High technology small and medium sized enterprises (HTSMEs): an assessment of the determinants of growth and constraints faced by HTSMEs in Malaysia

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HIGH TECHNOLOGY SMALL AND MEDIUM SIZED ENTERPRISES (HTSMEs): AN ASSESSMENT OF THE DETERMINANTS OF GROWTH AND CONSTRAINTS FACED BY HTSMEs IN MALAYSIA

by

MOHD. HASSAN MOHD. OSMAN

A Doctoral Thesis
Submitted in partial fulfilment of the requirement
For the award of Doctor of Philosophy of the Loughborough University

January 2002

ACKNOWLEDGEMENTS

In the name of Allah, the Most Beneficent, the Most Merciful.

I would primarily like to thank my supervisor Mr. Grahame Boocock for all his guidance, painstaking advice, support and constructive criticism throughout the research project. His availability, encouragement, time and personal interest have been invaluable for the completion of this thesis. Special thanks also go to my directors of research, Professor Malcolm Hill and Dr. David Johnson who have both contributed significantly to the direction of this thesis. In addition my special thanks goes to Dr. David Coates for his time and expertise in strengthening the statistical aspects of my thesis. I am grateful to Mrs. Joyce Tuson for her assistance in writing-up my thesis.

I am indebted to the support shown by MTDC, SMIDEC, Technology Park Malaysia, MASTIC, MIDA and UTM and would like to thank Encik Norhalim Yunus (General Manager – MTDC), Dr. Sharr Azni Harmin (Technology Development Manager - MASTIC), Encik Abdul Majid Ismail (Assistant Director - MIDA), Associate Professor Ir. Abdul Aziz Mohamed Amin (Deputy Director Business Development - UTM) for their willing participation in this study.

I must acknowledge the assistance and kindness of many Malaysian HTSMEs who participated in this study by responding to my questionnaire. I am also indebted to the fifteen companies who voluntarily participated in the time-consuming interviews for the case studies.

Last but not least, my gratitude and deepest appreciation goes to my beloved wife Hanim; my son Muhammad Basyir, for all their prayer, compassion, patience and sacrifices; my mother, father and in-laws for all their support and encouragement; En. Mohamad Abdullah and Pn Khadijah Daud for their prayers; and Pn. Kalthum Ahmad for proof-reading this thesis.
ABSTRACT

HIGH TECHNOLOGY SMALL AND MEDIUM SIZED ENTERPRISES (HTSMEs): AN ASSESSMENT OF THE DETERMINANTS OF GROWTH AND CONSTRAINTS FACED BY HTSMEs IN MALAYSIA

The industrial development of Malaysia has moved towards capital-intensive, high technology and high value-added industries. The development of high technology industries is an important element in the country's industrialisation process. High technology small and medium-sized enterprises (HTSMEs) are considered a key feature of growth in the high technology sphere in Malaysia - the creation and development of indigenous HTSMEs is vital.

The primary aim of this research is to examine the growth of HTSMEs and provide policy makers, owner-managers (OMs) and academics with a greater understanding of the factors affecting the growth of such firms in Malaysia. This study also identifies the main constraints faced by HTSMEs and explores ways in which these constraints might be overcome. The programme of research builds upon past studies, but it adds to existing knowledge in an area that is ripe for research.

After a literature review, and the development of an overarching theoretical framework, a number of hypotheses are put forward. The methodological approach combines a questionnaire survey with case studies based on interviews with selected HTSMEs and key informants. The questionnaire is principally concerned with identifying the factors that contribute to growth in HTSMEs, whereas the case studies and interviews concentrate on exploring the constraints identified in the questionnaire survey. The questionnaires were distributed to firms in databases maintained by a number of Government bodies. All the sample firms are considered high technology, as defined by the Promotion of Investment Act 1986. The sample includes firms involved in a variety of activities, from the manufacture of high technology products to the processing of resource-based products. Firms were randomly selected to reflect the size and racial composition of firms in the underlying population of HTSMEs. The questionnaire data were supplemented by 15 in-depth case studies.

Two major findings emerge from this study. First, a number of determinants did have a significant effect on growth of HTSMEs: age of OM; age and size of firm; process innovation and R&D. However, most the hypotheses relating to business strategy were rejected; the researcher offers some explanations for these rejections. Second, the case studies demonstrate that labour constraints among HTSMEs are prevalent, whereas other propositions were not substantiated. In particular, the case studies raise a number of questions about the effectiveness of Government support programmes.

On the basis of the research findings, the researcher is able to put forward a series of recommendations to enhance the growth of HTSMEs in Malaysia.
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<tbody>
<tr>
<td>7MP</td>
<td>Seventh Malaysia Plan</td>
</tr>
<tr>
<td>BIC</td>
<td>Business Innovation Centre</td>
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<tr>
<td>DTI</td>
<td>Department of Trade and Industry</td>
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<tr>
<td>FDI</td>
<td>Foreign Direct Investment</td>
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<td>FTZ</td>
<td>Free Trade Zone</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>HICOM</td>
<td>Heavy Industries Corporation of Malaysia</td>
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<tr>
<td>HTSME</td>
<td>High Technology Small and Medium-Sized Enterprise</td>
</tr>
<tr>
<td>ICA</td>
<td>Industrial Co-ordination Act</td>
</tr>
<tr>
<td>IGS</td>
<td>Industry R&amp;D Grant Scheme</td>
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<tr>
<td>IIA</td>
<td>Investment Incentives Act</td>
</tr>
<tr>
<td>ILP</td>
<td>Industrial Linkage Programme</td>
</tr>
<tr>
<td>IMP1</td>
<td>First Industrial Master Plan</td>
</tr>
<tr>
<td>IMP2</td>
<td>Second Industrial Master Plan</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>ITAF</td>
<td>Industrial Technical Assistance Fund</td>
</tr>
<tr>
<td>MASTIC</td>
<td>Malaysian Science And Technology Information Centre</td>
</tr>
<tr>
<td>MDC</td>
<td>Multimedia Development Corporation</td>
</tr>
<tr>
<td>MES</td>
<td>Minimum Efficient Scale</td>
</tr>
<tr>
<td>MESDAQ</td>
<td>Malaysian Exchange of Securities and Automated Quotation</td>
</tr>
<tr>
<td>MIDA</td>
<td>Malaysian Industrial Development Authority</td>
</tr>
<tr>
<td>MIGHT</td>
<td>Malaysian High Technology Government Group</td>
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<tr>
<td>MIMOS</td>
<td>Malaysian Institute of Microelectronics Systems</td>
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<tr>
<td>MITI</td>
<td>Ministry of Trade and Industry</td>
</tr>
<tr>
<td>MNC</td>
<td>Multinational Corporation</td>
</tr>
<tr>
<td>MOSTE</td>
<td>Ministry of Science, Technology and the Environment</td>
</tr>
<tr>
<td>MSC</td>
<td>Multimedia Super Corridor</td>
</tr>
<tr>
<td>MTDC</td>
<td>Malaysian Technology Development Corporation</td>
</tr>
<tr>
<td>NBD</td>
<td>National Biotechnology Directorate</td>
</tr>
<tr>
<td>NEP</td>
<td>New Economic Policy</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<tr>
<td>OM</td>
<td>Owner-Manager</td>
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<tr>
<td>PIA</td>
<td>Promotion of Investment Act</td>
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<tr>
<td>PIO</td>
<td>Pioneer Industries Ordinance</td>
</tr>
<tr>
<td>PLC</td>
<td>Private Limited Company</td>
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<tr>
<td>PSEE</td>
<td>Proportion of Engineers and Scientists</td>
</tr>
<tr>
<td>PUNB</td>
<td>Perbadanan Usahawan Nasional Berhad</td>
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<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
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<tr>
<td>RBI</td>
<td>Resource-Based Industry</td>
</tr>
<tr>
<td>RRDET</td>
<td>Ratio of Research and Development Expenditure to Turnover</td>
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<td>SIRIM</td>
<td>Standards and Industrial Research Institute of Malaysia</td>
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<tr>
<td>SME</td>
<td>Small and Medium-Sized Enterprise</td>
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<tr>
<td>SMIDEC</td>
<td>Small and Medium Industries Development Corporation</td>
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<tr>
<td>TFP</td>
<td>Total Factor Productivity</td>
</tr>
<tr>
<td>TPM</td>
<td>Technology Park Malaysia</td>
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<tr>
<td>UPM</td>
<td>Universiti Putra Malaysia</td>
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<tr>
<td>UTM</td>
<td>Universiti Teknologi Malaysia</td>
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<tr>
<td>VC</td>
<td>Venture Capital</td>
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<tr>
<td>VCC</td>
<td>Venture Capital Company</td>
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<tr>
<td>VCI</td>
<td>Venture Capital Investor</td>
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<td>VDP</td>
<td>Vendor Development Programme</td>
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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND TO THE RESEARCH

In the past two decades, Malaysia has been transformed from an agriculture-based to a manufacturing-based economy. This transition, which started from the 1970s onwards, has been assisted by a number of industrialisation programmes. These programmes were introduced to promote export-oriented and labour-intensive industries. Subsequently they have led to a rapid inflow of foreign direct investment (FDI) and subsequent growth in the manufacturing sector.

Over the years, the performance of the Malaysian economy, especially in the manufacturing sector, has been impressive. Gross Domestic Product (GDP) growth in 1996 was 8.2 percent, the ninth consecutive year of sustained high growth. Although growth dropped to 4.1 percent in 1997 (the average across the EU was 2.6 percent) and GDP declined by 7 percent in 1998, growth of 10.6 percent was restored by the fourth quarter of 1999.

During the 1990s, Malaysia's industrial development has moved towards capital-intensive, high technology and high value-added industries. The development of high technology industries is an important element in the country's industrialisation process. This development assumes greater importance because the availability of workers, both skilled and unskilled, is becoming a constraint (Low, 1993). With unemployment rate currently at 2.9 percent, technically full employment (Sulong, 1997), Malaysia is no longer attractive as a location for labour-intensive industries (Malaysia, 2000). The emergence of cheaper production bases in the newly emerging market economies, such as Thailand and Indonesia, means that Malaysia has to sustain its competitiveness by shifting towards higher productivity and the production of export-oriented, skill-intensive products and services.
The current strategies to achieve the nation’s industrialisation objectives include the Seventh Malaysia Plan (7MP: 1996-2000) and the Industrial Master Plan (IMP: 1986-1995 and IMP2: 1996-2005). The 7MP lays down policies and strategies to sustain the competitiveness of the manufacturing sector, and sets out measures to ensure a smooth transition from labour-intensive manufacturing towards high technology industries. The IMP, formulated in two stages, aims to chart a long-term industrialisation path for the country. The IMP emphasised moving beyond manufacturing operations to include research and development (R&D), the enhancement of industrial linkages, and increased productivity and competitiveness. 7MP and IMP led to the establishment of the Multimedia Super Corridor (MSC) in 1996, a strategy designed to act as a catalyst for information technology development in the region. The MSC project requires enormous financial input, as well as considerable technological and skilled manpower resources.

However, Malaysia’s march towards high technology development has been hindered by a number of setbacks. As stated above, the country is experiencing a lack of skilled manpower, and also funding problems (Ford, 1997). Incentives to lure back Malaysian engineers and scientists from overseas have been unsuccessful, and private sector financial institutions perceive high technology ventures as risky. High technology small and medium-sized enterprises (HTSMEs)\(^1\) have been a key feature of growth in high technology development in the UK and the US (Oakey et al., 1988). Much of the growth in the high technology sphere in the US was provided by small firms in the 1970s (Morse, 1976). After concentrating on larger entreprises for many years, Malaysia now needs to focus its efforts on indigenous HTSMEs.

HTSMEs are considered ‘special’ because they differ not only from conventional small and medium sized enterprises (SMEs), but also from larger high technology enterprises (Storey and Tether, 1998). They differ from ‘ordinary’ SMEs on the grounds that they are owned and managed by highly educated technical entrepreneurs who tend to lack managerial skills. HTSMEs are also engaged in a constant search for funds to finance R&D, the returns from which are long term and uncertain. HTSMEs have more problems than their larger counterparts in raising the necessary capital (Keogh and Evans, 1998).
While problems and constraints confront all SMEs, they tend to be more severe for HTSMEs (Moore, 1994; Oakey, 1997). HTSMEs have to develop their ideas in uncertain circumstances. Their products or processes are often not market tested and such firms are exposed to technology that becomes obsolete very quickly, requiring substantial R&D and new product innovation (Von Glinow and Mohrman, 1990; Slatter, 1992; Reid and Garnsey, 1996). Nevertheless, the evidence suggests that the risks involved in HTSMEs can be outweighed by their advantages.

