive prices and higher quality products. Hence, there should be an improvement of the government procurement system towards the products of SSIs. In Japan, for example, a special act was established in 1966 to ensure that SSIs are given equal chance or priority in government procurement (Madeline and Faridah 1989). This act required (i) government or public agencies to give priority to SSIs in providing purchase contracts, (ii) government policies regarding purchase contracts to be notified annually to SSIs to ensure that they have a chance of bidding for government contracts and (iii) MITI to have a complete record of government contracts and make sure that all government agencies follow regulations in providing government contracts. We suggest that Malaysia should also implement a similar act.

(ii) 'Konsep Payung' (Umbrella Concept)

Currently only BESTA Distributor Limited Company participates in the umbrella concept to market the products of small scale FPI under the brand name BESTA. Under this marketing concept, small scale firms concentrate on production, while

leaving the marketing aspect of their business to this organisation. At the same time, the organisation provides the necessary assistance such as financing, raw materials, quality control and packaging which are needed by SSIs. It is timely for more private companies to participate in this umbrella concept to increase the market for SSIs. The umbrella concept would enable small scale FPI to be competitive with larger firms and MNCs and penetrate export markets.

(iii) Strengthening inter-industry linkages

Linkages between small firms and large firms or between firms of different sectors should be strengthened through sub-contracting. The Sub-Contracting Exchange Unit in the MITI is responsible for creating these linkages. However, less than 10 per cent of the entrepreneurs of SSIs are aware of the existence of such a unit and not many food processing firms have the benefit of that unit (UKM 1990). Under Abatement for Purchases from Small Scale Companies, an incentive of 5 per cent of adjusted income will be given to large industries which purchase components from small scale light engineering industries. We suggest that a similar abatement be given for purchases of semi-processed products from small scale FPI to encourage interlinkages between small scale FPI with larger firms.

Linkages between small firms and larger firms are weak due to various factors. Among them are poor quality products, delay in delivery, shortage of suitably qualified small firms and instability of the management of SMIs (Ismail 1990: 21). Hence, in the light of these problems, assistance such as financial support to adopt technological innovation, upgrade management skill and quality

control should be given to small firms whose products have been identified for sub-contracting arrangement.

(iv) Export

Export incentives given to SMIs are double deduction of expenses on promotion of export overseas, double deduction of Premium Credit Insurance for Exports and Industrial Building Allowance. However, these incentives are only given to firms which have already exported their products. The majority of small firms do not export their products because they do not have the capacity to do so. Incentives should be given to establish linkage between specific small scale food processing industries and established exporters. The arrangement should allow for the facilitation of direct contact between exporters and producers, with MITI playing the role of initiator and facilitator, as well as provider of necessary information to both parties. Provision of appropriate incentives should be given to exporters which obtain supplies from small firms.

Assistance should also be made available to SSIs in order to help them to penetrate foreign markets. Thailand and Japan can be used as examples. Two institutions; the "Export Service Centre" and a programme under the Industrial Finance Co-operation in Thailand (IFCT) are responsible for promoting exports of SSIs. The Export Service Centre provides assistance in terms of packaging, providing information on overseas market by conducting market research and promoting export of SSIs products through publicity and trade fairs. IFCT, on the other hand, provides specific programmes for SSIs' which export their products, by providing assistance in technological innovation to modernise production

techniques and upgrade product quality. IFCT also provide technical support as well as financial support. Malaysia can also learn from Japan which promotes exports of SSIs by establishing an institutions like "Japan External Trade Office" (JETRO). JETRO has its branch offices in various countries, which carry out market research and provide information of export opportunities in the particular countries to SSIs. Also, through JETRO, linkages between SSIs in Japan and foreign firms through the process of sub-contracting can be created. JETRO is also responsible for promoting products of SSIs abroad at trade fairs and expositions (Madeline and Faridah 1989). The creation of such an establishment in Malaysia appears highly desirable.

(b) <u>Providing Financial And Technical Assistance Package</u>

Adoption of radical types of innovation also requires technical assistance from research institutions and financing. To finance such innovation the entrepreneurs cannot rely on MARA and KEMAS. They need to be able to obtain financing from government assisted institutions such as MIDF and Development Bank or from private commercial banks. However, financing from such institutions requires them to provide collateral, guarantors and an assurance of the success of the project. Hence, a package of financial and technical assistance should be provided to firms which have the potential to adopt a radical innovation. This package would use similar concepts to the *Technical and Management Guidance and Information Service* proposed for non-innovative firms. The only difference is that it would concentrate on technical and financial assistance. Hence, this package would be monitored by committee members consisting of officers

representing research and financing institutions. Other than a board of directors, members of the committee could act as the guarantors for project loans. Currently, MIDF and Development Bank finance up to the maximum of 70 per cent of the cost of fixed assets acquired by firms at an interest rate of 10-12 per cent per annum and maximum repayment period of 10 years. Since these financial institutions would become the main financiers, we suggest that these institutions should finance at least 90 per cent of the cost of innovation at an interest rate of not more than 10 per cent.

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APPENDIX I

Agencies Involved in Small Business Development in Malaysia and Their Functions

	Function												
	Policies and Strategies	Incen-tives	Basic Infra-structure	Market-ing	Financial & Credit facilities	Data base & informa-tion	Consul-tancy & Advisory Services	Training & Appren-ticeship	Business Premises	Subsidies	Identifi-cation of New Projects & Research	Enforce-ment & Control	Evalua-tion
Prime Minister department													
1. Economic Planning Unit	X		X			X					X		X
2. Implementaion Co- ordination Unit	X		X			X		X		X	X	X	X
Ministry of Trade and Industry													
1. Malaysian Industrial Development Autority (MIDA)		X					X				X	X	X
2. National Productivity Centre							X	X					
3. The Standards and Industrial Research Institute of Malaysia							X	X			X		
4. Technology Centre, Kuala Lumpur						X	X	X			X		
Ministry of Finance													
1. Bank Negara	X											X	X
2. Department of Inland Revenue												X	
3. Credit Guarantee Corporation					X								
Ministry of Public Entreprises													
1. State Economic Development		X	X						X	X	X	X	X
2. Urban Development Authority	X		X			X			X		X		
3. Development Bank of Malaysia					X		X	X			X		
4. Pernas Distribution			X	X	X	X	X	X		X			
5. Food Industry Malaysia Authority				X			X				X		
6. Malaysian Industrial Development Finance (MIDF)		X	X		X	X	X	X			X		

.....cont.

	Function												
	Policies and Strategies	Incentives	Basic Infrastructure	Marketing	Financial & Credit facilities	Data base & information	Consultancy & Advisory Services	Training & Apprenticeship	Business Premises	Subsidies	Identification of New Projects & Research	Enforcement & Control	Evaluation
Ministry of National and Rural Development													
1. Division of Small Industry	X		X								X		X
2. MARA					X		X	X	X	X			
3. Cooperative Department		X		X									
4. Handicraft Corporation of Malaysia		X		X									
5. Karyancka				X									
6. Bumiputera Entreprencurial Institute								X					
Ministry of land and Regional Development													
1. Federal Land Development Authority			X								X		
2. Rubber Industry Smallholders Development Authority		X		X			X				X		
3. Regional Development Authority	X		X			X					X		
4. Federal Land Coordination Rehabilitation Authority			X										
Ministry of Education	X							X					
Ministry of Labour								X					
Ministry of Culture and Sports								X					
Ministry of Science and Environment	X											X	

....cont.

	Function												
	Policies and Strategies	Incen-tives	Basic Infra-structure	Market-ing	Financial & Credit facilities	Data base & informa-tion	Consul-tancy & Advisory Services	Training & Appren-ticeship	Business Premises	Subsidies	Identifi-cation of New Projects & Research	Enforce-ment & Control	Evalu a-tion
Ministry of Public Work and Utilities-Bumiputera Participation Unit			X			X	X					X	
Ministry of Federal Territory		X							X				
Ministry of Agriculture													
1. Malaysian Agricultural Research and Development Authority							X						
2. Federal Agricultural Marketing Authority				X									
Commercial Banks					X	X	X						
Medium and Small Entreprises Association of Malaysia						X	X						
Small Business Development Centre Agricultural University of Malaysia						X							

Source: Ismail (1990a; 46-48)

APPENDIX II

TRANSLATION OF QUESTIONNAIRE

A study of

SMALL SCALE INDUSTRIES

Determinants of Technological Innovation among Bumiputera Food Processing Firms in Malaysia

Firm's name: .....

Firm's address: .....

.....

.....

Tel. no: .....

Enumerator's name: .....
Date of interview.....

Respondent's Code Number

Direction: *Please ask questions below clearly to the respondent and fill in the answers in the appropriate spaces provided*

A. ENTERPRISE/ORGANISATION

1. Name of organisation .....

2. Address .....
   .....
   .....

3. Form of organisation

   1. ☐ Sole proprietor
   2. ☐ Partnership
   3. ☐ Private limited company
   4 ☐ Limited company
   5. ☐ Others, please specify.....

4. Type of business

   1. ☐ Bakery
   2. ☐ Beverages
   3. ☐ Sauce
   4. ☐ Cracker
   5. ☐ Noodles
   6. ☐ Others, please specify.....

5. Year of establishment: 19.....

6. The founder of the organisation

   1 ☐ Respondent
   2 ☐ Father/mother/grandparent
   3 ☐ Relative (other than no 2)
   4 ☐ Friend
   5 ☐ Others, please specify.....

7. Percentage distribution of ownership by race

Race	**% of ownership**
1. Bumiputera	
2. Non-Bumiputera	
3. Non-Malaysian	
4. Others, please specify.....	
Total	**100.0**

8. Number of workers.

Workers' status	**Number of workers**	
	end of 1992	**end of 1989**
Full time		
Part time		

8.1 Please indicate the number of full-time workers by their job categories at the end of year 1992 and 1989

Job category	**Number of worker**	
	end of 1992	**end of 1989**
a. Professional		
b. Administrative		
c. Clerical		
d. Sales		
e. Technical		
f. Production		
g. Others		
Total		

9. Indicate the amount of initial capital and its sources

9.1 Amount of (a) initial capital RM .....
(b) paid-up capital RM .....

9.2 Sources of initial capital, if the initial capital was financed by any institutions please name the institutions.

Source	% of the total initial capital	Name of institutions
a Own		
b. Family		
c. Friends		
d. Commercial bank		
e. Government institutions		
f. Others, please specify		
Total	**100%**	

10. What is your firm's current market share? .....%

11. What is the total market share of the three largest competitors in your industry? .....%

12. Please state the percentages of sales based on the market channel. Also, please state whether the sales involve contract.

Marketing channel	% of sales	Does it involve contract	
		1. YES	2. NO
a) Direct			
b) Wholesaler			
c) Exporter			
d) Manufacturer			
e) Distributor			
f) Institutions			
Total	**100%**		

13. Please state your firm's main competitors and number them according to their importance (1=most important)

a) Large size firm ☐
b) Medium size firm ☐
c) Small size firm ☐
e) Others, please specify ☐

.....

14. In the last three years, how often has price cutting taken place in your firm?

..... times.

15. Please read the statements below carefully and for each statement, indicate the appropriate number that best describes your organisation, according to the code below.

1 - Rarely or almost never true
2 - Sometimes but frequently never true
3 - Occasionally true
4 - Very often true
5 - True for most of the time

Description	**1**	**2**	**3**	**4**	**5**
a. Ideas from workers are not easily accepted by management.	1	2	3	4	5
b. Decision making can only be done through proper meeting and consultation by top management only	1	2	3	4	5
c. Usually employees are involved in making decisions that affect them.	1	2	3	4	5
d. Management encourages its employees to reveal their personal problems to their superiors.	1	2	3	4	5
e. When the firm decides to buy new machine, a committee is set up to conduct a feasibility study on the machine	1	2	3	4	5
f. Only certain people make decisions for the firm	1	2	3	4	5
g. Workers are given a formal report of their poor performance.	1	2	3	4	5
h. Occasionally superiors delegate their work to subordinates.	1	2	3	4	5
i. Superiors share business problems with subordinates	1	2	3	4	5
j. The relationship between superiors and subordinates is rather informal	1	2	3	4	5

B. INFORMATION ON PRODUCTION AND MACHINES USAGE

1. Three main products produced

   1. .....
   2. .....
   3. .....

2. Why did you choose to produce the above products?

   1 ☐ Requires little capital
   2 ☐ Highly demanded
   3 ☐ Has skill to produce
   4 ☐ Suggested by friends/relatives
   5 ☐ Suggested by government
   6 ☐ Others, specify.....

3. Has your firm produced any new product(s) in the last three years?

   1 ☐ Yes 2 ☐ No.

4. Does your firm conduct research and development (R & D) activities?

   1 ☐ Yes 2 ☐ No.

4.1 If yes, what proportion of your expenditure is allocated for R & D?

..... %

5 If not, please state product evaluation techniques conducted by your firm.

   1 ☐ Compare with other firms' product
   2 ☐ Refer to publication
   3 ☐ Refer to research institution
   4 ☐ Others, please specify.....

6. Have you made any changes in raw materials used for production in the last three years? If you did, please state how you went about doing it.

1 ☐ Did not make any changes
2 ☐ Conduced own research
3 ☐ Contacted research institution
4 ☐ Read publication
5 ☐ Learned from other firm
6 ☐ Others, please specify.....

7. Has your firm introduce any product innovation in the last three years? If so, please state in what way.

1 ☐ Did not make any innovation
2 ☐ Storage
3 ☐ Packaging
4 ☐ Appearance
5 ☐ Taste
6 ☐ Others, please specify.....

8. Who initiated the innovation?

1 ☐ Owner
2 ☐ Staff
3 ☐ Other entrepreneur
4 ☐ Supplier
5 ☐ Expert from research institution
6 ☐ Others, please specify.....

9. Generally, what is your firm's level of mechanisation?

1. ☐ Manual
2. ☐ Partially mechanised
3. ☐ Fully mechanised
4. ☐ Others, please specify.....

10. Please briefly give the information on your main machines of production.

Type/name of machine	Countr y of origin	Source of information [Code 3]	Suppliers [Code 3]	Model 1 - Latest 2 - Old	Year of acquisition
a)					
b)					
c)					
d)					

Code 3

1. SIRIM
2. MARDI
3. MARA
4. Other govt. inst.
5. Parent Company
6. Suppliers
7. Other firms
8. Media
9. Distributor
10. Association
11. Exhibition/trade fair
12. Others, specify

11. Who makes decisions on the appropriateness of the machines used in this firm?

1 ☐ Owner
2 ☐ Skilled workers
3 ☐ Advice from research institution
4 ☐ Other firm .....
5 ☐ Supplier
6 ☐ Others, please specify

12. Has your firm bought new machine(s) in the last 3 years?

1 ☐ Yes 2 ☐ No.

12.1 If no, when was the last time your firm bought new machine?

1 ☐ Year .....
2 ☐ Never bought new machine since firm first established

(***go to section C***)

The rest of the questions in this section ask for the information about the last machine bought.

13. Reasons for buying the machine

1 ☐ Replacing old machine
2 ☐ Replacing manual method
3 ☐ Producing new product
4 ☐ Received assistance
5 ☐ Others, please specify .....

14. If your firm received assistance, please state the source and kind of assistance

.....

.....

15. Why did you choose that particular machine?

1 ☐ The best in market
2 ☐ Appropriate for firm
3 ☐ No choice
4 ☐ Limited budget
5 ☐ Others, please specify.

16. Was the machine brand new when you bought it?

1 ☐ yes 1 ☐ No.

16.1 If the machine was second hand, how old was the machine when you bought it?

..... years

17. Total cost incurred when you bought the machine

a) Price of the machine RM.....
b) Installation cost RM.....

18. Source of financing the machine; If it is financed by institutions, please name the institutions.

Source	**% of the total cost**	**Name of institutions**
a Own		
b. Family		
c. Friends		
d. Commercial bank		
e. Government institutions		
f. Others, please specify		
Total	**100%**	

19. Did you carry out a proper study before buying the machine?

1 ☐ Yes 2 ☐ No

19.1 If yes, how?

1. ☐ do feasibility study
2. ☐ visit to MARDI occasionally
3. ☐ Visit suppliers
4. ☐ visit or contact firm that had already bought the machine
5. ☐ Others, please specify.....

20 What was your firm's market share before adopting the machine under study?

.....%

21. What increase in profit did you expect when you bought the machine?

.....%

22. What is the actual increase in profit since you bought the machine.

.....%

23. Please indicate whether the situations described below existed when you first acquired the machine under study. If the situation existed, please indicate whether it was a problem to your firm and why it was a problem.

	Situation exist	**Was it a problem?**
(a) No existing employee was able to operate the machine	1 ☐ Yes 2 ☐ No	1 ☐ Yes 2 ☐ No
Why was it a problem?		
(b) Some employees had to be transferred to another division.	1 ☐ Yes 2 ☐ No	1 ☐ Yes 2 ☐ No
Why was it a problem?		
(c) Some employees became redundant.	1 ☐ Yes 2 ☐ No	1 ☐ Yes 2 ☐ No
Why was it a problem?		
(d) Some employees had to be retrained	1 ☐ Yes 2 ☐ No	1 ☐ Yes 2 ☐ No
Why was it a problem?		
(e) Firm had to recruit new employees	1 ☐ Yes 2 ☐ No	1 ☐ Yes 2 ☐ No
Why was it a problem?		

24. For each of the statements on the buying situation, given below, Please indicate the number in **code 4**, that represents the degree of problems that you faced in the process of buying the machine under study.

Code 4

0 - No problem at all
1 - Minor problem that could be solved by the entrepreneurs
2 - Serious problem that could be solved with external assistance
3 - Very serious problem that could not be solved

Buying situation	**Degree of problem**			
(a) Finding supplier of new technology	0	1	2	3
(b) Delegating responsibility while away to negotiate to buy new technology	0	1	2	3
(c) Dealing with legal matters such as contract	0	1	2	3
(d) Negotiating with supplier	0	1	2	3
(e) Getting finance	0	1	2	3
(f) Long absence from firm	0	1	2	3
(g) Getting after sales services from supplier	0	1	2	3

25. Please indicate the extent to which you agree with the following statements about the machine under study by indicating the appropriate number, as in **code 5,** in the box.

Code 5

5 - Strongly agree
4 - Agree
3 - Unsure
2 - Disagree
1 - Strongly disagree

a) Adopting the machine would involve risk of too great a loss.	1	2	3	4	5
b) The new machine does not give much advantage form the old one.	1	2	3	4	5
c) We'll gain better profit if we adopt the machine	1	2	3	4	5
d) Only a few firms are able to buy the machine	1	2	3	4	5
e) It is necessary to obtain financing to buy a new machine	1	2	3	4	5
f) The machine is the latest in the market	1	2	3	4	5
g) The machine is simple to use	1	2	3	4	5
h) The machine can easily be adapted to the existing process of production	1	2	3	4	5
i) It is a prestigious for the firm use the machine	1	2	3	4	5
j) Firms can easily penetrate the market if they have the machine.	1	2	3	4	5
k) I have had to change some of the work routine since the firm used the machine.	1	2	3	4	5
l) The machine produces better quality products.	1	2	3	4	5
m) There is a better alternative machine which would be appropriate for my firm	1	2	3	4	5
o) The machine is very expensive to buy and to install.	1	2	3	4	5
n) The machines can be operated by the firm's existing technician	1	2	3	4	5
p) It is difficult to get spare parts for the machine.	1	2	3	4	5

26. If you obtained or ever tried to obtain to obtain financing to buy the machine under study, please state the degree of problems that you faced in the following situations. Use **code 4** to represent the degree of problem and put the number in the box.

Loan applying process	**Degree of problem**			
a. Getting loan approved.	0	1	2	3
b. Providing proper work plan and feasibility study	0	1	2	3
c) Providing the required collateral	0	1	2	3
d) Approaching financial institution	0	1	2	3
e. High interest rate	0	1	2	3

27. Did you search for other alternative machines before deciding to buy the machine under study

1 ☐ Yes 2 ☐ No

27.1 If yes, how did you search for the alternatives?

1 ☐ Contact suppliers/agents
2 ☐ Contact other entrepreneur
3 ☐ Attend trade fair
4 ☐ Others, please specify.....

28 Does your firm intend to buy new machine(s) in the future?

1 ☐ Yes 2 ☐ No

28.1 If yes, when? Year .....

28.2 If not, please state the reasons

.....

.....

.....

Proceed to Section D
(page 19)

C) INFORMATION ON THE PROCESS OF INNOVATION SEARCH
for firms which had considered buying a new machine

> ***Directions***: *Questions in this section are only to be asked to firms which have not acqired any machinery in the last three years but had considered doing so*

1. Please state the reasons why your firm has not bought any new machinery in the last three years

1. ☐ Not sure of the machine's appropriateness to firm
2. ☐ The considered machine is expensive
3. ☐ Could not get financing
4. ☐ Do not have skilled workers
5. ☐ Some workers may become redundant
6. ☐ The existing machine is still good and reliable
7. ☐ Others, please specify.....

2. What are the main factors that you think very important when you buy a new machinery?
(*Please number the answers below according to their importance, 1 = the most important)*

a. The best in the market ☐
b. Appropriate for firm ☐
c. Suggested by an expert ☐
d. Budget ☐
e. Others, please specify ☐

3. What is the appropriate cost of new machinery for your firm

a) Price of the machine RM .....
b) Installation cost RM .....

4. If you want to buy new machinery, please state your source of financing

1 ☐ Own
2 ☐ Family
3 ☐ Friend
4 ☐ commercial bank
5 ☐ Govt. institution
6 ☐ Others, please specify .....

5. Do you make a proper study before buying the machine?

1 ☐ Yes 2 ☐ No

5.1 If yes, how

1. ☐ do feasibility study
2. ☐ visit to MARDI occasionally
3. ☐ visit suppliers
4. ☐ visit or contact firm that have already bought the machine
5. ☐ Others, please specify.....

6. Do you expect an increase in profit when you buy the new machine? If yes, what percentage of an increase do you expect?

.....%

7. Please indicate whether the situation described below will be likely to exist if your firm acquires new machinery. If the situation will exist, please indicate whether it might be a problem to your firm and why.

	Situation exist	**Will it be a problem?**
(a) No existing employee is able to operate the machine	1 ☐ Yes 2 ☐ No	1 ☐ Yes 2 ☐ No

Why will it be a problem?

(b) Some employees will have to be transferred to another division.	1 ☐ Yes 2 ☐ No	1 ☐ Yes 2 ☐ No

Why will it be a problem?

(c) Some employees will become redundant.

1 ☐ Yes
2 ☐ No

1 ☐ Yes
2 ☐ No

Why will it be a problem?

_____

_____

(d) Some employees will have to be retrained

1 ☐ Yes
2 ☐ No

1 ☐ Yes
2 ☐ No

Why will it be a problem?

_____

_____

(e) Firm will have to recruit new employees

1 ☐ Yes
2 ☐ No

1 ☐ Yes
2 ☐ No

Why will it be a problem?

_____

_____

8. For each of the statements on buying situation given below, please indicate the number in **code 4**, that represent the degree of problems that you will be likely to face in the process of buying new machinery.

Code 4

0 - No problem at all
1 - Minor problem that can be solved by the entrepreneurs
2 - Serious problem that can be solved with external assistance
3 - Very serious problem that can not be solved

Buying situation	**Degree of problem**			
(a) Finding supplier of new technology	0	1	2	3
(b) Delegating responsibility while being away to negotiate to buy new technology	0	1	2	3
(c) Dealing with legal matters such as contract	0	1	2	3
(d) Negotiating with supplier	0	1	2	3

(e) Getting finance	0	1	2	3
(f) Long absence from firm	0	1	2	3
(g) Getting after sales service from supplier	0	1	2	3

9. By using code 5, please indicate the extent to which you agree with the following statements on the machine you considered to acquire by putting the appropriate number in the box.