This study seeks to provide important insights into the growth of HTSMEs, and to explore how barriers of growth might be overcome. My findings should provide guidance for policy makers, practitioners and academics on how to enhance the growth of HTSMEs.

1.2 RESEARCH RATIONALE

In the past thirty years, much interest has been focused on the identification of factors affecting the growth of conventional SMEs. A number of studies, which examine the determinants of, and constraints on, the growth of SMEs have been conducted (for example: Bosworth and Jacob, 1987; Barber et al., 1989; Advisory Council on Science and Technology (ACOST), 1990; Birley and Westhead, 1990; Aston Business School, 1991; Barkham, 1992; University of Cambridge Small Business Research Centre, 1992; Reynolds, 1993; Storey, 1994b; Barkham et al., 1996b). There is, therefore, a well-documented body of knowledge that should guide policy makers in the effective development and implementation of support programmes to SMEs. However, to date, little empirical work has been conducted to explore the growth determinants and constraints affecting HTSMEs. Many of the studies on the growth of HTSMEs have been conducted by just a few researchers, including Oakey (1984; 1991b; 1993b), Roberts (1991), Slatter (1992) and Westhead et al. (1995).

While an extensive range of official support is available to SMEs or high technology firms in Malaysia, the researcher has the strong impression that the 'special' requirements specific to HTSMEs are not adequately addressed in the framework of the support services available. A study of growth factors should provide
policy makers with a better framework through which different types of HTSMEs could be identified and supported (Tether, 1997). There has been no empirical investigation of HTSMEs in Malaysia, hence my research addresses a gap in existing knowledge.

The growth factors adopted for this study are based on a number of previous studies conducted independently of each other (Storey, 1994b). According to Storey, if all elements in these studies could be simultaneously included within a single study, a more accurate assessment could be made of the relative impact of these elements on growth of HTSMEs. This study focuses on a number of relevant elements contributing to growth, although time constraints did not permit me to conduct an all-encompassing study.

Another central reason for the interest of policy makers in HTSMEs is their capacity to create, both directly and indirectly, greater employment and wealth than SMEs in traditional activities (Oakey, 1981; Markusen et al., 1986; Reid and Garnsey, 1996; Barkham et al., 1996b). Such research has been conducted only in the United States (Storey and Tether, 1998) and, to a certain degree, in the United Kingdom. However, no study on the contribution of HTSMEs towards wealth and employment creation has been conducted in Malaysia.

HTSMEs play a critically important role in ensuring the ‘future prosperity of national industrial economies’ (Oakey et al., 1988). However, little is known about the way HTSMEs develop and grow, especially the problems and constraints they face. Although there have been a number of studies conducted on the development of conventional SMEs, particularly in Malaysia, unfortunately there have been no attempts made to analyse the problems and constraints of HTSMEs.

1.3 RESEARCH OBJECTIVES
The present study attempts to fill a gap in the literature, especially in developing countries, by explicitly focusing on growth determinants and constraints. The primary aim of this research is to examine the growth of HTSMEs and provide policy makers, owner-managers (OMs) and academics with a greater understanding of how to
facilitate more rapid growth in this sector. More specifically, this research will address the following issues:

a) To identify the factors affecting the growth of HTSMEs in Malaysia and determine the relationship between these factors and growth.

b) To determine the main constraints faced by HTSMEs and explore ways in which these constraints could be overcome.

This research builds upon past studies and aims to identify and explore the relationship between growth determinants and constraints for HTSMEs.

This study also explores the contribution of HTSMEs towards employment creation, wealth generation and the enhancement of R&D activity in Malaysia. This information should be able to guide policy makers in formulating policies to facilitate growth in the high tech sector.

1.4  RESEARCH QUESTIONS

The study will attempt to answer the following major question:

How is it possible to facilitate more rapid growth in HTSMEs in Malaysia?

Against the background set out in Section 1.1, and in relation to the objectives formulated in Section 1.3, the study attempts to answer the following questions to address the principal question posed above:
The OM Characteristics

i) Is there a positive relationship between the level of education of the OM and the growth of HTSMEs?

ii) Is there a positive relationship between prior managerial experience of the OM and the growth of HTSMEs?

iii) Is there a positive relationship between the age of the OM and the growth of HTSMEs?

iv) Is there a positive relationship between the length of the career history of the OM and the growth of HTSMEs?

v) Is there a positive relationship between the gender of the OM and the growth of HTSMEs?

vi) Is there a positive relationship between the ethnic background of the OM and the growth of HTSMEs?

The Characteristics of the Firm

i) Is there a positive relationship between the age of the firm and the growth of HTSMEs?

ii) Is there a positive relationship between the size of the firm and the growth of HTSMEs?

iii) Is there a positive relationship between limited company status and the growth of HTSMEs?

iv) Is there a positive relationship between the location of a business and the growth of HTSMEs?
Introduction

v) Is there a positive relationship between business sectors and the growth of HTSMEs?

The Business Strategy

i) Is there a positive relationship between the level of market research conducted and the growth of HTSMEs?

ii) Is there a positive relationship between adopting a marketing orientation and the growth of HTSMEs?

iii) Is there a positive relationship between product innovation and the growth of HTSMEs?

iv) Is there a positive relationship between process innovation and the growth of HTSMEs?

v) Is there a positive relationship between accepting external equity and the growth of HTSMEs?

vi) Is there a positive relationship between receiving government support and the growth of HTSMEs?

vii) Is there a positive relationship between R&D expenditure and the growth of HTSMEs?

Constraints

a) What are the major constraints hindering the growth of HTSMEs?

b) How do these constraints affect growth?

c) What steps have been taken by HTSMEs and various Government agencies to overcome these barriers?
A study of the relationships above should assist OMs, policymakers, practitioners and academics in developing existing high value added and capital intensive industries as well as attracting new ones.

1.5 ORGANISATION OF THE THESIS

The content of this thesis is organised into nine chapters. Figure 1-1 shows an overview of the research process and corresponding chapters.

FIGURE 1-1 Overview of the Research Process and Corresponding Chapters

PROBLEM DEFINITION
- Background to the Research
- Research Rationale
- Objectives & Questions
- Organisation of the Thesis

Chapter 1

THEORETICAL FRAMEWORK & HYPOTHESES GENERATION
- Conceptual Framework
- Hypotheses

Chapter 5

RESEARCH DESIGN & METHODOLOGY
- Research strategy (Questionnaire Survey & Case Studies)
- Questionnaire Design Statistical analysis (Nonparametric Statistics)

Chapter 6

DATA COLLECTION, ANALYSIS & INTERPRETATION
- Data Collection (Mail Questionnaires & Interviews)
- Data Analysis
- Test of Hypotheses and Propositions

Chapters 7 & 8

PRELIMINARY DATA GATHERING
- Literature Survey
- Interviewing

Chapters 2, 3 & 4

CONCLUSIONS
- Conclusions
- Recommendations
- Limitations of the study
- Future research directions

Chapter 9

Adapted and modified from Sekaran (1992)
This first chapter gives an overview of the thesis, identifies the research problems and summarises the reasons for undertaking the research.

The following three chapters consist of literature reviews. Chapter Two reviews the development of industrial policy in Malaysia and examines the stages of industrial growth and policies formulated to support the growth of high technology industries and SMEs. A review of recent developments in the Multimedia Supercorridor (MSC), with specific reference to the role of SMEs in this high technology project, is also provided.

Chapter Three reviews the various definitions of a high technology industry, including both conceptual and operational definitions. Embedded in the discussion is the question of why HTSMEs should be the focus of industrial policies in any country. The chapter discusses various definitions of SMEs adopted in a number of developed countries and examines policies supporting HTSMEs in the US, UK and Japan.

The fourth chapter reviews the stages that HTSMEs have to pass through as they grow. The most appropriate measurement of growth adopted for the study is also discussed. A review of factors that influence growth of HTSMEs is also provided. The study adopts the strategic growth model to explain the relationship between determinants and constraints. The study utilises the three basic components of growth proposed by Storey (1994b): the OM; the firm; and, the business strategy. A review of the constraints that hinder the growth of HTSMEs is also provided.

Chapter Five outlines the conceptual framework developed from the literature and discusses the key variables to be studied in the two stages of research – questionnaire survey and case studies. The implied associations between variables to be studied are also discussed. After identifying and defining variables, and establishing the relationships among variables, the research hypotheses are then generated to test the relationships.

Chapter Six outlines the research methods used in collecting the data for analysis. The chapter begins by reviewing the methodologies employed by previous
researchers. The strategies adopted in this study, questionnaires and case studies, are given particular emphasis. The chapter also explains how the major constraints derived from the questionnaire survey are incorporated into the semi-structured interviews on which the case studies are based. Finally, the chapter describes the data analysis techniques used in the study.

Chapter Seven analyses the data gathered in the questionnaire survey. The hypothesis testing is discussed in some depth.

Chapter Eight presents and discusses the qualitative findings from the case studies. The validity of a series of propositions is explored, although any conclusions are only tentative.

Finally, Chapter Nine draws together the conclusions and recommendations from the research project. The key findings and contributions of the study are also presented and discussed. This final chapter also assesses: the implications of the study's findings for both research and practice; the limitations of the research; and potential areas for further research.

Notes

1 Little (1977) defined HTSMEs as independently owned businesses established for the exploitation of an invention or technological innovation, implying substantial technological risks. Other commonly used terms that have similar definitions to HTSMEs include: new technology-based firms (Little, 1977); technology-based SMEs (Mason et al., 1996); new technology-based small firms (Philpott, 1994); and, high technology small firms (Oakey, 1996).
CHAPTER 2

LITERATURE REVIEW I: INDUSTRIAL POLICY IN MALAYSIA

2.0 INTRODUCTION

This chapter describes the development of industrial policies in Malaysia from the 1950s until the 1990s, focusing on support for high technology industries. The chapter also summarises the current policies to assist SMEs engaged in high technology activity in Malaysia.

2.1 DEVELOPMENT OF INDUSTRIAL POLICIES (1958-2000)

Traditionally, Malaysia has been an agricultural economy depending heavily on the export of raw materials such as rubber, palm oil, cocoa and tin. Agriculture was the leading sector at the time of independence from Britain in 1957, contributing 33 percent of GDP, 67 percent of employment and 62 percent of exports (Mokhtar, 1990). However, in the wake of industrial development from the late 1950s, this scenario has changed. The manufacturing sector registered rapid growth in the 1970s and late 1980s, and it became more important than agriculture (A. Rahman, 1994). The share of the manufacturing sector in the gross domestic product (GDP) in 1997 was 35.5 percent, and this figure is expected to rise to 37.5 percent by the year 2000 (Malaysia, 1998b). Agriculture accounted for 12.1 percent and the remainder of GDP comprised: service, 44.8 percent; construction, 4.2 percent; and, mining 6.8 percent.¹

According to the OECD, Malaysia was expected to be a fast growing economy over 1996 to 1998, second only to China among the dynamic Asian economies (The Star, 14 January 1997). This prediction proved to be accurate for the 1996-1997 period when Malaysia experienced an average annual growth rate of 8.2 percent, but the economy contracted by 14.9 percent in 1998 after the Asian financial crisis². There was a recovery in 1999 (Malaysia, 1999a). However, Malaysia will have to review its economic strategies to ensure that, as far as possible, its stability will not be affected
by further regional or global downturns. At the time of writing, signs of economic recovery have emerged, but policy makers must learn from recent experience if further economic setbacks are to be avoided.

2.2 STAGES OF INDUSTRIAL GROWTH

Industrialisation in Malaysia has undergone various stages of growth. Since independence, strategic policy measures have reflected the continually changing needs of industrial growth. Fong (1986) categorised industrial growth in Malaysia into two stages, while Anuwar (1992) and Jomo et al. (1997) identified three stages. Fong focuses on the period from the 1950s to 1980, whereas Anuwar extended the period up to 1990. I have incorporated their views and extended the analysis up to the current period, adding a fourth stage (refer to Figure 2-1).

![Stages of Industrial Growth in Malaysia (1958 – current)]

As demonstrated by Figure 2-1, Malaysia started to focus on the high technology sector only during Phase III, after the introduction of the Heavy Industries...
Programme in 1981 and the Promotion of Investment Act 1986. The country started rather late in the high technology race. A vibrant technology sector is vital, if the country is to reach its goal of becoming a fully industrialised nation by the year 2020.