Code 5

5 - Strongly agree
4 - Agree
3 - Unsure
2 - Disagree
1 - Strongly disagree

a) Acquiring the machine would involve risk of too great a loss.	1	2	3	4	5
b) The considered machine will not give much advantage from the old one.	1	2	3	4	5
c) We'll gain better profit if we adopt the machine	1	2	3	4	5
d) Only a few firms are able to buy the machine	1	2	3	4	5
e) It is necessary to obtain financing to buy new machine	1	2	3	4	5
f) The considered machine is the latest in the market	1	2	3	4	5
g) The machine is simple to use	1	2	3	4	5
h) The machine can easily be adapted to the existing process of production	1	2	3	4	5
i) It is a prestigious for the firm use the machine	1	2	3	4	5
j) Firms can easily penetrate the market if they have the machine.	1	2	3	4	5
k) I will have to change some of the work routine of the firm uses the machine.	1	2	3	4	5
l) The machine produces better quality products.	1	2	3	4	5

m) There is a better alternative machine which is appropriate for my firm	1	2	3	4	5
o) The machine is very expensive to buy and to install.	1	2	3	4	5
n) The machines can be operated by the firm's existing technician	1	2	3	4	5
p) It is difficult to get spare parts for the machine.	1	2	3	4	5

10. If you intend to obtain financing when you buy new machinery, please state the degree of problems that you think you will face in the following situations. Use **code 4** that represent the degree of problem and mark the answer in the appropriate box.

Loan applying process	**Degree of problem**			
a. Getting loan approved.	0	1	2	3
b. Providing proper work plan and feasibility study	0	1	2	3
c) Providing the required collateral	0	1	2	3
d) Approaching financial institution	0	1	2	3
e. High interest rate	0	1	2	3

11. Did you look for other alternative machines before deciding to buy the considered machine? If yes, how

1 ☐ Contact suppliers/agents
2 ☐ Contact other entrepreneur
3 ☐ Attend trade fair
4 ☐ Others, please specify.....

12. Please state your reason for buying the considered machine?

.....

.....

D. SALES, REVENUE, ASSET AND VALUE ADDED

Please state the value of the following for the years 1992 and 1989.

1. Value of the following assets.

Assets	End of 1992	End of 1989
a) Land	RM	RM
b) Building	RM	RM
c) Machine	RM	RM
d) Others	RM	RM
e) TOTAL	RM	RM

2. Gross production

Production	End of 1992	End of 1989
a) Total value of production		
b) Stock on process at:		
the beginning of year		
the end of year		
c) TOTAL		

3. Expenditure

Expenditure on	End of 1992	End of 1989
a) Input cost:		
i) Raw material used	RM	RM
ii) Utilities	RM	RM
iii) Others	RM	RM
b) Salaries/wages	RM	RM
c) Tax (Direct & indirect)	RM	RM
d) Other expenditures (depreciation, etc)	RM	RM
f) TOTAL	RM	RM

4. Revenue/Income

Revenue/income	End of 1992	End of 1989
a) Sales	RM	RM
b) Other income (Dividend, etc...)	RM	RM
c) TOTAL	RM	RM

5. Value added

	End of 1992	End of 1989
Value added	RM	RM

6. Is the value added and sales for year 1992 increased from the previous year?
If yes, by what percent

Value added		**Sales**	
1	☐ Yes	1	☐ Yes
2	☐ No	2	☐ No
% increase		% increase	

E. ENTREPRENEURS' BACKGROUND

1. Respondent's status of ownership.

1. ☐ Sole owner
2. ☐ Partner
3. ☐ Major shareholder

2. If respondent is partner or major shareholder of the firm, please state, the percentage of share belong to respondent.

Percentage of share _____%

3. Respondent's current position in the firm

1. ☐ Chairman
2. ☐ Director
3. ☐ Manager
4. ☐ Others, please specify.....

4. Highest educational level:

1. ☐ No formal education
2. ☐ Primary school
3. ☐ Lower secondary
4. ☐ Upper secondary (O-level)
5. ☐ A - level or equivalent
6. ☐ College/University/Professional
7. ☐ Others; please specify

5. Age of respondent

1. ☐ 25 years old or less
2. ☐ 26 - 30
3. ☐ 31 - 35
4. ☐ 36 - 40
5. ☐ 41 - 45
6. ☐ 46 - 50
7 ☐ More than 50 years old

6. Sex of respondent

1 ☐ Male 2 ☐ Female

7. Number of years working in the current company

Number of years ----------

8. Respondent's previous working experience

Types of job	Sector	Number of years
a)		
b)		
c)		
d)		

10. If you have attended any formal courses that related to your business, please state the types of courses and the organiser.

Courses	Organiser	Year	Duration (days)
a)			
b)			
c)			
d)			
e)			

10.1 If you have never attended any courses, please state the reasons

.....

.....

.....

11. For the last five years, if you have ever visited (referred) to any government institution such as MARDI, MARA for your business, please name the institution, the number of visits and purpose of visits.

Institution	Number of visit	Purpose of visit

12. If your firm has never referred to any institution, please state the reasons

1 ☐ No reason to visit
2 ☐ The institution is very far
3 ☐ Do not know which institution to visit
4 ☐ Others, please specify.....

13. Are you a member of any association related to your business?

1 ☐ Yes 2 ☐ No

13.1 If yes, please name the association

a) .....
b) .....
c) .....

14. In the last 3 years how many times have you attended trade fairs and seminars related to your business?

Trade fairs ..... times
Seminars ..... times

15. Do you subscribe to any magazines related to your business? If yes, name the magazines

a) .....

b).....

F. PERCEPTION

1. Please read the statements below carefully and for each statement, indicate the number that best describes yourself, in the box beside the statement (refer to Code 6)

Code 6

1 - Rarely or almost never true for me
2 - Sometimes but not frequently true for me
3 - Occasionally true for me
4 - Very often true for me
5 - True for me all or most of the time

(a) I never delay to grab any opportunity that comes along.	1	2	3	4	5
(b) The success of my business depends on my relationship with politicians	1	2	3	4	5
(c) I expect my workers to work hard with minimal guidance from me.	1	2	3	4	5
(d) I hate to see people have nothing to do	1	2	3	4	5
(e) I feel a great sense of satisfaction when I do my job well	1	2	3	4	5
(f) When I am working, the demands I make upon myself are very high.	1	2	3	4	5
(g) In general I am strongly future-oriented	1	2	3	4	5
(h) All I want out of life in the way of a career is a secure, not too difficult job, with enough pay to afford a nice car and eventually a home of my own.	1	2	3	4	5
(i) Planning only makes me unhappy since plans hardly ever work out anyway.	1	2	3	4	5
(j) I believe in *'takdir'* (God determined our fate)	1	2	3	4	5
(k) I believe that I am capable of handling any business activities	1	2	3	4	5
(l) I worked hard at school to make sure that I would have a better life than my parents.	1	2	3	4	5
(m) I don't care what other entrepreneurs do, I go my own way.	1	2	3	4	5
(n) I find it easy to relax completely when I am on holiday	1	2	3	4	5

(o) I work hard for the future of my children, so that they will have better life	1	2	3	4	5
(p) I find it easy to forget about my work outside normal working hours	1	2	3	4	5
(q) Other people think I work very hard	1	2	3	4	5
(r) If I have not attained my goal and have not done a task well then I continue to do my best to attain the goal.	1	2	3	4	5

2. Using **code 7**, please indicate the extent to which you agree with the following statements by putting the appropriate number in the box.

Code 7

5 - Strongly agree
4 - Agree
3 - Unsure
2 - Disagree
1 - Strongly disagree

(a) Sales of my company are very much affected by its marketing strategy	1	2	3	4	5
(b) Government regulations play an important part in predetermining market opportunity in my industry.	1	2	3	4	5
(c) The success of my company are very much dependent on hard work of its staff.	1	2	3	4	5
(d) Many problems faced by firms can be solved internally	1	2	3	4	5
(e) There is little point in engaging in detailed strategic analyses and planning because often events occur that my company cannot control.	1	2	3	4	5
(f) Failure of SMI is due to mismanagement by their entrepreneurs.	1	2	3	4	5
(g) SMI fail because they have not taken	1	2	3	4	5

advantage of their opportunities					
(h) Good entrepreneurs should use the latest technology in the market.	1	2	3	4	5
(i) Success in food producing business, for the most part depends on luck - there's no way an entrepreneur can change his or her luck.	1	2	3	4	5
(j) In many case, getting what I want has little nor nothing to do with luck.	1	2	3	4	5
(k) Many times, I feel that I have little influence over the things that happen to me.	1	2	3	4	5

3. Below you will find a series of situations that are likely to occur in every day life. The central person in each situation is faced with a choice between two alternativees courses of action, which we might call X and Y. Alternative X is more desirable and attractive than alternative Y, but the probability of attaining or achieving X is less than that of attaining or achieving Y.

For each situation, you will be asked to indicate the minimum odds of success you would demand before recommending that the more attractive or desirable alternative, X, be chosen.

Read each situation carefully before giving your judgement. Try to place yourself in the position of the central person in each of the situations. There are six situations in all. Please do not omit any of them.

a) Mr. A, a doctor who is married, aged 35 years old has a child. Since graduating from university, ten years ago, he has been working at a government hospital with a salary of RM3,000 a month with annual increment of RM200.00 up to the maximum salary of RM5,000 a month. Upon retirement at the age of 55, he will receive pension benefit. Recently a friend proposed that Mr. A establish his own private clinic in town Z. Z is a small town with only a small government clinic. Being the only private clinic, and if his clinic manages to get contracts with nearby firms as their panel doctor, the friend estimated that Mr A could earn an income of more than RM4,000 a month without working during weekends and at night . Mr. A also has no problem in providing RM100,000 as an initial capital to open the clinic.

Imagine that you are advising Mr. A. Listed below are several probabilities that the proposed clinic will get contracts.

Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. A to establish his own private clinic.

_____ The chance are 1 in 10 that the clinic will get contract.

_____ The chance are 3 in 10 that the clinic will get contract.

_____ The chance are 5 in 10 that the clinic will get contract.

_____ The chance are 7 in 10 that the clinic will get contract.

_____ The chance are 9 in 10 that the clinic will get contract.

_____ Place a check here if you think Mr. A should not take the new job, no matter what the probabilities.

b) Mr. B, who is married, and has two children is 30 years old. Since graduating from university, five years ago, he has been working as an administrator in a government department with a salary of RM2,000 a month, with annual increment of RM150.00 up to the maximum salary of RM3,500 a month. Upon retirement at the age of 55, he will received pension benefit. Using a government loan, he is able to buy a nice 3 bed room terrace house and a Proton car. Recently he was offered a job as marketing executive in newly founded company which has a highly uncertain future. The company will pay him RM4,000 a month and in the future, would offer the possibility of a share in ownership if the company survives.

Imagine that you are advising Mr. B. Listed below are several probabilities of new company's proving financially sound.

Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. B to take the job.

____ The chance are 1 in 10 that the company will prove financially sound.

____ The chance are 3 in 10 that the company will prove financially sound.

____ The chance are 5 in 10 that the company will prove financially sound.

____ The chance are 7 in 10 that the company will prove financially sound.

____ The chance are 9 in 10 that the company will prove financially sound.

____ Place a check here if you think Mr. B should not take the new job, no matter what the probabilities.

c) Mr. C, a 35 year old man, is blind due to a certain illness when he was 4 years old. Although he is blind he can see distinguish light and shade, and make out blurred shapes and colours that enable him to move freely without assistance. Recently he was informed by a well known surgeon that he might see normally if he undergoes an operation. But if the operation fails, he might be completely blind.

Imagine that you are advising Mr. C. Listed below are several probabilities that the operation will prove successful.

Please check the lowest probability that you would consider acceptable for the operation to be performed.

____ The chance are 1 in 10 that the operation will be a success.

____ The chance are 3 in 10 that the operation will be a success.

____ The chance are 5 in 10 that the operation will be a success.

____ The chance are 7 in 10 that the operation will be a success.

____ The chance are 9 in 10 that the operation will be a success.

____ Please check here if you think Mr. C should not have the operation, no matter what the probabilities.

d) Mr. D is president of ABC corporation in Malaysia. The corporation is quite prosperous, and has strongly considered the possibilities of business expansion by building an additional plant in a new location. The choice is between building another plant in Malaysia, where there would be a moderate return on the initial investment, or building a plant in a foreign country. Lower labour costs and easy access to raw materials in that country would mean a much higher return on the initial investment. On the other hand, there is a history of political instability and revolution in the foreign country under consideration. In fact, the leader of a small minority party is committed to nationalising, that is taking over, all foreign investment.

Imagine that you are advising Mr. D. Listed below are several probabilities of continued political stability in the foreign country under consideration.

Please check the lowest probability that you would consider acceptable for Mr. D's corporation to build plant in that country.

_____ The chances are 1 in 10 that the foreign country will remain politically stable.

_____ The chances are 3 in 10 that the foreign country will remain politically stable.

_____ The chances are 5 in 10 that the foreign country will remain politically stable.

_____ The chances are 7 in 10 that the foreign country will remain politically stable.

_____ The chances are 9 in 10 that the foreign country will remain politically stable.

_____ Place a check here if you think Mr. E's corporation should not build a plant in the foreign country, no matter what the probability

e) Mr. E is a sole owner of a small firm that manufactures plastic bags. The firm has been operating for 10 years and makes a small amount of profit annually. Recently Mr.E has been introduced to a new machine that can manufacture plastic bags at triple the rate the current machine is producing. It means if he buys the new machine, the firm will make higher profit, providing that the firm is able to obtain a sales contract with a big manufacturing firm in the nearby town. In order to buy the new machine, Mr. E will have to obtain a loan from a bank and use his house as collateral.

Imagine that you are advising Mr. E. Listed below are several probabilities that Mr. E will obtain a sales contract with the big firm.

Please check the lowest probability that you would consider acceptable to make it worthwhile to buy a new machine.

_____ The chances are 1 in 10 that Mr. E gets a sales contract with the big firm.

_____ The chances are 3 in 10 that Mr. E gets a sales contract with the big firm.

_____ The chances are 5 in 10 that Mr. E gets a sales contract with the big firm.

_____ The chances are 7 in 10 that Mr. E gets a sales contract with the big firm.

_____ The chances are 9 in 10 that Mr. E gets a sales contract with the big firm.

_____ Place a check here, if you think Mr. E should not buy the new machine, no matter what the probabilities

f) Mr. F, a teacher, aged 35 years old, married withs two children aged 6 and 10 years old. The family live comfortably in a small town where Mr. F is teaching. Mr. F also participates in a number of civic activities of considerable value to the community. Mr. F has been approached by the leaders of his political party as a possible candidate in the next election. Although Mr. F's party is the majority party in the district, the candidate of the opponent party is a prominent person and also popular in the community. If Mr. F agrees to become the candidate of his party, he will have to quit his job before the election day and lose all the benefit of working with the government. If he wins the election, his family will have a better future.

Imagine you are advising Mr. F. Listed below are several probabilities of Mr. F's winning the election in his district.

Please check the lowest probabilities that you would consider acceptable to make it worthwhile for Mr. F to run for political office.

_____ The chance are 1 in 10 that Mr. F would win the election.

_____ The chance are 3 in 10 that Mr. F would win the election.

_____ The chance are 5 in 10 that Mr. F would win the election.

_____ The chance are 7 in 10 that Mr. F would win the election.

_____ The chance are 9 in 10 that Mr. F would win the election.

_____ Place a check here if you think Mr. F should not run for political office, no matter what the probabilities.

APPENDIX III

Logistic Regression Function of All Firms

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Total number of cases: 197 (Unweighted)
Number of selected cases: 197
Number of unselected cases: 0

Number of selected cases: 197
Number rejected because of missing data: 0
umber of cases included in the analysis: 197
Dependent Variable Encoding:

Original Value	Internal Value
.00	0
1.00	1

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	Value	Freq	Parameter Coding (1)
ASSIS			
yes	1.00	37	1.000
no	2.00	160	-1.000
KNOW			
yes	1.00	25	1.000
no	2.00	172	-1.000
COMB			
yes	1.00	110	1.000
no	2.00	87	-1.000
COMM			
yes	1.00	42	1.000
no	2.00	155	-1.000
SEX			
male	1.00	141	1.000
female	2.00	56	-1.000

Note: Category variable(s) with 0,1-values have been recoded using the above coding scheme.
Parameter estimates are not the same as for indicator(0,1) variables.

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Dependent Variable.. Z regroup resp. into two groups

Beginning Block Number 0. Initial Log Likelihood Function -2 Log Likelihood 273.0543
* Constant is included in the model.

Beginning Block Number 1. Method: Enter
Variable(s) Entered on Step Number

1..	AGE	age of entrepreneurs
	SEX	sex of respondents
	EDU	years in formal education
	MANAGE	number of years managing the existing firm
	PREXP	years of the previous work experience
	NACH	score of need of achievement
	RISKS	score of risk attitute of entrepreneur
	LOC	score of locus of control
	COURSE	number courses attended
	KNOW(1)	study in detail about innovation
	SIZE	no. of workers at year 1989
	FORMAL	formalisation of firm
	CENTRAL	centralisation of firms
	COMPLEX	complexity of firms
	FINANCE	degree of financing problem (COMPUTE fin_prob = tb26a_t + tb26b_t + tb26c_t + tb26d_t + tb26e_t (COMPUTE))
	YESB	firms' age (years)
	FATURN89	fixed asset turnover for year 1989
	ROI89	return on investment for year 1989
	PROD89	productivity (valueadded/number of workers) for year 1989
	MISMATCH	mismatch between employee and innovation
	COMMU	cummunication index (As,maj,exp,sem)
	BUY	degree of problems in the buying sitution
	MAC	entrepreneurs' perception of innovation (COMPUTE mac = (eco+simple+pres+compac+risiko)/5)
	MA_COST	the cost of innovation
	COMB	big firms are the main competitors
	COMM	medium firms are the main competitors
	INST	index of institutional index
	ASSIS	whether entrepreneurs receives government assistance

Estimation terminated at iteration number 5 because Log Likelihood decreased by less than .01 percent.

-2 Log Likelihood	165.302
Goodness of Fit	183.865

	Chi-Square	df	Significance
Model Chi-Square	107.752	28	.0000
Improvement	107.752	28	.0000

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Classification Table for Z

Observed		Predicted non n	Predicted innovative firms i	Percent correct
non	n	80	20	80.60%
innovative firms	i	18	79	81.44%
			Overall	80.71%

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---------- Variables in the Equation ----------

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
AGE	-.0525	.0353	2.2145	1	.1367	-.0280	.9489
SEX(1)	.0091	.2505	.0013	1	.9711	.0000	1.0091
EDU	-.0473	.0850	.3207	1	.5712	.0000	.9538
MANAGE	-.0852	.0800	1.355	1	.2866	.0000	.9183
PREXP	.0810	.0409	3.9182	1	.0478	.0838	1.0844
NACH	.0523	.6224	.0071	1	.9330	.0000	1.0537
RISKS	.4850	.3834	1.5996	1	.2060	.0000	1.6241
LOC	.1695	.6080	.0777	1	.7804	.0000	1.1847
COURSE	.9498	.3834	6.1375	1	.0132	.1231	2.5853
KNOW(1)	.3168	.3485	.8264	1	.3633	.0000	1.3727
SIZE	.0872	.0453	3.7150	1	.0539	.0793	1.0912
FORMAL	-.0166	.5400	.0009	1	.9754	.0000	.9835
CENTRAL	.0104	.0094	1.2087	1	.2716	.0000	1.0104
COMPLEX	.4312	.3273	1.6288	1	.2035	.0000	1.5429
FINANCE	-.5095	.2814	3.2778	1	.0702	-.0684	.6008
YESB	-.0724	.0726	.9939	1	.3188	.0000	.9302
FATURN89	.0006	.0668	.0001	1	.9923	.0000	.9994
ROI89	-.0292	.1111	.0693	1	.7924	.0000	.9712
PROD89	.0121	.0222	.2976	1	.5854	.0000	1.0122
MISMATCH	.0773	.2051	.1422	1	.7061	.0000	1.0804
COMMU	.3143	.2243	1.9638	1	.1611	.0000	1.3693
BUY	-.7768	.6200	1.5694	1	.2103	.0000	.4599
MAC	.3717	.6297	.3484	1	.5550	.0000	1.4501
MA_COST	-.0148	.0078	3.6258	1	.0569	-.0772	.9853
COMB(1)	-.3001	.2693	1.2418	1	.2651	.0000	.7407
COMM(1)	-.0361	.3272	.0122	1	.9121	.0000	.9645
INST	.0893	.1513	.1743	1	.6298	.0000	1.0421
ASSIS(1)	1.6782	.3582	22.6254	1	.0000	.2748	5.3557
Constant	.4116	3.9714	.0107	1	.9175		

APPENDIX IV

Correlation Coefficients of Independent Variables in Logistic Function for All Firms

SPSS for MS WINDOWS Release 6.0

File: SPSS/PC+ System File Written by Data Entry II

-- Correlation Coefficients --

	AGE	EDU	MANAGE	PREXP	NACH	LOC
AGE	1.0000	-.5102**	.4730**	3372**	.0174	.0596
EDU	-.5102**	1.0000	-.3990**	-.0114	.0461	.0202
MANAGE	.4730**	-.3990**	1.0000	-.1295	.0668	-.0818
PREXP	.3372**	-.0114	-.1295	1.0000	.1141	.1888**
NACH	.0174	.0461	.0668	.1141	1.0000	.5591**
LOC	.0596	.0202	-.0818	.1888**	.5591**	1.0000
RISKS	-.2158**	.1470*	-.1528*	-.0010	.0685	.0455
COURSE	-.2125**	.2482**	-.1284	-.0037	.2912**	.1105
SIZE	.0219	.1399*	.1446*	.1093	.1287	.1056
CENTRAL	.2099**	-.2421**	.1477*	.0486	-.0608	-.0773
FORMAL	-.0531	.1233	.0230	-.1493*	-.0648	-.0964
COMPLEX	-.1030	.1884**	.0557	.0116	.0903	.0435
FINANCE	-.0557	-.0304	.0305	.0343	-.2008**	-.1183
YESB	.3424**	-.2794**	.8201**	-.0370	.0663	-.0086
FATURN89	-.2032**	.1269	-.1183	-.0405	.0394	.0139
ROI89	-.1642	.0527	-.0825	-.0262	-.0172	-.0076
PROD89	-.0413	.2229**	.0463	.0452	.0665	.0218
MISMATCH	-.1755*	.0791	-.0681	.0214	.2493**	.1753*
COMMU	-.0946	.2594**	-.0267	.0635	.3248**	.1200
BUY	-.1009	.0820	-.0791	-.0399	-.1502*	-.2010**
MAC	-.0009	-.0274	.0283	.0204	.2738**	.1763*
MA_COST	-.1209	.1425*	-.0459	.0141	.2353**	.2316**
INST	-.1617*	.2626**	-.0367	-.0819	.2669**	.0898

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)
" . " is printed if a coefficient cannot be computed

SPSS for MS WINDOWS Release 6.0

File: SPSS/PC+ System File Written by Data Entry II

-- Correlation Coefficients --

	RISKS	COURSE	SIZE	CENTRAL	FORMAL	COMPLEX
AGE	-.2158**	-.2125**	.0219	.2099**	-.0531	-.1030
EDU	.1470*	.2482**	.1399*	-.2421**	.1233	.1884**
MANAGE	-.1528*	-.1284	.1446*	.1477*	.0230	.0557
PREXP	-.0010	-.0037	.1093	.0486	-.1493*	.0116
NACH	.0685	.2912**	.1287	-.0608	-.0648	.0903
LOC	.0455	.1105	.1056	-.0773	-.0964	.0435
RISKS	1.0000	.1616*	.1163	-.2240**	.0177	.1043
COURSE	.1616*	1.0000	.0107	-.1084	-.0002	.1089
SIZE	.1163	.0107	1.0000	-.1837**	.0860	.5001**
CENTRAL	-.2240**	-.1084	-.1837**	1.0000	-.1190	-.2255**
FORMAL	.0177	-.0002	.0860	-.1190	1.0000	.1000
COMPLEX	.1043	.1089	.5001**	-.2255**	.1000	1.0000
FINANCE	-.0251	-.0574	-.2421**	.1726*	-.0654	-.2379**
YESB	-.1024	-.1523*	.3428**	.0482	.0447	.1491*
FATURN89	.1331	.1512*	.0391	-.0085	.0509	.0169
ROI89	.1521*	.0172	.0333	.0672	.0266	.0176
PROD89	.0328	.1470*	-.0232	-.0021	-.1012	.0650
MISMATCH	.1407*	.1634*	.0874	.0346	-.0522	.1674*
COMMU	.2105**	.4186**	.3369**	-.0994	-.0276	.2154**
BUY	.1112	-.0510	-.1196	.0579	.0172	.0140
MAC	.1924**	-.0095	.1845**	-.2451**	.1137	.0666
MA_COST	.1558*	.3704**	.2336**	-.1810*	.0013	.3005**
INST	.1420*	.8740**	.0274	-.0636	-.0001	.1190