2.2.1 Phase I (1958 - 1968)

It is generally acknowledged that the first stage of industrialisation lasted from 1958 to 1968, the era after the independence of Malaya in 1957 and including the formation of Malaysia in 1963. This period is known as the import-substitution phase because industrialisation was based mainly on the manufacture of goods for domestic consumption (Fong, 1986).

At the start of this period, the 1958 Pioneer Industries Ordinance (PIO) gave tax concessions to pioneer industries to promote the growth of import-substitution in Peninsular Malaysia. However, the Ordinance had some serious shortcomings. According to Fong (1986), the Ordinance did not lead to an increase in resource-based manufacturing establishments because it failed to encourage industries to utilise local raw materials in their production. The Ordinance also failed to encourage the promotion of manufactured exports, as domestic-oriented sub-sectors proved to be the main source of growth during that period.

Manufacturing output rose at an average annual rate of 17.4 percent between 1959 and 1968, but the average annual growth rate of the manufacturing sector across a range of factors during the same period did not rise significantly. Furthermore, the output growth rate of industries qualifying for pioneer status dropped dramatically in real terms (Jomo, 1994). This sharp fall revealed the inherent limitations of the import-substitution strategy. Industrial production for mass consumption did not have sufficient demand in the domestic economy. Malaysia’s population was too small and the average income level was too low to create an effective domestic market (Jomo and Edwards, 1993).
TABLE 2-1 Manufacturing Employment in Malaysia (1947-1980)

<table>
<thead>
<tr>
<th>Selected Years</th>
<th>Manufacturing Employment ('000)</th>
<th>Manufacturing Employment as a percentage of Total Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td>126</td>
<td>6.7</td>
</tr>
<tr>
<td>1957</td>
<td>136</td>
<td>6.4</td>
</tr>
<tr>
<td>1960</td>
<td>166&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.2&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>1965</td>
<td>217</td>
<td>8.4</td>
</tr>
<tr>
<td>1970</td>
<td>448</td>
<td>11.4</td>
</tr>
<tr>
<td>1975</td>
<td>N/A</td>
<td>10.1</td>
</tr>
<tr>
<td>1980</td>
<td>755</td>
<td>15.8</td>
</tr>
</tbody>
</table>

Source: Jomo (1994)  
<sup>a</sup>: truncated figures  
N/A: Not Available

In the 1960s, the labour absorption capacity of the manufacturing sector was relatively low, as shown in Table 2-1. The proportion of workers employed in the manufacturing sector was only about one-sixth of those in agriculture, forestry and fishing (Figure 2-2).

FIGURE 2-2 Peninsular Malaysia: Employment by Economic Sectors

Source: Fong (1986)

The PIO failed to encourage industries to utilise the large supply of labour. Capital-intensive industries, such as petroleum and food processing, were more likely
to benefit from the PIO incentives than labour-intensive industries, such as textiles and furniture. Lim (1973) commented that the PIO offered investment incentives only to industries that satisfied the strict conditions required for pioneer status, failing to encourage the bulk of manufacturing establishments to expand operations.

The import-substitution phase also failed to provide a suitable environment for technological development (Anuwar, 1992). Even capital-intensive industries were very reliant upon their technology suppliers or foreign joint-venture partners. Phase I was dominated by enterprises, which were unaware of modern technology or which lacked the ability to master it. Fong (1990) suggested that the incentives and tariff protection granted to import-substitution industries gave them a sense of security operating within the domestic market, thus making them less export-oriented.

### 2.2.2 Phase II (1969 - 1980)

**FIGURE 2-3** Share of Agriculture and Manufacturing Sectors in GDP

By 1968, the domestic market was becoming saturated and it was recognised that further industrial development would have to be export-oriented. This recognition underpinned the second phase of industrialisation, the export-oriented phase, which resulted in the rapid growth of the manufacturing sector. By 1980 the manufacturing
contribution to GDP was 20 percent, compared to 23 percent for agriculture. This achievement was creditable compared to 1960, where the corresponding figures were 9 percent and 38 percent respectively (Figure 2-3).

Realising the inherent contradictions of its import-substitution strategy and the shortcomings of the PIO, a number of policy measures were introduced to encourage diversification into new industries, principally the 1968 Investment Incentives Act (IIA). A key objective of this Act was to encourage the expansion of manufactured exports by providing export incentives to new or existing industrial establishments. The Act incorporated tax holidays to firms granted pioneer status and gave additional tax holidays based on the nature of product, location of firm or the content of raw materials. The content of the Act indicated a strategic change in emphasis from import-substitution to export-oriented industrialisation (Jomo, 1994). During this period, Free Trade Zones (FTZs) were established in Malaysia to encourage and facilitate the growth of manufacturing exports.

According to Athukorala and Menon (1995), the most important factor behind the country’s phenomenal economic and industrial performance since the 1970s has been Foreign Direct Investment (FDI). Towards the late 1970s, FDI contributed significantly towards the shift in policy from import-substitution to export-oriented industries (Fong and Cheong, 1984). FDI was considered an important catalyst for growth because it brought the latest technological advances, export market linkages and new management techniques (Lim, 1973; Atan, 1994).

The IIA also designated the electronics sector as a ‘priority industry’ for investment incentives, in order to attract export-oriented foreign investment (Abdul Aziz, 1989). Malaysia viewed semiconductor assembly as offering scope for large-scale job creation, particularly for unskilled labour (Chen, 1999). After the IIA was introduced, the global electronics industry was experiencing a fundamental change. Competitive pressures from global competitors (especially the Japanese companies) encouraged American semiconductor producers, such as Hewlett Packard and Motorola, to shift their assembly operations to Asia. Japanese producers themselves subsequently faced similar competitive pressures. The rapid increases in domestic
labour costs in the late 1970s forced American and Japanese semiconductor manufacturers to relocate their labour-intensive assembly operations to low-wage developing countries such as Malaysia (Ismail, 1999). On the threshold of its export-led industrial programme, it offered an ideal location (Malaysia, 1998c).

### TABLE 2-2 Manufacturing Exports from Malaysia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical or electronic components</td>
<td>3</td>
<td>46</td>
<td>50</td>
<td>56</td>
<td>65</td>
</tr>
<tr>
<td>Food beverages &amp; tobacco</td>
<td>18</td>
<td>8</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Textiles, apparel &amp; footwear</td>
<td>7</td>
<td>13</td>
<td>11</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Wood &amp; wood products</td>
<td>14</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Rubber products</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Chemical &amp; petroleum products</td>
<td>32</td>
<td>6</td>
<td>12</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Non-metallic mineral products</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Iron &amp; Steel &amp; fabricated metal products</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Transport</td>
<td>11</td>
<td>7</td>
<td>8</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Sources: Malaysia (1989) and Malaysia (1996c)*

A significant number of multinationals were attracted because of low labour costs, political and economic stability, generous incentives and other support for industry, and the perception that the Malaysian Government was “development-oriented and favoured the expansion of high-technology electronics” (USECM, 1986). Table 2-2 shows that electrical and electronic components have accounted for more than half of total manufactured exports since the mid-1980s. However, after a decade when multinationals had benefited from Government incentives, it was realised that those MNCs had not transferred sufficient technology to enable an indigenous electronics industry to survive in their absence (O’Connor, 1993). This recognition led to a critical appraisal of the direction and effectiveness of export-oriented industrialisation.

The racial riots of 1969⁴ also had a significant impact on subsequent industrial policies. The riots were a result of an ownership and employment imbalance between ethnic groups in Malaysia. The New Economic Policy (NEP) was formulated in 1970,
with the objective of reducing inequality between Bumiputeras and non-Bumiputeras (Rani and Muhd. Salleh, 1994). A 30 percent equity ownership target was set for Bumiputeras but progress towards this target was slow. This shortfall led to the enactment of new legislation, the Industrial Co-ordination Act (ICA) of 1975; the main objective of the ICA was to ensure orderly development and growth in the manufacturing sector (Malaysia, 1998a).

The ICA required all manufacturing firms with an overseas partner to submit project proposals to the Ministry of International Trade and Industry (MITI) for approval. This process was designed to ensure that contracts would not impose unfair restrictions on Malaysian companies. The Act was also used as an instrument to achieve the objectives of the NEP with regard to Bumiputera employment and equity participation, particularly in the manufacturing sector (Anuwar, 1992). All new and existing manufacturing companies (excluding those employing fewer than 75 full-time workers and having shareholders' funds of less than RM2.5 million) needed to apply for a manufacturing licence (Appendix 2-1). With the issue of these licences, the Government was able to impose conditions on equity ownership for Bumiputeras.

The ICA was successful in increasing Bumiputera corporate stock ownership from 2.4 percent in 1970 to 19.1 percent in 1985 - refer to Table 2-3. The Chinese business community also experienced an increase in ownership from 27.2 percent to 33.4 percent. The foreign investors were the losers, with their share declining from 63.3 percent to 26 percent. This loss of power had a significant effect on high technology industrial development in Malaysia, an issue that is taken up in the next section.
TABLE 2-3 Ownership of Share Capital (at par value) - According to Ethnic Group.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Bumiputera</td>
<td>N/A</td>
<td>2.4</td>
<td>RM4050.5</td>
</tr>
<tr>
<td>Malaysian Chinese</td>
<td>N/A</td>
<td>27.2</td>
<td>N/A</td>
</tr>
<tr>
<td>Foreign Residents</td>
<td>N/A</td>
<td>63.3</td>
<td>RM13,927</td>
</tr>
<tr>
<td>Others</td>
<td>N/A</td>
<td>7.1</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Source: Adapted from Yasuda (1991)

2.2.3 Phase III (1981 - 1996)

Phase III encompassed the Fourth Malaysia Plan (1981-1985), the Industrial Master Plan (IMP), 1986-1995, and the Promotion of Investment Act 1986 (PIA). The country had expanded its capital-intensive industries by promoting heavy industries, for example, 4MP saw the formation of the Heavy Industries Corporation of Malaysia, HICOM (Anuwar, 1992). HICOM, a joint public-private sector venture, was established in 1981 to oversee the development of projects, such as Proton, the ‘national car’. The Government took the initiative because projects in this field usually require huge investment outlays, long gestation periods and offer low rates of return (Alavi, 1996). In view of the strategic importance of such projects, the Government wanted local control, ownership and management (Lee, 1981). Another reason was to generate linkages within the domestic economy through the utilisation of natural resources and the saving of foreign exchange (Alavi, 1996). IMP1 focused on developing heavy industries and raised the issue of ‘which’ heavy industries should be given priority. However, the Government avoided the critical task of selection by sub-contracting decisions on support to HICOM (Lim, 1987). It was hoped that the heavy industries, especially basic metal and engineering industries, would provide the basis for developing an indigenous technology and the development of skills that could be utilised in high technology industries.

The focus then switched to the high technology sector, in particular, enhancing the technological capacity of local industries by implementing the action plan for Industrial Technology Development. By the early 1980s, the manufacturing sector had the capability to move into high technology (Anuwar and Rasiah, 1996). A
measures were introduced in order to achieve export-led growth and attract FDI into the manufacturing sector. Inward FDI had stagnated, partly due to the NEP’s insistence on active local participation in all equity ventures (Ramasamy, 1998). Between 1980 and 1985, the ICA had resulted in a decrease of 16.9 percent in foreign control of corporate stock in Malaysia (Yasuda, 1991). The business community interpreted the ICA as imposing Government policy with respect to Bumiputera ownership participation. This caused some uncertainty in the investment environment (Fong, 1986), and it was vital for Malaysia to continue to arrest the decline in FDI. After the Promotion of Investment Act (PIA) was introduced in 1986, FDI resumed its growth, see Table 2-4.

**TABLE 2-4 FDI Flows in Approved Manufacturing Projects, 1980-1993**

<table>
<thead>
<tr>
<th>Year</th>
<th>Net DFI (RM million)</th>
<th>Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>1,158</td>
<td>15.9</td>
</tr>
<tr>
<td>1979</td>
<td>1,255</td>
<td>8.4</td>
</tr>
<tr>
<td>1980</td>
<td>2,033</td>
<td>62.0</td>
</tr>
<tr>
<td>1981</td>
<td>2,914</td>
<td>43.3</td>
</tr>
<tr>
<td>1982</td>
<td>3,262</td>
<td>11.9</td>
</tr>
<tr>
<td>1983</td>
<td>2,926</td>
<td>-10.3</td>
</tr>
<tr>
<td>1984</td>
<td>1,869</td>
<td>-36.1</td>
</tr>
<tr>
<td>1985</td>
<td>1,725</td>
<td>-7.7</td>
</tr>
<tr>
<td>1986</td>
<td>1,262</td>
<td>-26.8</td>
</tr>
<tr>
<td>1987</td>
<td>1,065</td>
<td>-15.6</td>
</tr>
<tr>
<td>1988</td>
<td>1,884</td>
<td>76.9</td>
</tr>
<tr>
<td>1989</td>
<td>4,518</td>
<td>139.81</td>
</tr>
<tr>
<td>1990</td>
<td>6,309</td>
<td>39.6</td>
</tr>
<tr>
<td>1991</td>
<td>11,200</td>
<td>77.5</td>
</tr>
</tbody>
</table>

*Source: Atan (1994)*

The introduction of PIA led to the liberalisation of foreign investment policies, provision of attractive incentives and intensification of promotional efforts. FDI flows into the manufacturing sector increased significantly.

The inflow of FDI has contributed valuable capital, technology, marketing access and managerial inputs, which constitute the essential ingredients for rapid industrialisation (Jegathesan et al., 1997). With these resources, Malaysia is moving away from labour-intensive manufacturing industries to
high value-added, high technology, and capital-intensive industries. The Malaysian Government has focused on promoting sophisticated industries that are capable of integrating with world markets. In line with this policy, the Government has identified certain key sectors in the high technology sector that are considered new and emerging technologies to Malaysia (Appendix 2-2).

As discussed in Section 2.2.2, FDI is a means of transferring production technology, skills, innovative capacity, and organisational and managerial practices between developed and developing countries (Mallampally and Sauvant, 1999). FDI facilitates R&D spillovers. McGrath (1997) and Sjoholm (1999) confirm that MNCs conduct most of the world’s R&D, and host countries may benefit when knowledge transfer leaks from a parent firm to its affiliates.

The PIA was the first policy measure that clearly defined ‘high technology’ companies and introduced incentives for this sector. The PIA defined high technology companies as (Malaysia, 1996a, p. 8):

Companies engaged in promoted activities in areas of new and emerging technologies

The PIA listed 10 promoted activities and products of high technology companies (Appendix 2-2). Incentives given to such companies included:

- Pioneer Status with full tax exemption at statutory income level (see Appendix 2-3 for details) for a period of 5 years

- Investment tax allowances of 60 percent for a period of 5 years.
Other than being involved with promoted products and activities, a company would be considered ‘high technology’ if it fulfilled the following criteria:

- Local R&D expenditure to gross sales of at least 1 percent per annum
- Science and technical graduates as a minimum of 7 percent of the total workforce.

The PIA allowed foreign equity ownership up to 100 percent for projects exporting 80 percent or more of their production and up to 79 percent for projects exporting between 51 percent and 79 percent. A sliding scale operates for lower export levels. However, the PIA tended to favour larger companies. For instance, the most attractive tax incentive, the provision of pioneer status, favoured larger enterprises (Asian Development Bank, 1990). Those companies with a paid-up capital exceeding RM25 million or employing 500 or more Malaysian workers were eligible for additional tax relief; larger firms could gain tax exemption for a maximum of ten years, whereas tax relief for capital intensive HTSMEs was restricted to five years.

The PIA was introduced to attract foreign investment, but the Government realised that heavy dependence on foreign investment in key areas such as technology, marketing and management could undermine the development of an indigenous industrial base (Malaysia, 1986). IMPI offered a critical analysis of Malaysia's industrialisation problems, particularly in the high technology sector. It acknowledged that the excessive technological dependence of the manufacturing sector had resulted in outflows of royalty payments and fees for technology transfer (Jomo, 1994). IMPI emphasised support to R&D (Alavi, 1996) and sought to raise the nation's indigenous technology capacity. IMPI pointed out that Malaysia had been a latecomer to industrialisation because successful primary export growth had weakened the urgency to industrialise (Jomo and Edwards, 1993). The manufacturing sector was therefore narrowly based upon a few labour-intensive and resource-based industries.

The purpose of IMPI was to guide the development of the manufacturing sector in Malaysia, and it set out the following objectives for industrial development:
i) Accelerating the growth of the manufacturing sector.

The 1986 PIA, together with the amendment of the Income Tax Act of 1967 (see Appendix 2-3), provided liberal investment incentives to potential investors (Anuwar, 1992). The PIA allowed the authorities more flexibility in approving higher foreign equity participation in manufacturing projects. As a result of these changes FDI increased significantly after 1987 (Table 2-5, overleaf).

During the IMP1 period, manufacturing output expanded significantly (Malaysia, 1997d). Table 2-6 shows the performance of the manufacturing sector over IMP1. The average annual growth rate of the manufacturing sector over the period 1986-1995 was 13.5 percent, higher than the projected rate of 8.8 percent. The 9.4 percent projected growth rate in exports of manufactured goods was surpassed by almost 200 percent, at 28.6 percent. (The contribution of the manufacturing sector to total exports increased from 32.8 percent in 1985 to 79.6 percent in 1995 - not shown in Table 2-6). The share of manufacturing output to Gross Domestic Product (GDP) increased to 33.1 percent, compared to a projection of 23.9 percent. Employment in the manufacturing sector increased at an average annual rate of 8.9 percent. Furthermore, the manufacturing sector share of total employment increased from 15.8 percent to 25.5 percent over IMP1.
### TABLE 2-5 Projects Approved by Ownership

<table>
<thead>
<tr>
<th>Year</th>
<th>Malaysian Owned(^1)</th>
<th>Foreign Owned(^2)</th>
<th>Equal Partnership</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>358</td>
<td>97</td>
<td>4</td>
<td>459</td>
</tr>
<tr>
<td>1981</td>
<td>477</td>
<td>111</td>
<td>8</td>
<td>596</td>
</tr>
<tr>
<td>1982</td>
<td>400</td>
<td>63</td>
<td>5</td>
<td>468</td>
</tr>
<tr>
<td>1983</td>
<td>416</td>
<td>69</td>
<td>5</td>
<td>490</td>
</tr>
<tr>
<td>1984</td>
<td>656</td>
<td>85</td>
<td>8</td>
<td>749</td>
</tr>
<tr>
<td>1985</td>
<td>535</td>
<td>78</td>
<td>12</td>
<td>625</td>
</tr>
<tr>
<td>1986</td>
<td>335</td>
<td>99</td>
<td>13</td>
<td>447</td>
</tr>
<tr>
<td>1987</td>
<td>191</td>
<td>132</td>
<td>10</td>
<td>333</td>
</tr>
<tr>
<td>1988</td>
<td>403</td>
<td>301</td>
<td>28</td>
<td>732</td>
</tr>
<tr>
<td>1989</td>
<td>333</td>
<td>439</td>
<td>20</td>
<td>792</td>
</tr>
<tr>
<td>1990</td>
<td>352</td>
<td>533</td>
<td>21</td>
<td>906</td>
</tr>
<tr>
<td>1991</td>
<td>399</td>
<td>561</td>
<td>13</td>
<td>973</td>
</tr>
<tr>
<td>1992</td>
<td>443</td>
<td>425</td>
<td>6</td>
<td>874</td>
</tr>
<tr>
<td>1993</td>
<td>347</td>
<td>328</td>
<td>11</td>
<td>686</td>
</tr>
<tr>
<td>1994</td>
<td>226</td>
<td>277</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Source: Malaysia (1994)*

\(^1\) Malaysian Owned i.e. wholly or majority Malaysian-owned

\(^2\) Foreign Owned i.e. wholly or majority foreign-owned.

### TABLE 2-6 Achievements of IMP1 (1986 – 1995)

<table>
<thead>
<tr>
<th></th>
<th>Projected</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth of the Manufacturing Sector (%)</td>
<td>8.8</td>
<td>13.5</td>
</tr>
<tr>
<td>Growth of Manufacturing Exports (%)</td>
<td>9.4</td>
<td>28.6</td>
</tr>
<tr>
<td>Share of Manufacturing to GDP (%)</td>
<td>23.9</td>
<td>33.1</td>
</tr>
<tr>
<td>Growth of Manufacturing Employment (%)</td>
<td>6.8</td>
<td>8.9</td>
</tr>
<tr>
<td>Total Manufacturing Employment (million)</td>
<td>1.5</td>
<td>2.1</td>
</tr>
<tr>
<td>Share of Manufacturing to Total Employment (%)</td>
<td>15.8</td>
<td>25.5</td>
</tr>
</tbody>
</table>

*Source: Malaysia (1997d)*

ii) Promoting opportunities for optimum utilisation of local natural resources.

IMP1 proposed the intensive development of resource-based industries (RBIs), particularly in sectors with the potential for export and upgrading technical skills. IMP1 identified seven RBIs as worthy of support. Four of the industries were agriculture based, the others being chemical and petroleum products, metal products and non-metallic mineral products. Although Malaysia has comparative advantage in most of these RBIs, notably rubber and tin, they
were typically characterised by primary processing and low value-added products (Anuwar, 1992). The RBIs needed technological and skills enhancement to increase Malaysia’s influence in world markets.

**FIGURE 2-4** An Integrated Semiconductor Industry

![Diagram of an integrated semiconductor industry](image)

*Wafer making involves the making of silicon wafers by chemical manufacturers and is distinct from semiconductor production.

*Source: Chen (1999)*

It was also argued that the achievements of the semiconductor industry had been limited and lopsided, despite the fact that it had registered impressive growth. The output of components in the electronics industry was dominated by assembly and testing (Figure 2-4) rather than R&D or product development such as wafer fabrication. This imbalance was acknowledged by IMP1 (Malaysia, 1986, p. 49):

This lopsided structure makes the Malaysian electronics industry very precarious, particularly because components manufacturing is limited to relatively simple assembly and testing activities based on imported materials.

This situation arose because the majority of electronics companies in Malaysia were foreign owned. Furthermore, even if all other materials besides wafers were sourced locally, local value-added would probably have risen by less than 10 percent (O’Connor, 1993).
To achieve this objective, IMPI identified 'information' as the most critical determinant of Malaysia's technological development. There was rapid expansion in the global information technology (IT) sector in the 1980s owing to developments in microelectronics. Malaysia realised that, in order to compete successfully, it must adopt IT to enhance the nation's productivity and reduce its costs (Anuwar, 1992). Failure to adopt IT would widen the technological gap separating Malaysia from the more industrialised countries. The Action Plan for Industrial Technology Development was therefore initiated in 1988 by the Ministry of Science, Technology and the Environment. The purpose of the Action Plan was (Malaysia, 1990, p.13):

to support the implementation of the IMP(I), with emphasis on concrete, practical and effective measures for the fullest beneficial development of industrial technology, consonant with the healthy and dynamic short, medium and long-term advancement of investment, private enterprise and national development.

The Action Plan focused on enhancing technological innovation through extensive R&D and the development of knowledge and skills in the work force.

IMPI also recognised the role of SMEs in industrial development. The growth of SMEs was seen as essential "for a rapid increase in manufactured exports and closer linkages between exports and the domestic sector" (Malaysia, 1986), as well as offering employment generation and a training ground for employees and entrepreneurs (Malaysia, 1986). A number of development programmes were introduced during IMPI period to assist SMEs, including the Vendor Development Programme (VDP) and the Industrial Technical Assistance Fund (ITAF).

a) The Vendor Development Programme (VDP)

The VDP was launched in 1988 with the Proton Components Scheme as its first programme. The Scheme was funded by MITI. Proton assumed the role of a pioneer anchor company in providing the captive market for its SME
suppliers. The second programme, the Electrical and Electronics Components Scheme, was introduced in 1992, with Sapura and Sharp as the anchor companies. In 1993 a new concept of VDP emerged, known as the ‘Tripartite Arrangement’. Under this arrangement, the anchor companies provided the assurance of markets for the vendors and financial facilities were provided by financial institutions (Malaysia, 1994a). There are currently 77 large corporations and multi-national corporations (MNCs) participating as anchor companies under the dual and Tripartite VDP (Malaysia, 1998f). Table 2-7 shows the breakdown of anchor companies according to sectors.

| TABLE 2-7 Number of VDP Anchor Companies by Year and Sector |
|------------------|------------------|------------------|------------------|------------------|
| Automotive       | 1         | 1           | 2         | 4                |
| Electrical & Electronics | 2          | 18          | 20         | 40               |
| Wood Based       | -         | 1           | 12         | 13               |
| Telecommunications | -         | -           | 3         | 3                |
| Others           | -         | -           | 17         | 17               |
| Total No. of Anchor Companies | 3     | 20           | 54         | 77               |

Source: Malaysia (1994) and Malaysia (1998f)

By 1994, the 20 anchor companies had been able to approve a total of 59 vendors. The vendors are involved in various industrial or manufacturing activities, including plastic injection moulding, metal stamping or fabrication, telecommunications equipment, wire-harnessing, automotive components, electroplating and wood-based furniture components. The number of vendors increased from 24 in 1992 to 155 in 1995, with total sales turnover estimated at about RM348 million (Malaysia, 1994; Malaysia 1996b). The VDP has been successful in creating an industrial market in which Malaysian SMEs have become reliable manufacturers and suppliers of industrial inputs, machinery and equipment to large-scale industries and MNCs. The VDP has also provided greater integration and linkages between SMEs, large-scale industries/MNCs and financial institutions to further enhance industrial development (Malaysia, 1994a).
b) The Industrial Technical Assistance Fund (ITAF)

The ITAF was launched in 1990 with an initial allocation of RM50 million. The objective of the Fund was to develop SMEs into a dynamic sector capable of supporting the larger industries. This was to be achieved through the following Schemes (details in Appendix 2-4):

- Consultancy Service Scheme (ITAF 1);
- Product Development and Design Scheme (ITAF 2);
- Quality and Productivity Improvement Scheme (ITAF 3);
- Market Development Scheme (ITAF 4).