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

SPSS for MS WINDOWS Release 6.0

File: SPSS/PC+ System File Written by Data Entry II

-- Correlation Coefficients --

	FINANCE	YESB	FATURN89	ROI89	PROD89	MISMATCH
AGE	-.0557	.3424**	-.2032**	-.1642*	-.0413	-.1755*
EDU	-.0304	-.2794**	.1269	.0527	.2229**	.0791
MANAGE	.0305	.8201**	-.1183	-.0825	.0463	-.0681
PREXP	.0343	-.0370	-.0405	-.0262	.0452	.0214
NACH	-.2008**	.0663	.0394	-.0172	.0665	.2493**
LOC	-.1183	-.0086	.0139	-.0076	.0218	.1753*
RISKS	-.0251	-.1024	.1331	.1521*	.0328	.1407*
COURSE	-.0574	-.1523*	.1512*	.0172	.1470*	.1634*
SIZE	-.2421**	.3428**	.0391	.0333	-.0232	.0874
CENTRAL	.1726*	.0482	-.0085	.0672	-.0021	.0346
FORMAL	-.0654	.0447	.0509	.0266	-.1012	-.0522
COMPLEX	-.2379**	.1491*	.0169	.0176	.0650	.1674*
FINANCE	1.0000	-.0052	.0224	.0304	.0795	.0387
YESB	-.0052	1.0000	-.0156	-.0217	.0784	-.0577
FATURN89	.0224	-.0156	1.0000	.8340**	.1275	.2257**
ROI89	.0304	-.0217	.8340**	1.0000	.1540*	.1972**
PROD89	.0795	.0784	.1275	.1540*	1.0000	.0129
MISMATCH	.0387	-.0577	.2257**	.1972**	.0129	1.0000
COMMU	-.2060**	.0240	.0378	-.0425	.2163**	.1481*
BUY	.2852**	-.0242	.0819	.0666	.0069	.2170**
MAC	-.2603**	.0310	-.1187	-.0787	-.1255	.0186
MA_COST	-.1276	-.0544	-.0362	-.0688	.0088	.1278
INST	-.0542	-.0720	.0742	-.0068	.2140**	.1268

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

SPSS for MS WINDOWS Release 6.0

File: SPSS/PC+ System File Written by Data Entry II

-- Correlation Coefficients --

	COMMU	BUY	MAC	MA_COST	INST
AGE	-.0946	-.1009	-.0009	-.1209	-.1617*
EDU	.2594**	.0820	-.0274	.1425*	.2626**
MANAGE	-.0267	-.0791	.0283	-.0459	-.0367
PREXP	.0635	-.0399	.0204	.0141	-.0819
NACH	.3248**	-.1502*	.2738**	.2353**	.2669**
LOC	.1200	-.2010**	.1763*	.2316**	.0898
RISKS	.2105**	.1112	.1924**	.1558*	.1420*
COURSE	.4186**	-.0510	-.0095	.3704**	.8740**
SIZE	.3369**	-.1196	.1845**	.2336**	.0274
CENTRAL	-.0994	.0579	-.2451**	-.1810*	-.0636
FORMAL	-.0276	.0172	.1137	.0013	-.0001
COMPLEX	.2154**	.0140	.0666	.3005**	.1190
FINANCE	-.2060**	.2852**	-.2603**	-.1276	-.0542
YESB	.0240	-.0242	.0310	-.0544	-.0720
FATURN89	.0378	.0819	-.1187	-.0362	.0742
ROI89	-.0425	.0666	-.0787	-.0688	-.0068
PROD89	.2163**	.0069	-.1255	.0088	.2140**
MISMATCH	.1481*	.2170**	.0186	.1278	.1268
COMMU	1.0000	-.0089	.0872	.3133**	.5256**
BUY	-.0089	1.0000	-.0964	-.0208	-.0441
MAC	.0872	-.0964	1.0000	.0875	-.0595
MA_COST	.3133**	-.0208	.0875	1.0000	.3623**
INST	.5256**	-.0441	-.0595	.3623**	1.0000

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

APPENDIX V

Correlation Coefficients of Independent Variables in Logistic Regression Function for Tiny Firms

SPSS/PC+ System File Written by Data Entry II

-- Correlation Coefficients --

	AGE	EDU	MANAGE	PREXP	NACH	LOC
AGE	1.0000	-.3715**	.3472**	.3544**	-.0452	.0935
EDU	-.3715**	1.0000	-.2877**	.0915	.2242*	.1434
MANAGE	.3472**	-.2877**	1.0000	-.0750	.0705	-.0679
PREXP	.3544**	.0915	-.0750	1.0000	.1459	.2534*
NACH	-.0452	.2242*	.0705	.1459	1.0000	.4937**
LOC	.0935	.1434	-.0679	.2534*	.4937**	1.0000
RISKS	-.2365*	.1619	-.2255*	.1295	.2765**	.2001
COURSE	-.1890	.2602*	-.1620	.0383	.3489**	.0792
SIZE	.0100	.2205*	.0337	-.0269	.0890	.0660
CENTRAL	.1409	-.1077	.2362*	-.0194	-.0864	.0186
FORMAL	.0237	.1358	-.1854	-.0919	.0965	.0987
COMPLEX	.1631	.1443	.0821	.2243*	.1886	.0963
FINANCE	-.1941	.1458	-.0903	.2069*	.0456	.1073
YESB	.1787	-.1715	.7599**	-.0229	.0291	.0211
FATURN89	-.1754	.1522	-.1278	.0088	.2113*	.1520
ROI89	-.1470	.0204	-.0721	.0400	.1428	.1210
PROD89	-.0919	.3606**	.0407	.0343	.2973**	.2000
MISMATCH	-.0967	.0583	.0245	.0814	.3638**	.1170
COMMU	-.2921**	.3518**	-.2012	-.0837	.2740**	.0347
BUY	-.1655	.0977	-.3225**	.0223	-.0881	-.1685
MAC	-.1179	.2248*	.0504	-.0639	.2501*	.0968
MA_COST	-.1359	.1290	-.0126	-.0067	.3299**	.0839
INST	-.1919	.2735**	-.0524	-.0608	.3538**	.1307

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

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-- Correlation Coefficients --

	RISKS	COURSE	SIZE	CENTRAL	FORMAL	COMPLEX
AGE	-.2365*	-.1890	.0100	.1409	.0237	.1631
EDU	.1619	.2602*	.2205*	-.1077	.1358	.1443
MANAGE	-.2255*	-.1620	.0337	.2362*	-.1854	.0821
PREXP	.1295	.0383	-.0269	-.0194	-.0919	.2243*
NACH	.2765**	.3489**	.0890	-.0864	.0965	.1886
LOC	.2001	.0792	.0660	.0186	.0987	.0963
RISKS	1.0000	.2887**	.2061	-.2538*	-.0524	.1915
COURSE	.2887**	1.0000	-.0423	-.0729	.0543	.0769
SIZE	.2061	-.0423	1.0000	-.1515	.0741	.2266*
CENTRAL	-.2538*	-.0729	-.1515	1.0000	-.0747	.0669
FORMAL	-.0524	.0543	.0741	-.0747	1.0000	.2397*
COMPLEX	.1915	.0769	.2266*	.0669	.2397*	1.0000
FINANCE	.0806	.1828	.0769	-.0599	-.0205	.1773
YESB	-.1866	-.2340*	.0460	.2264*	-.1583	-.0617
FATURN89	.2720**	.1725	.1301	.0580	.0617	.0855
ROI89	.2615*	.0008	.1186	.0860	.0306	.1060
PROD89	.0808	.2536*	.0148	.0222	-.1281	.0807
MISMATCH	.1904	.1227	.1154	.0705	.0415	.0694
COMMU	.3575**	.5105**	.1688	-.1122	.0369	.0021
BUY	.0855	-.1033	.0969	-.1300	.0552	.0616
MAC	.2670*	.0395	.1390	-.2854**	.0745	-.0187
MA_COST	.0770	.4603**	.0456	-.2599*	.0433	.0289
INST	.2632*	.9002**	-.0315	-.0586	.0240	.0056

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

SPSS for MS WINDOWS Release 6.0

File: SPSS/PC+ System File Written by Data Entry II

-- Correlation Coefficients --

	FINANCE	YESB	FATURN89	ROI89	PROD89	MISMATCH
AGE	-.1941	.1787	-.1754	-.1470	-.0919	-.0967
EDU	.1458	-.1715	.1522	.0204	.3606**	.0583
MANAGE	-.0903	.7599**	-.1278	-.0721	.0407	.0245
PREXP	.2069*	-.0229	.0088	.0400	.0343	.0814
NACH	.0456	.0291	.2113*	.1428	.2973**	.3638**
LOC	.1073	.0211	.1520	.1210	.2000	.1170
RISKS	.0806	-.1866	.2720**	.2615*	.0808	.1904
COURSE	.1828	-.2340*	.1725	.0008	.2536*	.1227
SIZE	.0769	.0460	.1301	.1186	.0148	.1154
CENTRAL	-.0599	.2264*	.0580	.0860	.0222	.0705
FORMAL	-.0205	-.1583	.0617	.0306	-.1281	.0415
COMPLEX	.1773	-.0617	.0855	.1060	.0807	.0694
FINANCE	1.0000	-.0386	.0492	-.0009	-.0756	.1920
YESB	-.0386	1.0000	-.0751	-.0481	.0149	-.0714
FATURN89	.0492	-.0751	1.0000	.8217**	.2471*	.2033
ROI89	-.0009	-.0481	.8217**	1.0000	.2162*	.1876
PROD89	-.0756	.0149	.2471*	.2162*	1.0000	-.0151
MISMATCH	.1920	-.0714	.2033	.1876	-.0151	1.0000
COMMU	-.0182	-.1316	.2340*	.0160	.2204*	.1064
BUY	.2366*	-.1522	.1603	.0663	-.0632	.2530*
MAC	-.0645	.0530	-.1002	-.0456	-.1281	.0724
MA_COST	.1697	-.0649	.1265	-.0029	.1311	.2372*
INST	.1382	-.1343	.1226	-.0057	.2525*	.0530

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

SPSS for MS WINDOWS Release 6.0

File: SPSS/PC+ System File Written by Data Entry II

-- Correlation Coefficients --

	COMMU	BUY	MAC	MA_COST	INST
AGE	-.2921**	-.1655	-.1179	-.1359	-.1919
EDU	.3518**	.0977	.2248*	.1290	.2735**
MANAGE	-.2012	-.3225**	.0504	-.0126	-.0524
PREXP	-.0837	.0223	-.0639	-.0067	-.0608
NACH	.2740**	-.0881	.2501*	.3299**	.3538**
LOC	.0347	-.1685	.0968	.0839	.1307
RISKS	.3575**	.0855	.2670*	.0770	.2632*
COURSE	.5105**	-.1033	.0395	.4603**	.9002**
SIZE	.1688	.0969	.1390	.0456	-.0315
CENTRAL	-.1122	-.1300	-.2854**	-.2599*	-.0586
FORMAL	.0369	.0552	.0745	.0433	.0240
COMPLEX	.0021	.0616	-.0187	.0289	.0056
FINANCE	-.0182	.2366*	-.0645	.1697	.1382
YESB	-.1316	-.1522	.0530	-.0649	-.1343
FATURN89	.2340*	.1603	-.1002	.1265	.1226
ROI89	.0160	.0663	-.0456	-.0029	-.0057
PROD89	.2204*	-.0632	-.1281	.1311	.2525*
MISMATCH	.1064	.2530*	.0724	.2372*	.0530
COMMU	1.0000	.0771	.0676	.2889**	.5058**
BUY	.0771	1.0000	-.0706	-.0571	-.1886
MAC	.0676	-.0706	1.0000	.0993	-.0229
MA_COST	.2889**	-.0571	.0993	1.0000	.4586**
INST	.5058**	-.1886	-.0229	.4586**	1.0000

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

APPENDIX VI

Correlation Coefficients of Independent Variables of Logistic Regression Function for Small Firms

SPSS for MS WINDOWS Release 6.0

File: SPSS/PC+ System File Written by Data Entry II
-- Correlation Coefficients --