The performance of ITAF 1 during the 1991 to 1994 period was not satisfactory because many SMEs did not see the benefits of employing consultants (Malaysia, 1994a) - Table 2-8. There was also a shortage of affordable consultants available to SMEs under the Scheme. The outcome was that only a fraction of projects were completed, compared to approvals.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Applications Evaluated</th>
<th>Number Approved</th>
<th>Amount (RM Million)</th>
<th>Projects Completed</th>
<th>Amount Reimbursed (RM Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>229</td>
<td>116</td>
<td>4.95</td>
<td>14</td>
<td>0.48</td>
</tr>
<tr>
<td>1992</td>
<td>84</td>
<td>48</td>
<td>2.25</td>
<td>22</td>
<td>0.84</td>
</tr>
<tr>
<td>1993</td>
<td>196</td>
<td>137</td>
<td>3.76</td>
<td>37</td>
<td>0.90</td>
</tr>
<tr>
<td>1994</td>
<td>416</td>
<td>291</td>
<td>7.20</td>
<td>138</td>
<td>1.08</td>
</tr>
<tr>
<td>Total</td>
<td>925</td>
<td>592</td>
<td>18.16</td>
<td>211</td>
<td>3.30</td>
</tr>
</tbody>
</table>

Source: Malaysia (1994)

One of the objectives of the ITAF schemes was to inculcate an innovation culture in local SMEs. The funding was designed to encourage SMEs to pursue technological development, particularly product development. The grants also invited universities and public research institutions to provide consultancy or exploit their research. However, the universities and research institutes very rarely took advantage of the ITAF Funds (Kassim, 1991).
failure to develop linkages with academics and researchers had serious consequences for HTSMEs lacking suitably qualified technical specialists to support formal R&D within the enterprise. Table 2-9 shows that approvals over the 1991 to 1994 period were most prominent in low-technology-based companies operating in the wood-based, food and textile industries. As mentioned earlier, even the electronics industry is mainly involved with assembly and testing, hence it does not contribute much towards innovation.

### TABLE 2-9 ITAF Approvals by Industry and Scheme, 1991-1994

<table>
<thead>
<tr>
<th>Industry</th>
<th>Total Approved</th>
<th>ITAF 1</th>
<th>ITAF 2</th>
<th>ITAF 3</th>
<th>ITAF 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>79</td>
<td>26</td>
<td>3</td>
<td>1</td>
<td>49</td>
</tr>
<tr>
<td>Food</td>
<td>75</td>
<td>30</td>
<td>6</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>Textiles</td>
<td>72</td>
<td>16</td>
<td>2</td>
<td>2</td>
<td>52</td>
</tr>
<tr>
<td>Electrical &amp; Electronics</td>
<td>69</td>
<td>8</td>
<td>25</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Plastics</td>
<td>54</td>
<td>18</td>
<td>9</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>Iron &amp; Steel</td>
<td>44</td>
<td>15</td>
<td>12</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Non-metallic Mineral</td>
<td>38</td>
<td>8</td>
<td>6</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>Chemical &amp; Petrochemicals</td>
<td>35</td>
<td>5</td>
<td>12</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Automotive</td>
<td>30</td>
<td>5</td>
<td>13</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Machinery &amp; Engineering</td>
<td>30</td>
<td>11</td>
<td>13</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Rubber</td>
<td>18</td>
<td>1</td>
<td>3</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Others</td>
<td>48</td>
<td>22</td>
<td>11</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>592</strong></td>
<td><strong>165</strong></td>
<td><strong>115</strong></td>
<td><strong>92</strong></td>
<td><strong>220</strong></td>
</tr>
</tbody>
</table>

*Source: Malaysia (1994)*

Figure 2-5 shows that the largest number of approvals went to the Market Development scheme (ITAF 4), followed by the Consultancy Service Scheme, the Product Development and Design Scheme, and the Quality and Productivity Scheme.
Overall, the ITAF programme has not been successful in enhancing the technological development of SMEs in Malaysia. According to Kassim (1991, p. 126) ITAF required:

- the development of other infrastructures such as venture capital, public sector R&D, skilled manpower, domestic capability in engaging other technology clusters, a strong environment for promoting an innovative culture and a policy framework that would promote greater risk-taking.

The measures introduced under IMP1 focused on technological development, including the encouragement of R&D activities and enhancing the technological capability of SMEs. IMP1 also acknowledged that, in order to move into the high-technology sphere, the manufacturing sector would require:

- an effective organisational structure capable of achieving an optimum level of productivity, and
• qualified managerial personnel, as well as engineering and technical expertise.

Picking up the second point, one of the major constraints to rapid industrial development identified by IMPI was a short supply of skilled manpower (Asian Development Bank, 1990). The manufacturing sector had been suffering from a lack of managerial and technical expertise, a factor exacerbated by the inadequate output of such expertise from the tertiary education system. This shortfall in expertise was holding back Malaysia’s ambition of moving into high technology and higher value-added industries. An insufficient supply of engineers and technicians also hindered the manufacturing sector’s ability to absorb technology from foreign sources or to develop indigenous technology. It limited the nation’s capacity to acquire and adapt transferred technologies, as well as holding back the domestic innovative capabilities of manufacturing industries (Anuwar, 1992). These problems affected both large organisations and SMEs.

FIGURE 2-6 Proportion of R&D Expenditure to GDP

![Proportion of R&D Expenditure to GDP](image)

Source: Dakian (1998)
Another factor that inhibited Malaysia's progress in high technology in Phase III was its failure to make industrial R&D a strategic priority. During the 1980s, there were only two public sector research organisations involved in industrial research, the Standards and Industrial Research Institute of Malaysia (SIRIM) and the Malaysian Institute of Microelectronics Systems (MIMOS); other public sector research institutions were involved in agricultural research (Anuwar, 1992). The private sector conducted a small amount of R&D, with only a minimal impact on the nation's technological development. Figure 2-6 shows Malaysia's ratio of R&D expenditure to GDP between 1972 to 1996. The increase in R&D expenditure in the 1970s and 1980s, a period when Malaysia was undergoing intensive industrial development, was negligible.

The authorities in Malaysia realised that the country could not stimulate R&D from scratch as a homegrown product (Gwynne, 1997). Thus, Malaysia needed to implement a series of initiatives to promote and enhance R&D, as well as to increase its supply of engineers, scientists and skilled workers. In an attempt to leapfrog Malaysia's high technology development, various initiatives were introduced in Phase IV.

2.2.4 Phase IV (1996 - 2000)
Phase IV began with the launching of the Seventh Malaysia Plan (7MP, 1996-2000). The 7MP put forward two principal strategies to enhance the nation's international competitiveness. One was to move from labour-intensive to productivity-driven support measures, the other was to increase the country's share of global markets (Sulong, 1996). A key objective of 7MP is to enhance the nation's total factor productivity\(^8\) (TFP). According to Krugman (1994), industrialising economies such as Malaysia have placed reliance on increasing labour and capital inputs rather than improving the efficiency of their utilisation, i.e., improving TFP. Menon (1998) found that, over the period 1988 to 1992, Malaysian-owned firms experienced lower TFP growth than foreign-owned firms. The rapid growth in Malaysia's manufacturing sector was achieved without much contribution from TFP growth.

The concurrent launch of the 7MP and the Second Industrial Master Plan
(IMP2) was another attempt by the authorities to achieve productivity growth and global competitiveness (Malaysia, 1996b, p. 284).

The authorities in Malaysia consider enhanced technological capacity an essential component of its ongoing industrial development. 7MP calls for the utilisation and application of new and advanced technologies to promote industrial innovation. The approaches suggested by 7MP to achieve this end include:

- inducing the flow of investment into high technology industries (or promoted industries) as laid out by the PIA (Appendix 2-5)
- upgrading the role of the Malaysian Technology Development Corporation (MTDC) and the Malaysian High Technology Government Group (MIGHT)
- providing R&D incentives to corporations that set up R&D facilities in Malaysia
- improving existing incentives, and introducing new measures to promote R&D in high technology products and processes
- enhancing manpower skills training

SMEs in Malaysia are recognised as making a valuable contribution to the growth of Malaysia and to its objective of becoming a fully developed country by the year 2020 (A. Wahab, 1996). Although contributing only 14.7 percent of total output, SMEs in Malaysia make up approximately 84 per cent of businesses in the local manufacturing sector (Malaysia, 1998d). To oversee the development of SMEs in Malaysia, the Small and Medium Industries Development Corporation (SMIDEC) was established under 7MP. However, 7MP does not place much emphasis on SMEs as a major force in industrial development; SMEs are only to be developed in terms of supporting larger enterprises (Malaysia, 1996b). In order for SMEs to fulfil this role, IMP2 aims to provide the necessary environment and support programmes for the modernisation and expansion of their plant, machinery, technology and production capacity.
Realising the contribution of R&D towards the development of technology-based SMEs, 7MP improved fiscal and financial incentives, and put in place the technology infrastructure to stimulate R&D and technological innovation. For example, the ITAF programme (discussed above) gave out grants amounting to RM25.1 million to more than 400 SMEs over the period 1996 to 1998 (Malaysia, 1999b). In terms of infrastructure, more than 80 start-up technology-based SMEs have been given access to common user facilities at Technology Park Malaysia, the UPM-MTDC Incubation Centre and the UTM Technovation Park. However, because SMEs are seen as supporting players, R&D support is directed towards improving efficiency and productivity rather than product innovation or new product development (Malaysia, 1996b. This approach may be appropriate for conventional SMEs, such as those in the textile or food industries. However, HTSMEs are research-intensive and R&D is a key driver to product and process innovation (Jankowski, 1998).

IMP2 is a follow-up programme to the Industrial Master Plan (1986-1995). It moves from an industry-based manufacturing strategy to a cluster-based approach\(^\text{15}\). IMP2 proposed the development of industrial clusters to promote large-scale production and international competitiveness. Each cluster comprises a primary industry supported by suppliers of components, raw materials, supporting services and cluster-specific infrastructure (The Star, 7 May 1996). IMP2 focused on capital-intensive manufacturing, aiming to encourage the application of high technology, greater innovation and better utilisation of resources. The cluster-based industrial policy is not new in global terms and Malaysia is not the only country to have adopted such a strategy. Efforts to stimulate and nurture a cluster-based strategy can be found in the United States (Sternberg, 1991; Held, 1996; Kohout, 1997), Germany, Japan (Harrison, 1994), Ireland and Singapore (Van Grunsven and Van Egeraat, 1999). It was Porter (1990) who first emphasised the importance of industrial clusters as a means of enhancing the competitiveness of a nation\(^\text{16}\). On the same lines as Porter, IMP2 defines a cluster as an agglomeration of inter-linked or related activities (Malaysia, 1997d). The cluster-based strategy promoted by IMP2 has to be underpinned by a strong economic foundation in the form of human resources, technology, financing, infrastructure and support services (A. Rahman, 1997). The
growth of the manufacturing sector has to be supported by the service sector and key suppliers.

FIGURE 2-7 ‘Manufacturing ++’ Strategy

Source: Malaysia (1997d)

In order to achieve its objectives, IMP2 proposes a strategy called “Manufacturing ++” to develop both the manufacturing and service sectors. The intention is to integrate R&D and design capabilities, and to develop support industries in, for example, packaging, distribution and marketing. The purpose of this integration is to strengthen industrial linkages and increase the productivity and competitiveness of Malaysian industries (Malaysia, 1998b). Figure 2-3 illustrates the Manufacturing ++ strategy. Value-added\(^{17}\) per employee can be increased by moving along value chain\(^{18}\) A or B. However, productivity-driven growth will be achieved only when value-added per employee moves to a higher plane, i.e., from plane A to B.

The two current strategies, 7MP and IMP2, are expected to provide Malaysia with an effective platform and network for domestic and international linkages in high technology industries. However, the two strategies have only been operating for four years and it is difficult to gauge their success to date.
Malaysia has also embarked on a very ambitious plan to create an industrial park for multimedia development, known as the Multimedia Super Corridor (MSC). Physically, the MSC is a 15 by 50-km corridor\textsuperscript{19} that includes Technology Park Malaysia. This concept builds on the 6MP framework when substantial investments were directed towards the basic IT infrastructure in preparation for the more sophisticated network of facilities and services required for the MSC (Malaysia, 1996b).

Malaysia’s move into multimedia is necessary as other South-East Asian nations are competing for manufacturing investment. With a fast-rising standard of living and labour shortages, Malaysia may not be able to compete with its neighbours that offer huge, low-cost manufacturing work forces unless it invests in multimedia development (McHale, 1997). Malaysia’s venture into multimedia development is backed by its experience in the semiconductor industry, having long been the hotbed of semiconductor packaging and electronic equipment assemblies (Dunn, 1995).

Companies wanting to enter the MSC need to apply for ‘MSC’ status\textsuperscript{20} by submitting their applications to the Multimedia Development Corporation (MDC), an implementation agency set up to oversee the development of MSC. Companies with MSC status are entitled to incentives and benefits backed by the Government’s Bill of Guarantees (Appendix 2-6). MSC status companies are also entitled to financial and non-financial status (Appendix 2-7).

By July 1999, a total of 228 companies, including 33 world-class corporations, had been accorded MSC status and these companies are in various stages of implementing their business plans (Ng, 1999). Forty of these companies were operating within the MSC area in March 1999 (The Star, 17 March 1999).

The MDC has taken a number of initiatives (Appendix 2-7) to develop a cluster of home grown HTSMEs; for example, a specialised consultation centre known as MDC Access has been established. The Centre assists SMEs to prepare for MSC status by providing business and technological advice. By March 2000, of the 586 SMEs operating in the IT field in Malaysia, 158 had achieved MSC status
(BERNAMA, 8 March, 2000). A number of these companies participated in my research programme.

Malaysia sees the MSC as a way to help move the country away from labour-intensive activities into the production of high-value-added goods and services. However, MSC will need about 17,000 knowledge workers over the next five years (The Star, 12 June, 1998). Between 1991 to 1995, the demand for IT manpower exceeded output by around 7,000 employees (Figure 2-8). Shortages were evident in systems development and engineering, software development and database management (Malaysia, 1996b). This situation still prevails today as the demand for IT graduates in Malaysia exceeds the supply from universities and technical colleges.

![FIGURE 2-8 Output and Demand of IT Manpower, 1991-1995](image)

At present, high technology companies tend to see Malaysia as a place to set up a regional headquarters for marketing and distribution, or technical support, rather than for product development. For example, Microsoft's office in Kuala Lumpur provides only sales and technical support to the local market. By offering state of the art infrastructure and generous subsidies, MSC has been able to attract participation from major IT companies such as Microsoft, IBM, Apple and Sun Microsystems.
However, the more established Singapore Science Park or the Bangalore 'Silicon Plateau' might still look more promising to foreign-based corporations.

A problem currently affecting MSC-status companies is the difficulty in raising venture capital (Einhorn, 1999). Compared to conventional SMEs, HTSMEs require a high level of up-front investment and are exposed to uncertainty in market acceptance of their products (Boocock, 1995). These problems became more severe after the Asian Financial Crisis in 1997 and were exacerbated when Malaysia introduced currency controls in 1998. Many MSC-status companies are now struggling to survive (Einhorn, 1999) – an issue dealt with in more detail in Chapter Eight. An increased supply of venture capital is essential for the successful implementation of the MSC concept. The success of Silicon Valley was driven by the willingness of venture capitalists to fund entrepreneurs. Without an injection of foreign venture capital, the MSC project may be delayed, since domestic venture capital companies have not been very supportive of companies wishing to locate in the MSC. For example, of 30 Malaysian venture capital companies, less than five are involved in financing IT businesses (The New Straits Time, 3 July, 1998). The low participation may indicate a lack of experience by domestic venture capital companies in assessing and evaluating multimedia or IT companies, or a lack of confidence that investments will mature at a profit.

2.3 SUMMARY
Malaysia has undergone four phases of industrial growth, beginning in 1958 after its independence from Britain, up to the year 2000, the end of the Seventh Malaysia Plan. Various policy measures have been introduced to propel Malaysia from an agriculture-based economy to an industrial nation.

In the early 1960s, foreign investors were invited to develop import substitution industries such as food and beverages. However in the late 1960s, the limited domestic market placed constraints on continued industrial development. The Government therefore began to encourage the development of export-oriented and labour-intensive industries. The early 1980s saw Malaysia’s involvement in heavy industries, when HICOM was established. Malaysia started rather late in promoting
the high technology sphere. Only after the introduction of the Promotion of Investment Act in 1986 did Malaysia look seriously at measures to improve its high technology capacity.

The launching of the 7MP marked Malaysia's interest in involving SMEs in the industrialisation of the country. The 7MP calls for the utilisation of new and advanced technology to promote industrial innovation by encouraging R&D and enhancing manpower skills. IMP2, which was launched simultaneously with 7MP, also focuses on creating strong linkages between SMEs and larger corporations through cluster-based industrial development. To this end, IMP2 proposed the 'Manufacturing++' strategy to develop the manufacturing and service sectors by integrating R&D, product design and support industries.

At this stage in its development, Malaysia might lose FDI to its lower-cost neighbours. The authorities have therefore embarked on an ambitious high technology multimedia development by establishing the Multimedia Super Corridor (MSC). MSC is seen as an opportunity for companies wishing to add value to their manufacturing and trading activities using multimedia technologies. Local HTSMEs are expected to participate actively in the project and some may evolve into highly innovative companies. However, in common with other high technology projects across the globe, MSC is currently plagued with escalating costs and a lack of skilled manpower.

The next chapter will highlight the importance of high technology sector, attempt to define what is meant by the term 'high technology' and describe policies formulated to support HTSMEs in the UK, the US and Japan.

Notes

FIGURE 2-1

1 The total exceeds 100 percent, as bank service charges and import duties were not taken into account.

2 The crisis was triggered by speculative activities of hedge funds, which made huge profits through massive short-term capital flows and, in the process, seriously destabilised the East Asian currencies (Malaysia, 1999a).

3 The calculation of the average overall manufacturing growth rate includes sales, wages, capital investment, exports and profitability.
Malaysia has been an ethnically diversified nation since British colonial rule, when immigrants from China and India were brought to live and work in the country. The indigenous Malay majority had been economically backward compared to the Chinese community (Yasuda, 1991).

The term Bumiputera means indigenous race (or “son of the soil”) of Malaysia. Usually used in reference to the Malays, it also encompasses other indigenous communities in Malaysia.

‘Leap-frogging’ refers to efforts initiated by the manufacturing sector to surpass the existing state of the art in the development of new technologies which are still in pre-commercialisation stage (Anuwar, 1992).

To ensure the success of the VDP, potential vendors are required to go through a process of factory auditing to enhance their chances of being selected as vendors by the anchor companies. Under this requirement, a technical team from MITI and its Technical Support Institutions carry out an evaluation of the technical, financial and managerial aspects of the potential vendor company. Upon compliance with the factory audit requirements, vendors are appointed by the anchor companies (Malaysia, 1994a).

Total factor productivity (TFP) refers to the additional output generated through enhancements in efficiency arising from advancements in worker education, skills and expertise, and the acquisition of superior management techniques, new technology and innovation, or upgrading of existing technology and enhancement of information technology (Malaysia, 1996b).

High technology companies that set up manufacturing plants in Malaysia qualify for full corporate tax exemption over a five-year period.

MTDC was formed by the government in 1992 to spearhead technology development in Malaysia. It is a joint venture between the Malaysian Government and seventeen of the largest corporations in Malaysia (Federation of Malaysian Manufacturers, 1998). MTDC was set up to commercialise the research results of universities and research organisations and encourage the growth of technology based SMEs in Malaysia. MTDC provides capital at various stages of a company’s growth (seed, start-up and expansion financing). Non-financial assistance includes technical consultancy and support services. This assistance is provided to companies, universities and R&D institutions to commercialise new research findings and facilitate the transfer of new technologies.

MIGHT is a non-profit partnership between 19 government agencies and 51 companies. MIGHT acts as a think-tank for the formulation and development of science and technology policy in Malaysia. MIGHT hopes to identify business and investment opportunities for industry, formulate policy options for the Government and identify research priorities for public and private sector institutions (Malaysia, 1996d).

Incentives are given to companies that carry out R&D activities. Contract R&D and R&D companies are also eligible for the incentives. An ‘R&D Company’ is a company that provides R&D services in Malaysia to a related, or any other, company. An R&D company qualifies for 100 percent corporate tax exemption for a full ten year period. A ‘Contract R&D Company’ provides R&D services to a company, other than a related company, and it is eligible for 100 percent for five years (Malaysia, 1998a). Other initiatives include the financing of research projects with commercial potential in the development of emerging technologies. This is being done through the existing Intensification of Research in Priority Areas (IRPA) Fund set up by the Government in 1988. The setting up of Technology Park Malaysia and the Kulim High Technology Park should also assist in the commercialisation of R&D and the training of workers for high technology industries.
Previous incentive schemes have been largely tax-based (except the IRPA Fund), whereas the Industry R&D Grant Scheme (IGS) introduced in 1997 is up-front direct R&D grant support based on the concept of risk sharing. The recipient will pay royalties to the Government at a low percentage of net sales if the project is commercialised internally and a higher percentage if the product/process is licensed out (Malaysia, 1998g).

Under 7MP, nine new public training institutes will be set up to provide the specific training needed by high technology industries. 7MP also encourages the corporate sector to initiate training programmes by granting financial assistance for the establishment of such institutes (Malaysia, 1996b).

A cluster can comprise companies within an industry that compete against each other (Kotval and Mullin, 1998).

Porter (1990) defines clusters as: "Geographic concentrations of interconnected companies and institutions in a particular field. Clusters encompass an array of linked industries and other entities important to competition".

Value-added is the value that an industry adds to its inputs by using labour and capital. It is represented by the value of total output less the value of bought-in materials and services (Malaysia, 1997d).

The value chain is the range of activities undertaken by an industry group within a region or country in the process of bringing a product from its earliest conception to its final sale (Malaysia, 1997d).

Two Smart Cities are being developed in the Corridor: Putrajaya, the new seat of government and administrative capital of Malaysia where the concept of electronic government will be introduced; and Cyberjaya, an intelligent city with multimedia industries, R&D centres, a Multimedia University and operational headquarters for multinationals wishing to direct their world-wide manufacturing and trading activities using multimedia technology.

Companies seeking MSC status need to fulfil one of the following three criteria: be a provider or a heavy user of multimedia products and services; or employ a substantial number of knowledge workers; or have a strong intent to transfer technology and/or knowledge to Malaysia, or contribute to the development of the MSC and the Malaysian economy.
CHAPTER 3

REVIEW OF THE LITERATURE II: HIGH TECHNOLOGY SMALL AND MEDIUM SIZED ENTERPRISES (HTSMEs)

3.0 INTRODUCTION
This chapter looks at the importance of the high technology sector. The chapter will also review the general literature on defining ‘high technology’ industries and small and medium sized enterprises (SMEs). Finally this chapter will look at the various policies formulated to support HTSMEs in Malaysia, the United States, the UK and Japan.

3.1 IMPORTANCE OF THE HIGH TECHNOLOGY SECTOR
The study of HTSMEs is important because of the “problems specific to smaller firms as well as the increasing importance of high technology in industrial growth” (Oakey et al., 1988). High technology industries produce high value-added products that have rippling or spillover effects on other industries (Fujita, 1988). Employment creation, the generation of wealth, and R&D spillover benefits have been identified as the three major reasons for supporting high technology industries.