	AGE	EDU	MANAGE	PREXP	NACH	LOC
AGE	1.0000	-.6147**	.5380**	.3265**	.0463	.0218
EDU	-.6147**	1.0000	-.4696**	-.0794	-.0921	-.0725
MANAGE	.5380**	-.4696**	1.0000	-.1615	.0453	-.1115
PREXP	.3265**	-.0794	-.1615	1.0000	.0911	.1431
NACH	.0463	-.0921	.0453	.0911	1.0000	.5978**
LOC	.0218	-.0725	-.1115	.1431	.5978**	1.0000
RISKS	-.2283*	.1195	-.1586	-.1101	.1471	.1085
COURSE	-.2365*	.2365*	-.1274	-.0336	.2433*	.1242
SIZE	-.0325	.1289	.1096	.1767	.0824	.0675
CENTRAL	.2785**	-.3092**	.1410	.0968	-.0119	-.1180
CEN-R	.2833**	-.2915**	.1546	.1558	.0026	-.1143
FORMAL	-.1116	.1104	.1038	-.1903	-.1939*	-.2385*
COMPLEX	-.1963*	.2016*	.0182	-.0124	.0455	.0019
COM-R	-.1916*	.1599	-.0323	-.0404	-.0005	-.0562
FINANCE	.0751	-.1092	.1339	-.0933	-.3412**	-.2382*
FIN-R	.0733	-.0923	.1685	-.0816	-.3242**	-.2261*
YESB	.4161**	-.3549**	.8342**	-.0457	.0536	-.0510
YESB-R	.4882**	-.4607**	.8454**	-.0709	.0147	-.0803
FATURN89	-.2277*	.1122	-.1210	-.0839	-.1116	-.1000
ROI89	-.1952*	.0968	-.1049	-.1112	-.2180*	-.1583
PROD89	.0110	.1570	.0733	.0538	-.0774	-.0813
MISMATCH	-.2513**	.0841	-.1335	-.0280	.1381	.2091*
COMMU	-.0193	.1949*	-.0062	.1560	.3259**	.1326
BUY	-.0473	.0820	.0372	-.0863	-.1843	-.2142*
MAC	.0550	.0718	-.0231	.0895	.2518**	.2010*
MA_COST	-.1474	.1385	-.0784	.0227	.2008*	.2773**
INST	-.1451	.2554**	-.0345	-.0967	.2066*	.0604

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

SPSS for MS WINDOWS Release 6.0

File: SPSS/PC+ System File Written by Data Entry II
- - Correlation Coefficients - -

	RISKS	COURSE	SIZE	CENTRAL	CEN-R
AGE	-.2283*	-.2365*	-.0325	.2785**	.2833**
EDU	.1195	.2365*	.1289	-.3092**	-.2915**
E7	-.1586	-.1274	.1096	.1410	.1546
PREXP	-.1101	-.0336	.1767	.0968	.1558
NACH	.1471	.2433*	.0824	-.0119	.0026
LOC	.1085	.1242	.0675	-.1180	-.1143
RISKS	1.0000	.0546	.0356	-.1730	-.1700
COURSE	.0546	1.0000	-.0217	-.1221	-.1180
SIZE	.0356	-.0217	1.0000	-.1580	.0385
CENTRAL	-.1730	-.1221	-.1580	1.0000	.9779**
CEN-R	-.1700	-.1180	.0385	.9779**	1.0000
FORMAL	.0578	-.0395	.0859	-.1381	-.1365
COMPLEX	.0571	.1193	.4216**	-.2591**	-.1846
COM-R	.0404	.1594	.0427	-.2205*	-.2157*
FINANCE	-.0368	-.2047*	-.1730	.2811**	.2476*
FIN-R	-.0390	-.2163*	.0054	.2596**	.2624**
YESB	-.1123	-.1366	.3428**	.0096	.0706
YESB-R	-.1509	-.1496	.0078	.0895	.0852
FATURN89	.0079	.1366	.0634	-.0636	-.0501
ROI89	.0230	.0399	.0769	.0475	.0639
PROD89	.0317	.0864	.0700	-.0480	-.0205
MISMATCH	.0765	.1896	.0636	.0282	.0474
COMMU	.0685	.3724**	.2926**	-.0448	.0357
BUY	.1542	-.0100	-.1377	.1692	.1490
MAC	.0708	-.0672	.0818	-.1750	-.1581
MA_COST	.1682	.3655**	.1822	-.1428	-.1214
INST	.0508	.8581**	.0286	-.0636	-.0447

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

SPSS for MS WINDOWS Release 6.0

File: SPSS/PC+ System File Written by Data Entry II
-- Correlation Coefficients --

	FORMAL	COMPLEX	COM-R	FINANCE	FIN-R	YESB
AGE	-.1116	-.1963*	-.1916*	.0751	.0733	.4161**
EDU	.1104	.2016*	.1599	-.1092	-.0923	-.3549**
MANAGE	.1038	.0182	-.0323	.1339	.1685	.8342**
PREXP	-.1903	-.0124	-.0404	-.0933	-.0816	-.0457
NACH	-.1939*	.0455	-.0005	-.3412**	-.3242**	.0536
LOC	-.2385*	.0019	-.0562	-.2382*	-.2261*	-.0510
RISKS	.0578	.0571	.0404	-.0368	-.0390	-.1123
COURSE	-.0395	.1193	.1594	-.2047*	-.2163*	-.1366
SIZE	.0859	.4216**	.0427	-.1730	.0054	.3428**
CENTRAL	-.1381	-.2591**	-.2205*	.2811**	.2596**	.0096
CEN-R	-.1365	-.1846	-.2157*	.2476*	.2624**	.0706
FORMAL	1.0000	.0875	.0535	-.0779	-.0593	.1218
COMPLEX	.0875	1.0000	.9034**	-.2527**	-.1826	.1239
COM-R	.0535	.9034**	1.0000	-.1911*	-.1919*	-.0129
FINANCE	-.0779	-.2527**	-.1911*	1.0000	.9795**	.0776
FIN-R	-.0593	-.1826	-.1919*	.9795**	1.0000	.1579
YESB	.1218	.1239	-.0129	.0776	.1579	1.0000
YESB-R	.1101	-.0233	-.0307	.1489	.1589	.9204**
FATURN89	.0437	.0170	-.0035	-.0033	.0176	.0174
ROI89	.0266	.0213	-.0159	.0614	.0915	-.0001
PROD89	-.0741	.1350	.1535	.1398	.1753	.1452
MISMATCH	-.1301	.1995*	.2185*	-.0432	-.0244	-.0768
COMMU	-.0836	.1853	.0957	-.2315*	-.1701	.0223
BUY	-.0027	.0399	.1112	.3078**	.2989**	.0494
MAC	.1279	-.0060	-.0477	-.3273**	-.3164**	-.0410
MA_COST	-.0227	.2848**	.2136*	.1785	-.1623	-.0907
INST	-.0167	.1523	.1710	-.1776	-.1704	-.0534

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

SPSS for MS WINDOWS Release 6.0

File: SPSS/PC+ System File Written by Data Entry II
-- Correlation Coefficients --

	YESB-R	FATURN89	ROI89	PROD89	MISMATCH
AGE	.4882**	-.2277*	-.1952*	.0110	-.2513**
EDU	-.4607**	.1122	.0968	.1570	.0841
MANAGE	.8454**	-.1210	-.1049	.0733	-.1335
PREXP	-.0709	-.0839	-.1112	.0538	-.0280
NACH	.0147	-.1116	-.2180*	-.0774	.1381
LOC	-.0803	-.1000	-.1583	-.0813	.2091*
RISKS	-.1509	.0079	.0230	.0317	.0765
COURSE	-.1496	.1366	.0399	.0864	.1896
SIZE	.0078	.0634	.0769	.0700	.0636
CENTRAL	.0895	-.0636	.0475	-.0480	.0282
CEN-R	.0852	-.0501	.0639	-.0205	.0474
FORMAL	.1101	.0437	.0266	-.0741	-.1301
COMPLEX	-.0233	.0170	.0213	.1350	.1995*
COM-R	-.0307	-.0035	-.0159	.1535	.2185*
FINANCE	.1489	-.0033	.0614	.1398	-.0432
FIN-R	.1589	.0176	.0915	.1753	-.0244
YESB	.9204**	.0174	-.0001	.1452	-.0768
YESB-R	1.0000	-.0164	-.0546	.0957	-.1380
FATURN89	-.0164	1.0000	.8832**	.0268	.2496**
ROI89	-.0546	.8832**	1.0000	.0872	.2253*
PROD89	.0957	.0268	.0872	1.0000	.0538
MISMATCH	-.1380	.2496**	.2253*	.0538	1.0000
COMMU	-.0990	-.0876	-.0974	.2809**	.1528
BUY	.0463	.0160	.0695	.0426	.2007*
MAC	-.0720	-.1380	-.1206	-.0770	-.0624
MA_COST	-.1371	-.1003	-.1222	.0011	.0868
INST	-.0833	.0377	-.0079	.1953*	.1804

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

SPSS for MS WINDOWS Release 6.0

File: SPSS/PC+ System File Written by Data Entry II
-- Correlation Coefficients --

	COMMU	BUY	MAC	MA_COST	INST
AGE	-.0193	-.0473	.0550	-.1474	-.1451
EDU	.1949*	.0820	.0718	.1385	.2554**
MANAGE	-.0062	.0372	-.0231	-.0784	-.0345
PREXP	.1560	-.0863	.0895	.0227	-.0967
NACH	.3259**	-.1843	.2518**	.2008*	.2066*
LOC	.1326	-.2142*	.2010*	.2773**	.0604
RISKS	.0685	.1542	.0708	.1682	.0508
COURSE	.3724**	-.0100	-.0672	.3655**	.8581**
SIZE	.2926**	-.1377	.0818	.1822	.0286
CENTRAL	-.0448	.1692	-.1750	-.1428	-.0636
CEN-R	.0357	.1490	-.1581	-.1214	-.0447
FORMAL	-.0836	-.0027	.1279	-.0227	-.0167
COMPLEX	.1853	.0399	-.0060	.2848**	.1523
COM-R	.0957	.1112	-.0477	.2136*	.1710
FINANCE	-.2315*	.3078**	-.3273**	.1785	-.1776
FIN-R	-.1701	.2989**	-.3164**	-.1623	-.1704
YESB	.0223	.0494	-.0410	-.0907	-.0534
YESB-R	-.0990	.0463	-.0720	-.1371	-.0833
FATURN89	-.0876	.0160	-.1380	-.1003	.0377
ROI89	-.0974	.0695	-.1206	-.1222	-.0079
PROD89	.2809**	.0426	-.0770	.0011	.1953*
MISMATCH	.1528	.2007*	-.0624	.0868	.1804
COMMU	1.0000	-.0318	.0078	.2934**	.5568**
BUY	-.0318	1.0000	-.0928	.0045	.0531
MAC	.0078	-.0928	1.0000	.0375	-.0966
MA_COST	.2934**	.0045	.0375	1.0000	.3597**
INST	.5568**	.0531	-.0966	.3597**	1.0000

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

APPENDIX VII

Logistic Regression Function of Tiny Firms

Total number of cases: 91 (Unweighted)
Number of selected cases: 91
Number of unselected cases: 0

Number of selected cases: 91
Number rejected because of missing data: 0
Number of cases included in the analysis: 91

Dependent Variable Encoding:

Original Value	Internal Value
.00	0
1.00	1

	Value	Freq	Parameter Coding (1)
ASSIS			
yes	1.00	22	1.000
no	2.00	69	-1.000
KNOW			
yes	1.00	78	-1.000
no	2.00	13	1.000
COMB			
yes	1.00	55	1.000
no	2.00	36	-1.000
COMM			
yes	1.00	14	1.000
no	2.00	77	-1.000
SEX			
male	1.00	59	1.000
female	2.00	32	-1.000

Note: Category variable(s) with 0,1-values have been recoded using the above coding scheme. Parameter estimates are not the same as for indicator(0,1) variables.

Dependent Variable.. Z regroup resp. into two groups

Beginning Block Number 0. Initial Log Likelihood Function

-2 Log Likelihood 119.75714

* Constant is included in the model.