3.1.1 Employment Creation
It has been a popular view that high technology enterprises are the key to new job creation (Reid and Garnsey, 1996). Even if new technology diminishes jobs in industries that use its products, it has been argued that the sectors producing high technology products will create jobs overall (Oakey, 1981). For example, robot welders may displace workers in motor vehicle plants, but more jobs will be created in the robotics industry.

However, opinions differ as to the ability of high technology industries to create employment. Some researchers argue that high technology industries have
never been a large employer and there is no prospect of them ever becoming one (Rumberger and Levin, 1984; Riche et al., 1983). Furthermore, the Science Policy Research Unit (SPRU) at the University of Sussex argues that high technology industries are more capable of job destruction than job creation (Freeman, 1982). The critical factor is how the technology is adopted and how organisations adapt to change (Mandeville et al., 1983). If industries adopt technology with the intention of cutting labour costs then technology may reduce employment (Macdonald, 1988). On the contrary, Markusen et al. (1986) pointed to the significant number of new jobs created in high technology industries in the US since 1972. Shachar and Felsenstein (1992) also contend that growth from high technology industries operating in an international context 'leaks out' to the local economy in the form of employment linkages.

Within high technology industries, HTSMEs can also be a powerful medium for creation of new jobs (Rothwell, 1984; Oakey, 1991a), but this may be an opportunity that is not fully exploited in most countries (Giaoutzi et al., 1988). Silicon Valley and Route 128 in Massachusetts give impressive examples of HTSMEs being employment generators (Dorfman, 1983; Rogers and Larsen, 1984). Armington (1984) suggests that HTSMEs are not simply concentrated in faster growing regions, and are able to generate new jobs in depressed areas. HTSMEs also have a lower 'death' rate than the overall small firm population, resulting in greater job creation by high technology firms (Bruno & Cooper, 1982).

While case studies in the UK suggest that HTSMEs have only a modest impact on employment (Oakey, 1984; Segal Quince Wicksteed, 1985, Oakey, 1991a) suggested two ways in which HTSMEs do contribute to employment growth. Firstly, the transition from small to large firm may create employment growth, for example, major US employers in the electronics industry, including Intel, Mostec and Texas Instruments, all started as small firms (Morse, 1976). Secondly the 'splintering' of new small firms from large firms creates employment opportunities.
3.1.2 Wealth Generation
High technology industries create wealth (Macdonald, 1988). Indeed wealth creation is increasingly based on new technologies or advanced technological expertise, rather than existing resources or factors of production (Stonier, 1983; Toffler, 1981).

The emergence of global competition indicates the need to innovate, and adopt and apply technological and organisational opportunities (Jegathesan et al., 1997). Stonier (1983) stresses the importance of R&D in wealth creation. The introduction of new technologies, such as those based on microprocessors, has created new products, like high-speed computers, which, in turn, improve the profitability of new process technologies, such as robot arms and computer software. Returns from high technology ventures can be huge and the owners of many high technology firms have made fortunes. For example, in the last 25 years, the US high technology sector has created more than 7,000 millionaires and a few dozen billionaires, nearly all of them self-made (Cringely, 1997).

An important contribution of HTSMEs is their impact on national wealth through the balance of payments mechanism. Smaller firms in the UK have achieved a significant share in manufacturing exports (Bannock & Peacock, 1989). In a survey of high technology firms located on the Cambridge Science Park, about 42 percent of firms exported more than 30 percent of sales and 27 percent exported more than 50 percent (Segal Quince Wicksteed, 1985; Pratten, 1991). In a similar study conducted in Germany, about one-third of HTSMEs exported more than 40 percent of sales and two-thirds more than 10 percent (Kulicke, 1986). In Japan, many HTSMEs assist export activity indirectly by acting as suppliers to larger companies (Kodama, 1991).

3.1.3 Research and Development Spillover Benefits
By definition, companies in high technology industries undertake a greater share of R&D spending than conventional companies. R&D benefits not only the firms conducting the research, but also other manufacturers and consumers, whether abroad or at home (Tyson, 1992). Spillover benefits can occur in a number of ways, including:
i) Scientific findings or breakthroughs may yield potential uses beyond the applications of a specific producer.

ii) Competitors may be able to copy or 'reverse-engineer' an innovation even after patent protection.

iii) Scientists and engineers may leave an established company to set up a competing one; this happens frequently in the semiconductor and computer industries.

As a result of spillovers, the social returns to R&D spending remain significantly higher than the return on ordinary capital (Baily and Chakrabarti, 1988). R&D spillovers are increasingly global and not necessarily national in scope. Spillover benefits made possible by information technology and modern communication systems may accrue to the rest of the world, either illegally through patent infringement and industrial espionage, or legally through joint ventures, partnerships, journals and the internet.

Technological innovation also helps to produce new high technology industries (Hall et al., 1987). R&D is one of the key characteristics of the successful implementation of innovation (Pavitt et al., 1989; Abernathy and Utterback, 1978; Oakey, 1991c; Young and Francis, 1991), and it is also an important means for enhancing the national rate of technological innovation (Rothwell, 1984; Oakey, 1991c; Berry, 1996).

HTSMEs have also contributed to R&D spillover benefits, as most HTSMEs are committed to product innovation. Oakey et al., (1988) discovered that 58 percent of HTSMEs had a full-time R&D department, 60 percent were involved in process innovation and 62 percent in product innovation.

The importance of the high technology sector is evident. The next section reviews various definitions of high technology industries used in the UK, the US and Malaysia, and determines the most appropriate definition for this study.
3.2 WHAT IS A HIGH TECHNOLOGY INDUSTRY?

The term 'high technology' carries different meanings to different people. To governments, high technology is associated with economic growth that might help to reduce unemployment and boost exports. To industry, high technology means new products and processes, while academia associates it with funding for research and development (Markusen et al., 1986). However, there is still no universally accepted definition of 'high technology' at either the industry or firm level (Riche et al., 1983; Butchart, 1987; Hall et al., 1987; Baruch, 1997). The definition of what constitutes a high technology industry is important because it allows support to be targeted at growth firms and industries (Markusen et al., 1986).

3.2.1 Problems in Defining High Technology

High technology industries are associated with high risk, as a result of uncertainty in a rapidly changing environment (Von Glinow and Mohrman, 1990). However, it is very difficult to pin down what constitutes a high technology firm or industry, how such firms are organised and managed, and why they are located in certain areas (Markusen et al., 1986; Riche et al., 1983; Butchart, 1987).

McQuaid and Breheny (1985, p. 5) suggested that:

The reason why the definition is so problematical is that researchers are trying to compromise between devising a conceptually sound, consistent and exhaustive definition and one which allows measurement and is practicable.

The measures used to categorise industries as high technology tend to suffer from problems of 'aggregation' or fail to treat all industries in the same manner (Glasmeier, 1985). Furthermore, the concept of high technology applicable to one region or country may not be appropriate for other regions or countries, for example, owing to differences in economic conditions or the availability of skilled human resources.

3.2.2 Conceptual Definition of High Technology

In trying to explain what is meant by a high technology industry, there are three major theoretical concepts which form the basis of increased understanding (Hall et al., 1987).
The first concept is known as the Kondratieff or long wave theory of economic change (Kondratieff, 1935; Freeman, 1982). Kondratieff, a Russian economist, postulated the existence of cycles of economic activity over very long periods of time (47 to 60 years). He argued that technological development created new opportunities and thus generated economic expansion. However, after a time, markets become saturated, and recession is followed by depression until a new wave of innovation sparks off the process again (Hall, 1985). Kondratieff suggested that depressed conditions stimulate "human inventiveness", leading to inventions that are exploited during the succeeding wave (Warren, 1982). However Kondratieff did not offer any explanation for the length of the 47-60 year economic cycle (Hall et al., 1987).

In the second concept, Schumpeter (1939) proposed that the diffusion of major new technologies produces a cyclical pattern of growth in capitalist economies (Freeman, 1984; Nelson, 1984). According to Schumpeter, innovation is the prime mover in the capitalist process. Each innovation jump starts the economic process and is subsequently followed by several other innovations (Bauer, 1997). For example, the introduction of steam engine led to the creation of railroads, which then led to the process of the Bessemer steel-making process (Hall et al., 1987).

The third concept (or group of concepts) is based on product and profit cycle theories (Markusen et al., 1986). The product cycle was first developed by Kuznets and Burns in 1930 (Hall et al., 1987) and subsequently adopted by Vernon (1966) and Hirsch (1967). Vernon used the theory to explain the development of capital-intensive manufacturing in low-wage countries. This work was later adopted by other researchers to explain the relocation of manufacturing sectors to the rural areas of the US in the 1960s and the 1970s (Mack and Schaeffer, 1992). The product cycle theory suggests all industries (and their products) go through a similar cycle. During the early stage, products are generally perceived to be 'high technology'. However, in the later stages of the cycle, the products mature and many early entrants drop out in the face of fierce competition, leaving a few successful firms to dominate the industry. At this stage, capital is substituted for labour as companies search for more efficient production methods, and process innovation becoming more important than product
innovation (Markusen et al., 1986). The profit cycle part of the theory was introduced by Markusen (1985b); rapid market growth means that early entrants to an industry may enjoy windfall profits. The average profit of companies in the industry is reduced by competition, but profits remain at above average levels at maturity. Finally, profits drop as the product reaches market saturation (Markusen, 1985b).

The three theoretical perspectives highlight the importance of innovation and product development over time, and high technology industries are clustered around the leading edge of such developments (Rothwell and Zegveld, 1981; Gershuny and Miles, 1983; Markusen et al., 1986). The theoretical perspectives provide some background on the nature of industrial innovation and the development of high technology industries. However, as stated above, an operational definition of high technology industries is required, to enable government support to be directed to appropriate firms and/or industries.

3.2.3 Operational Definition of High Technology

There are a number of ways that have been adopted to measure whether an industry should be classified as high technology (Malecki, 1981; Premus, 1982; Nelson, 1984; Hall et al., 1985; Markusen et al., 1986; Patrick, 1986; Von Glinow and Mohrman, 1990). The two most frequently cited criteria are discussed below.

i) The proportion of engineers and scientists (including technologists) employed in an industry (PSEE).

Under this definition, high technology industries are those in which the proportion of engineers, technicians and scientists (including life and computer scientists) exceeds the industrial average. The focus is on “how an industry is able to harness scientific and technical expertise in the development of new products” (Markusen et al., 1986, p. 16); one major advantage in using this occupational criterion is that data are “easily available, precise and comprehensive”. Furthermore, the measurement is more reliable than other criteria, because job definitions across industries are standardised and well defined. Markusen et al. (1986) also evaluated three other measurements of high technology industries: product sophistication;
employment growth rate; and R&D expenditure as a percentage of sales. The PSEE measurement was found to be the most objective and precise. According to Hall et al. (1987, p. 16):

The data available for this delineation are more comprehensive, precise, standardised and reliable than alternatives such as R&D as a percentage of sales.

Furthermore, the PSEE measurement is simple to apply because standardised classification of occupation (SIC - Standardised Industrial Classification) data are available on a global basis.

ii) The ratio of research and development expenditure to turnover (RRDET).

High technology industries are often identified on the basis of an above average R&D expenditure as a percentage of total industry sales (Markusen et al., 1986). This measurement may give some idea of an industry's capacity for “technical evolution” and its “information content” (Aydalot and Keeble, 1988, p. 2). R&D expenditure is essential if high technology industries are to search for new technical information and develop new products (Oakey et al., 1988). However this measure can be quite misleading for sectors where a large sales volume makes up the denominator of the measurement, such as the petroleum refining sector (Markusen et al., 1986).

Hall and Markusen (1983) and Hall et al. (1987) used PSEE to define high technology industries. However, Langridge (1984) used employment growth rate, PSEE and RRDET. In determining the criteria for high technology industries, the US Department of Commerce (United States of America, 1983, p.35) suggested the following cut-off points:

As a general proposition, technology-intensive industries are defined as those which normally spend 5 percent or more of their gross product on R&D and/or normally 5 percent or more of their total employment consists of 'natural' scientists, engineers and technicians. High technology industries normally spend at least 10 percent of their gross product (value added) on R & D and/or at least 10 percent of their total employment consists of 'natural' scientists, engineers and technicians.
'High technology' industries, therefore, are clearly more R&D intensive and employ greater numbers of scientists, engineers and technicians than 'technology-intensive' industries. Hall and Markusen (1983) used the US Department of Commerce high technology criteria in their study of high technology industries in the US. Hall et al. (1987) also used the same criteria to define UK high technology industries. This approach, classifying certain industries as high technology, with all firms within the industry automatically classed as high technology companies, has been adopted by most industrialised countries and practised globally. However, it was not possible to use the same approach for this study, because it is almost impossible to obtain data relating to the proportion of engineers and scientists across Malaysian industries.