Beginning Block Number 1. Method: Enter

Variable(s) Entered on Step Number

1..	AGE	age of entrepreneurs
	SEX	sex of entrepreneurs
	EDU	years in formal education
	MANAGE	number of years managing the existing firm (e7)
	PREXP	years of previous work experience
	NACH	score of need for achievement
	LOC	score of locus of control
	RISKS	score of risk attitute of entrepreneur
	COURSE	number of course attended (course_i)
	KNOW(1)	study in detail about innovation (B19.0_T)
	FORMAL	formalisation of firm
	CENTRAL	centralisation of firm
	COMPLEX	complexity of firm
	FINANCE	degree of financing problems (FIN_PROB)
	YESB	firms' age (YESB1)
	FATURN89	fixed asset turnover for year 1989
	ROI89	return on investment for year 1989
	PROD89	productivity (valueadded/number of worker) for year 1989
	MISMATCH	mismatch between employee and innovation
	COMMU	communication index (As.,maj.,exp.,sem.) (COMMU_A)
	BUY	degree of problems in the buying process
	MAC	entrepreneurs' perception of the innovation
	MA_COST	cost of the technology adopted or technology considered to be adopted
	COMB	big firms are the main competitors
	COMM	medium sized firms are the main competitors
	INST	institutional involvement index (INST_A)
	ASSIS	entrepreneurs received government assistance

Estimation terminated at iteration number 9 because
Log Likelihood decreased by less than .01 percent.

-2 Log Likelihood	34.322
Goodness of Fit	73.618

	Chi-Square	df	Significance
Model Chi-Square	85.435	27	.0000
Improvement	85.435	27	.0000

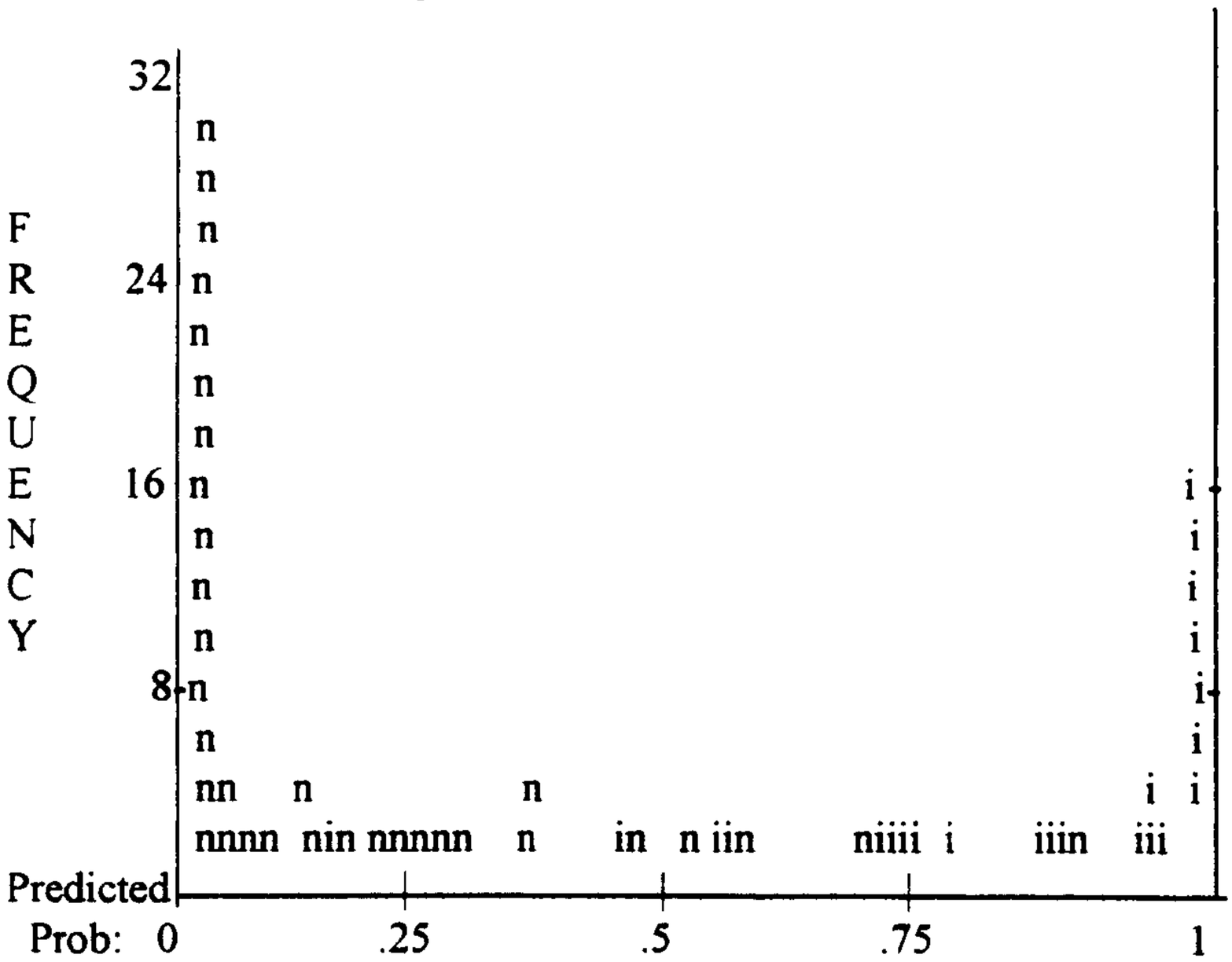
Classification Table for Z

		Predicted non n	Predicted innovate firm le i	Percent Correct
Observed non	n	48	3	94.12%
innovate firm le	i	5	35	87.50%
			Overall	91.20%

---------- Variables in the Equation ----------

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
AGE	-.5314	.2534	4.2892	1	.0372	-.1342	.6021
SEX(1)	4.2033	2.3115	3.7821	1	.0654	.1281	73.9152
EDU	.6873	.4314	2.6303	1	.1126	.0730	.4992
MANAGE	-1.3014	.7975	2.7213	1	.1035	-.0825	.2791
PREXP	.4017	.3084	1.6276	1	.1796	.0000	1.4884
NACH	5.8232	2.9167	4.1356	1	.0487	.1352	336.0342
LOC	-3.1257	1.5085	1.3062	1	.2531	.0000	.0439
RISKS	4.1245	2.3014	3.4501	1	.0820	.1187	.0224
COURSE	5.4562	3.1271	3.2132	1	.0927	.1265	.0154
KNOW(1)	1.7276	1.5942	1.1744	1	.2785	.0000	.1777
FORMAL	1.3433	2.4584	.2986	1	.5848	.0000	3.8318
CENTRAL	.0796	.0620	1.6456	1	.1996	.0000	1.0828
COMPLEX	1.4185	2.9304	.2343	1	.6283	.0000	.2421
FINANCE	-3.9956	1.4823	2.3832	1	.1178	-.0678	.1096
YESB	-1.8285	1.1282	2.6269	1	.0965	-.0724	.1607
FATURN89	-.0671	.7659	.0077	1	.9302	.0000	1.0694
ROI89	.6925	.9497	.5318	1	.4659	.0000	1.9988
PROD89	-.4198	.1543	4.6718	1	.0301	-.1452	.8712
MISMATCH	.5672	.3412	2.3451	1	.1382	.0420	1.7821
COMMU	1.5406	.6366	5.8574	1	.0155	.1782	4.6674
BUY	-2.3714	1.4132	2.8158	1	.0933	-.0819	.0933
MAC	2.4768	1.4519	2.9100	1	.0880	.0866	11.9028
MA_COST	-.1843	.1187	2.4154	1	.1091	-.0624	.9137
COMB(1)	.1764	.5761	.0937	1	.7595	.0000	.7781
COMM(1)	-2.8561	2.1321	1.5213	1	.1932	.0000	1.2317
INST	3.9542	2.0765	3.4567	1	.0612	.1045	85.6212
ASSIS(1)	1.7920	.6156	8.4748	1	.0036	.2309	6.0015
Constant	12.6761	26.8226	.2233	1	.6365		

Observed Groups and Predicted Probabilities



Predicted Probability is of Membership for innovate
Symbols: n - non
i - innovate firm
Each Symbol Represents 2 Cases.

CASE		Observed Z	Pred	PGroup	Resid	ZResid
17	S	i	.5821	i	.4179	.8474
22	S	i **	.4642	i	.6358	.8789
68	S	i **	.1151	n	.8849	2.7728
96	S	n	.4562	n	-.4562	-.9160
110	S	n **	.5834	i	-.5834	-1.1833
136	S	n **	.7122	i	-.7122	-1.5731
148	S	n **	.5170	i	-.5170	-1.0345
166	S	i **	.4406	n	.5594	1.1269
170	S	i **	.0537	n	.9463	4.1964
176	S	n **	.9046	i	-.9046	-3.0788

S=Selected U=Unselected cases
** = Misclassified cases

* Cases with studentized residuals greater than 2.0000000 are listed.

APPENDIX VIII

Logistic Regression Function of Small Firms

Total number of cases: 106 (Unweighted)
Number of selected cases: 106
Number of unselected cases: 0

Number of selected cases: 106
Number rejected because of missing data: 0
Number of cases included in the analysis: 106

Dependent Variable Encoding:

Original Value	Internal Value
.00	0
1.00	1

	Value	Freq	Parameter Coding (1)
ASSIS			
yes	1.00	15	1.000
no	2.00	91	-1.000
KNOW			
no	.00	82	1.000
yes	1.00	24	-1.000
COMB			
yes	1.00	55	1.000
no	2.00	51	-1.000
COMM			
yes	1.00	28	1.000
no	2.00	78	-1.000
SEX			
male	1.00	82	1.000
female	2.00	24	-1.000

Note: Category variable(s) with 0,1-values have been recoded using the above coding scheme. Parameter estimates are not the same as for indicator(0,1) variables.

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Dependent Variable.. Z regroup resp. into two groups

Beginning Block Number 0. Initial Log Likelihood Function

-2 Log Likelihood 143.828827

* Constant is included in the model.

Beginning Block Number 1. Method: Enter

Variable(s) Entered on Step Number

1..	AGE	age of entrepreneur
	SEX	sex of entrepreneur
	EDU	number of years in formal education
	MANAGE	number of years managing the existing firm (E7)
	PREXP	years of the previous work experience
	NACH	score of need for achievement
	LOC	score of locus of control
	RISKS	score of risk attitute of entrepreneur
	COURSE	number of courses attended (course-i)
	KNOW	study in detail about innovation (B19.1_T)
	SIZE	number of full time workers for year 1989 (WORKER89)
	FORMAL	formalisation of firm
	CEN-R	cenralisation of firms relative of firms' size (CE_REL_S)
	COM-R	complexity of firms relative to firms' size (CO_REL_S)
	FIN-R	degree of financing problem relative to firms' size (F1_REL_S)
	YESB-R	firms' age (years) relative to size (YS_REL_S)
	FATURN89	fixed asset turnover for year 1989
	ROI89	return on investment for year 1989
	PROD89	productivity (valueadded/number of workers) for year 1989
	MISMATCH	mismatch between employees and innovation
	COMMU	cummunication index (As,maj,exp,sem) (COMMU_A)
	BUY	degree of problem in buying sitution
	MAC	index measuring the perceived characteristics of machinery
	MA_COST	the cost of innovation
	COMB	big firms as is main competitors
	COMM	medium sized firms as competitors
	INST	index of institutional involvement (INST_A)
	ASSIS	whether entrepreneurs receive government assistance

Estimation terminated at iteration number 12 because
Log Likelihood decreased by less than .01 percent.

-2 Log Likelihood	41.989
Goodness of Fit	551.409

	Chi-Square	df	Significance
Model Chi-Square	101.839	28	.0000
Improvement	101.839	28	.0000

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Classification Table for Z

		Predicted non n	Predicted innovate firm le i	Percent Correct
Observed non	n	44	5	89.80%
innovate firm le	i	4	53	92.98%
			Overall	91.51%

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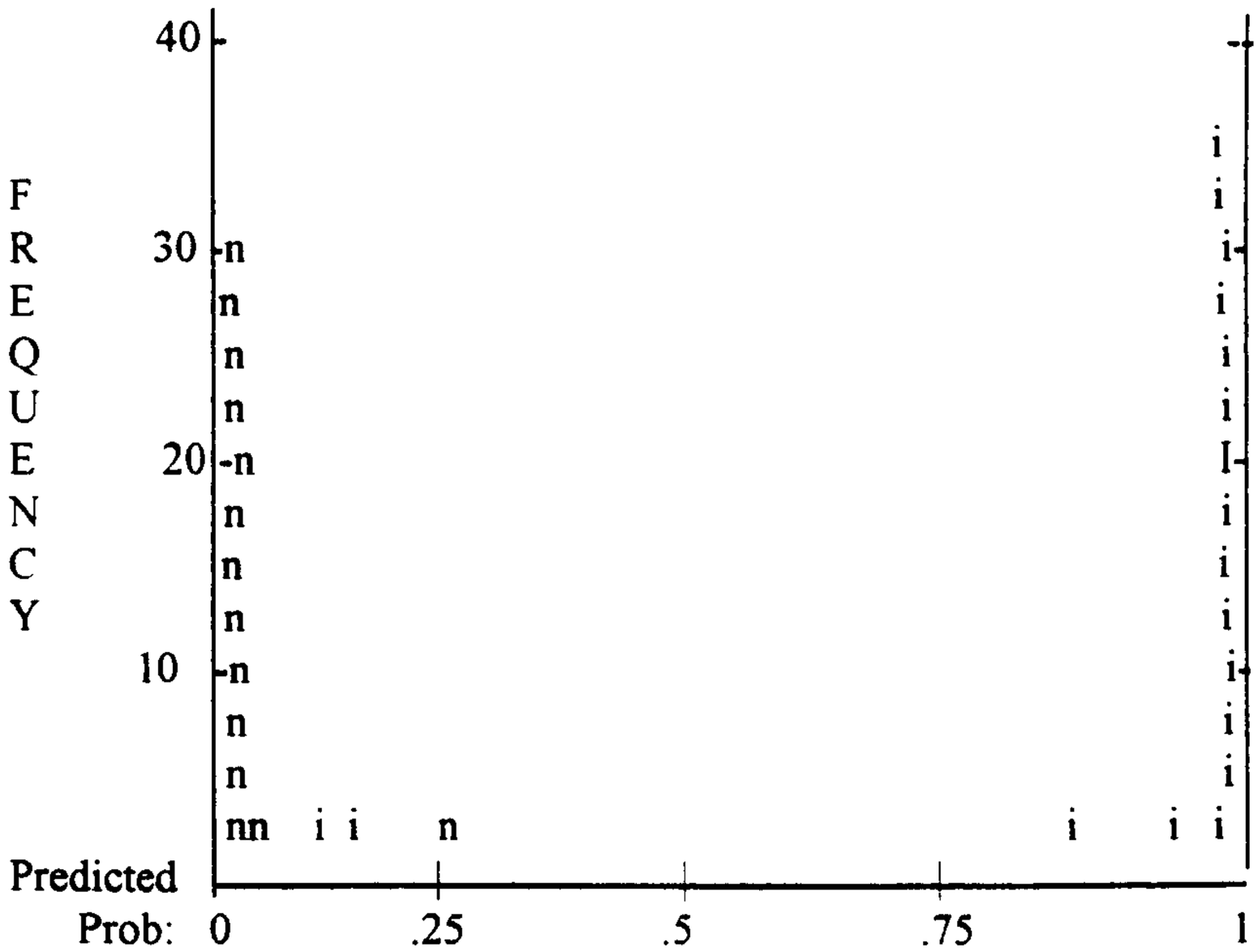
---------- Variables in the Equation ----------

Variable	B	S.E.	Wald	df	Sig.	R	Exp(B)
AGE	-2.1231	1.1585	2.9034	1	.0736	-.0897	.1987
SEX(1)	-.3339	.7857	.1806	1	.6709	.0000	1.3964
EDU	2.7812	1.8215	2.9124	1	.0995	.1032	.0587
MANAGE	-.2964	.1991	2.2170	1	.1365	- .0389	.7435
PREXP	.3329	.1605	4.3015	1	.0381	.1226	1.3951
NACH	3.1036	1.8638	2.7728	1	.0959	.0734	.0449
LOC	4.5434	2.0695	4.8198	1	.0281	.1402	94.0136
RISKS	2.4455	1.1361	4.6336	1	.0314	.1362	11.5359
COURSE	1.5135	.8031	3.5516	1	.0595	.1045	4.5428
KNOW(1)	.7951	.8712	.8327	1	.3615	.0000	2.2146
SIZE	.3798	.1347	7.9464	1	.0048	.2035	1.4620
FORMAL	-.4675	1.2432	.1414	1	.7069	.0000	.6266
CEN-R	- 4.7687	2.9461	2.6200	1	.1055	-.0657	117.7701
COM-R	2.2087	1.2522	3.1109	1	.0778	.0880	9.1037
FIN-R	-4.8028	2.2816	4.4312	1	.0353	-.1301	.0082
YESB-R	-.6368	1.8766	.1151	1	.7344	.0000	.5290
FATURN89	.4275	.2086	4.1995	1	.0404	.1238	1.5334
ROI89	-1.3989	.6259	4.9956	1	.0254	-.1445	.2460
PROD89	.3610	.1332	7.3476	1	.0067	.1930	1.4348
MISMATCH	.1385	.1206	1.3194	1	.2507	.0000	.8707
COMMU	1.1174	.7344	2.3153	1	.1281	.0468	.3271
BUY	-4.0715	2.1111	3.7195	1	.0538	-.1093	58.6432
MAC	1.0444	1.7431	.3590	1	.5490	.0000	.3519
MA_COST	-.0534	.0204	6.8478	1	.0089	-.1836	.9480
COMB(1)	.8663	.7691	1.2687	1	.2600	.0000	2.3780
COMM(1)	-1.1385	.9597	1.4074	1	.2355	.0000	3.1221
INST	2.0164	1.0417	3.7469	1	.0529	.1102	.1331
ASSIS(1)	4.1983	1.7274	5.9070	1	.0151	.1648	66.5740
Constant	17.5222	14.9854	1.3672	1	.2423		

SPSS for MS WINDOWS Release 6.0

Observed Groups and Predicted Probabilities



SPSS for MS WINDOWS Release 6.0

CASE	Observed					
	Z		Pred	PGroup	Resid	ZResid
9	S	i	.6925	i	.3075	.6664
23	S	i	.5773	i	.4227	.8557
27	S	i	.7657	i	.2343	.5532
40	S	i **	.1213	n	.8787	2.6921
43	S	i	.6061	i	.3939	.8061
51	S	i	.8767	i	.1233	.3751
57	S	i **	.4723	n	.5277	1.0570
58	S	n **	.7937	i	-.7937	-1.9614
71	S	n	.4326	n	-.4326	-.8732
73	S	n **	.6378	i	-.6378	-1.3270
76	S	n **	.6505	i	-.6505	-1.3644
77	S	n **	.5338	i	-.5338	-1.0700
79	S	n **	.5308	i	-.5308	-1.0637
83	S	i	.7820	i	.2180	.5281
95	S	n	.2621	n	-.2621	-.5959
101	S	i **	.0794	n	.9206	3.4054
172	S	i	.7115	i	.2885	.6368
174	S	i	.8354	i	.1646	.4439
182	S	i **	.9444	n	.0556	.2426
184	S	i	.7278	i	.2722	.6116

S=Selected U=Unselected cases

** = Misclassified cases

* Cases with studentized residuals greater than 2.0000000 are listed.

APPENDIX IX

Loan Schemes

Feasibility Study Scheme

Objective
The purpose of this scheme is to appoint a consultant to carry out a feasibility study:-

- o to modernise and increase the capacity of existing plants;
- o to increase production and improve product quality;

Eligible Expenses
Expenses eligible to be claimed are as follows:

- o service fee for the consultant undertaking the study which covers:-
  - data collection and analysis;
  - plant layout;
  - manufacturing process and marketing,
  - documentation cost.

Maximum Grant
The maximum grant for each study is RM10,000

Mode of Disbursement
The grant will be distributed in two stages on a reimbursement basis. The first disbursement will amount up to 50% of the cost incurred or up to 50% of the grant approved, whichever is lower. The balance of the grant will be disbursed after the report of the study has been submitted and *Bank Pembangunan* (Development Bank) is satisfied with the result of the study.

All claims for payment must be accompanied by supporting documents verified by an external auditor.

Conditions For Approval

Companies applying for the grant must satisfy the following conditions:-

- o The grant shall be utilised by SMI to engage consultants to conduct feasibility studies to:
  - Modernise and upgrade existing plants; and
  - Improve quality and increase productivity
- o The feasibility study must be a new one which has not been done before by any party;
- o The study is to be carried out by a local consultant company accredited by and registered with *Bank Pembangunan* or other agencies;
- o The consultant firm appointed by the applicant company to undertake the feasibility study must possess sufficient experience, knowledge and is capable of undertaking the study;
- o The applicant company must have the ability to implement the project if the study prove to be viable;
- o The company must possess the technical and management knowledge in the relevant field;
- o The company must be capable of supporting at least 50% of the cost of the project/study;
- o The company must possess production facility or have access to other facilities approved by the Government, such as the Technology Park and SIRIM, to carry out the project; and
- o The company must have a good business record with financial institutions and Government agencies.

Product Development and Design Scheme

Objectives

- o to improve local product development and design;
- o to build up indigenous technological know-how to develop new product/process;
- o to improve existing product/process

Eligible expenses

- o salary of technical manpower directly involved in product development;
- o cost of purchasing additional equipment for existing machinery;
- o cost of materials used for designing prototypes;
- o cost of acquiring technology/licence/patent/copyright/ prototype;
- o cost of packaging and documentation.
- o consultancy fees

Maximum Grant

The maximum grant for each study/project is RM100,000

Mode of Disbursement

The grant will be disbursed in two stages on a reimbursement basis. The first disbursement will amount up to 50% of the cost incurred or up to 50% of the grant approved, whichever is lower. The balance of the grant will be disbursed after completion of the project and submission of all claims and a project report.

All claims for payment must be accompanied by supporting documents verified by an external auditor.

Conditions For Approval

Companies applying for the grant must satisfy the following conditions:-

- o The proposed product must be of a high technical standard in the Malaysian context and conform to sound design practice;
- o The development team undertaking the project must possess in-depth knowledge of the technical and commercial aspects of the product and/or process;
- o The development work must be carried out in Malaysia by local engineers or designers. However, where appropriate foreign experts or consultants may be engaged to lead or supervise the project;
- o The project and/or process must be a marketable item and not a one-off project tailored to a particular customer;
- o Should a company decide to conduct a technical and/or marketing feasibility study to establish the viability of a proposed product/process, 50% of the related expenses can also be supported subject to a maximum grant of RM5,000;
- o A separate application is required for a feasibility study, Upon completion of the study, the applicant company can then apply for the grant to carry out the development phase of a project provided that the outcome of the feasibility study is positive;
- o A company must apply for the two phases simultaneously but the approval for the second (development) phase is conditional upon the positive outcome of the first (feasibility study) phase;
- o In cases where a feasibility study is not necessary, a company can

proceed to apply for support of the development phase;

- The company must possess the technical and management knowledge in the relevant field;
- The company must be capable of supporting at least 50% of the cost of the project/study;
- The company must possess production facility or have access to other facilities approved by the Government, such as the Technology Park and SIRIM, to carry out the project; and
- The company must have good business record with financial institutions and Government agencies

Quality and Productivity Improvement Scheme

Objectives

- to improve the quality assurance system in order to meet the requirements of the National Certification Scheme, the ISO 9000 as a recognition for 'Good Manufacturing Practice (GMP)' and other standard schemes of SIRIM:
- to encourage SMIs to achieve high Quality Management Practice.

Eligible Expenses

- service fee for the consultant accredited by SIRIM to carry out the study;
- cost of training managers, technical staff and other approved personnel
- testing fees charged by SIRIM or other approved laboratories
- registration fees charged by SIRIM
- cost of purchasing additional quality development tools

Maximum Grant

The maximum grant for each study/project is RM100,000

Mode of Disbursement

The grant will be disbursed in three stages on a reimbursement basis. The first disbursement of 20% will be made after the appointment of the project consultant. The second payment of 30% will be made upon submission of the consultant's report. the balance of the grant will be paid upon obtaining certification with SIRIM and submission of final project report.

All claims for payment must be accompanied by supporting documents verified by an external auditor.

Conditions For Approval

Companies applying for the grant must satisfy the following conditions:-

- Have applied to SIRIM to participate in the relevant certification scheme;
- Have been in production and its product is sold in the market;
- Possess the necessary technical and management knowledge in the relevant field;
- Capable of financing at least 50% of the cost of the project/study;
- Possess production facility or have access to other facilities approved by the Government, such as the Technology Park and SIRIM, to carry out the project; and
- Have good business record with financial institutions and government agencies.