An alternative approach is one that defines high technology companies or establishments rather than industries (Hall et al., 1987). For example, Little (1977) defines high technology firms as those based on a patented invention or those with substantial technological risk. While an approach based on the definition of individual firms may be appropriate for the evaluation of specific policies, it is not appropriate for national studies. In a national study, the firm-based approach is likely to complement an industry-based approach (Hall et al., 1987). The principal difficulty in adopting the company-specific approach in Malaysia is that firms are reluctant to reveal information on R&D and the number of technical employees.

In any event, an industry approach is more appropriate for my study. Toffler (1970) argued that:

The moment is right for the formation in each of the high technology nations of a movement for total self-review, a public examination aimed at broadening and defining in social, as well as merely economic terms, the goals of progress. On the edge of a millennium we are racing blindly into the future, but where do we want to go?

A sound definition of high technology industries will enable planning and assistance to be channelled to these growth industries, thus facilitating further growth (Oakey et al., 1988). The argument for a universally accepted and applicable definition was put forward by Oakey et al. (1988, p. 37):
A common 'bench-mark' should be created against which both academics and government planners might 'offer up' particular industries in order to measure the extent to which they are truly worthy of the title 'high technology'.

Unfortunately, Malaysia does not have a clear and standardised measure for defining high technology industries. It does not adopt the global definition of high technology, choosing to rely upon the arbitrary definition operated by MITI. The PIA identified eleven areas as new and emerging technologies and classified them as high technology industries (Appendix 2-2). Every company that operates within one of those industries, and is involved in the activities and products listed by the PIA, is considered to be a high technology company. Moreover, the PSEE and the RRDET criteria are used only for the purpose of determining eligibility for high technology incentives (Appendix 3-1) a high technology firm qualifies for pioneer status and investment tax allowances, provided that:

- the local R&D expenditure to gross sales is at least 1 percent annually for a period of three years after commencement of business, and

- the proportion of science and technical graduates within the total workforce is at least 7 percent.

This policy of defining high technology industries based on promoted activities and products leads to anomalies and inconsistencies. A number of MITI promoted industries would not be classed as high technology elsewhere. For example, companies using high technology processes, such as microelectronics, but producing traditional low technology goods such as furniture would not be classified as high technology companies in the developed world. Companies producing high technology products such as medical equipment, a promoted high technology product under PIA, but using low technologies involving a high degree of manual labour can also be classified as high technology in Malaysia. Most commentators would exclude the latter companies from the definition of high technology and consider that such companies simply experience the impact of new technology (Braun and Senker, 1982). Unfortunately, in Malaysia, the examples cited above are still considered as...
high technology companies because they engage in an activity or manufacture a product classified as ‘high technology’.

In summary, therefore, while the most appropriate definition for my study of HTSMEs would have been the RRDET and PSEE criteria, I was forced to adopt the Malaysian definition of a high technology industry, as set out in Chapter Two and Appendix 2-2. I could not compile a sampling frame based on the PSEE and/or the RRDET approach because it is almost impossible to obtain data on the proportion of skilled employees, or R&D and sales turnover. By adopting the ‘official’ Malaysian definition based on PIA approved activities and products, I was able to compile a sample of SMEs operating in high technology sectors. (The construction of the sample is explored more fully in Chapter Six on Research Methodology). However, the obvious drawback of using this somewhat arbitrary approach is it may result in the exclusion of certain high technology companies and the inclusion of companies that should not be classified as high technology under the globally-accepted RRDET and PSEE criteria.

3.3 WHAT IS A SMALL OR MEDIUM-SIZED ENTERPRISE (SME)?
It is necessary to define what is meant by an SME in order to avoid any misunderstanding of the term (Scott and Bruce, 1987; Wilson, 1992). Defining an SME is not just an academic exercise, it also assists governments in formulating policies to support the growth of HTSMEs.

As with the high technology debate above, there is no single, precise and universally-accepted definition of an SME. The definitions differ because they are used for different purposes such as support policy, taxation and legislation (Bridge et al., 1998). Furthermore, different countries tend to adopt different definitions based on the local context (Teng and Boon, 1995). This diversity is demonstrated in Tables 3-2 and 3-3 below.

The most common basis for defining an SME is size. According to Bridge et al. (1998), size is used as a distinguishing feature because it is easy to measure. The most common measure of size is employment, though some researchers use sales
turnover. Even when employment is used, the definitions change over time. For example, the EU definition of an SME used to be fewer than 500 employees, but the limit was changed to fewer than 250 in 1996 (Table 3.2).

In the UK, the Bolton Committee described the key characteristics of small firms (Bolton, 1971) in qualitative terms as:

- being managed by its owner(s)
- having a relatively small share of the market in economic terms
- being independent, i.e., it does not form part of a larger enterprise.

Nevertheless, Bolton warned against relying on a single size threshold. A number of criticisms of the Bolton definition have been made, including the difficulty of measuring independence and the fact that low market share is not always a characteristic of a small firm (Stokes, 1995). The Bolton Report also defined small firms quantitatively (Table 3-1).

<table>
<thead>
<tr>
<th>Sector</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Manufacturing</td>
<td>200 employees or fewer</td>
</tr>
<tr>
<td>Construction, mining and quarrying</td>
<td>25 employees or fewer</td>
</tr>
<tr>
<td>Retailing and Miscellaneous</td>
<td>Turnover of £50,000 or less</td>
</tr>
</tbody>
</table>

Source: Bolton (1971)

The Department of Trade and Industry (DTI) usually uses the criteria set out in Section 249 of the Companies Act of 1985. The Act defines small companies as having a maximum of 50 employees and medium-sized enterprises a maximum of 250 employees – see Table 3-2 (Bridge et al., 1998). When firms are examined at a sectoral level, all firms in some sectors may be regarded as small, while other sectors might contain no small firms (Keeble et al., 1991; Storey, 1994b). Bolton acknowledged that:
... a firm of a given size could be small to one sector where the market is large and there are many competitors, whereas a firm of similar proportions could be large in another sector with fewer players and/or generally smaller firms within it.

The US takes a different approach (Table 3.2). An SME is defined by employee numbers in the manufacturing sector and by performance in the non-manufacturing sector (Bridge et al., 1998).

| Table 3-2 Definition of an SME: UK, EU, Malaysia and US |
|----------------------------------|------------------|------------------|
| Country                         | Small | Medium |
| UK                              | 50    | 250    |
| European Union                  | 50    | 250    |
| Malaysia                        | 50    | 150    |
| US                              | N/A   | 500    |

N/A: Not Applicable

As in other countries, Malaysia has faced difficulty in defining SMEs. There is no legal or formal definition of an SME (A. Wahab, 1996; Abdullah, 1999). Various government agencies have adopted different definitions for different purposes. The Credit Guarantee Corporation (CGC) defines SMEs as establishments having net assets or shareholders’ fund not exceeding RM250,000 (Credit Guarantee Corporation, 1999). Most government agencies responsible for assisting SMEs normally use the definition of the Coordinating Council for Development of Small-Scale Enterprises Division (Chee, 1990); that SMEs should have paid-up capital not exceeding RM2.5 million (Abdullah, 1999). Malaysia has recently redefined SMEs as firms with fewer than 150 full-time employees (Malaysia 1999b). Previously, shareholders’ funds or net assets were also used (Hassan, 1992). The new definition based solely on employees will ensure that more companies are eligible for SME support programmes (Malaysia, 1998e). However, the new definition applies only to companies in the manufacturing sector (Federation of Malaysian Manufacturers, 1998). Companies in service sectors, such as Information Technology (IT), will thus be excluded from incentives available to SMEs, even though many of those would be categorised as high technology enterprises.
Given the discussion above, it is not surprising that previous studies have used differing definitions of SMEs. Hakim (1989) and Barkham et al. (1996a) restricted their analysis to firms employing fewer than 50 people. North and Smallbone (1995) used 100 employees as the limit, while Crick (1997) defined an SME as a firm employing fewer than 250 people. Many researchers have used the Bolton maximum of '200 employees' as the threshold (Oakley, 1984; Oakey et al., 1988; Wilson, 1992; Mukhtar, 1998). However, Storey (1994b) pointed out that the economic and statistical definitions suggested by Bolton might no longer be relevant. An alternative definition suggested by Storey is the previous EU definition of an SME, i.e., firms employing fewer than 500 workers. According to Storey (1994b, p. 13), the major advantage of using the EU definition is:

Unlike Bolton, it does not use any criteria other than employment, and does not vary its definition according to the sector of the enterprise.

Other studies, such as Advisory Council on Science and Technology (1990), Bryson et al. (1997) and Pfirrmann (1998), have also used 500 employees as the threshold for differentiating SMEs from large companies. Japan's definition of SMEs varies according to sectors (Table 3.3). In Malaysia, Fong (1990) adopted the ICA definition, where an SME is an establishment, which employs fewer than 75 full-time employees and is engaged in manufacturing activities. Mohamed (1996) defined SMEs as companies employing 5 or more fulltime employees, a rather strange choice!

<table>
<thead>
<tr>
<th>Industries</th>
<th>Maximum No. of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining, manufacturing &amp; other industries</td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Wholesale</td>
<td>-</td>
</tr>
<tr>
<td>Retail and service</td>
<td>-</td>
</tr>
<tr>
<td>Manufacturing and other industries</td>
<td>20</td>
</tr>
<tr>
<td>Commerce and services</td>
<td>5</td>
</tr>
</tbody>
</table>

*Source: Japan (1997)
After careful consideration of the theoretical and practical issues, I decided to utilise a size classification based on employment. This measure of firm size is more practical as "information about employment is readily available and ... considered by managers to be less confidential" (Pratten, 1991). A measure based on turnover has been found to vary according to the type of sector (Storey, 1994b) and change over time with inflation (Bridge et al., 1998). Thus, turnover presents problems in terms of sampling.

In view of the lack of a uniformly accepted definition of what constitutes a small firm, I decided to adopt the UK classification of an SME, comprising 250 employees or fewer. The UK definition takes in bigger companies (250 employees compared to 150 in Malaysia), and this size limit enables me to explore the characteristics of more high-technology companies in my sample.

3.4 GOVERNMENT POLICY TOWARDS HTSMEs

3.4.1 Introduction

Throughout the 1980s, Europe and the US experienced growth in the small firm sector (Keeble and Weber, 1986). Technological change, in most countries throughout the world, is seen as a driving force for growth and economic development (Brown and Rushing, 1986). This factor has encouraged policy makers to target assistance at SMEs engaged in high technology as a vehicle for industrial growth, especially for depressed regions (Oakey et al., 1988). Owing to the large capital investment required and long lead-times of product innovation in high technology companies, government involvement is necessary. For example, the Japanese Government assisted R&D in HTSMEs by doubling the Science and Technology budget between 1992 and 2000 (Yoshida, 1999).

This section will be confined to general comments about the nature of government assistance in a number of countries including the UK, the US and Japan. In discussing technology policy, both small and large firms must be considered since they interact in the chain of production. Furthermore, small firms of today may become large firms of tomorrow (Oakey, 1991b). According to Oakey (1991b, pp.143):
If government is concerned with the maximisation of industrial growth in high technology sectors, the encouragement of small firms is warranted, both on grounds of aggregate small firm output and employment growth, and in terms of the encouragement of individual transition from small-to large-firm status.

However, it is important to emphasise that the objectives of high technology policy towards SMEs vary from country to country, depending on the economic and industrial background, the resources available and the social and political agenda. For example, the national technology policy in Denmark reflects the dominance of small firms in the economy, since Denmark is not a significant ‘home nation’ to any large multinational companies (Higgins, 1996). Its policy focuses on the transfer of technological knowledge and mechanisms for transfer of technology from foreign to local firms. Canada, on the other hand, has a large technology deficit with the US, a major trading and free trade partner (Litvak, 1996). The Canadian Government may therefore need to consider the ‘binational’ character of its SMEs, many of whom have subsidiaries in the US.

What distinguishes high technology policies from more traditional economic development policies is that the former are more strategic and broader in scope. Muniak (1994, p. 804) pointed out:

Compared with more conventional economic development efforts, these high-tech initiatives are far more broad and multi-faceted, characteristically involving an elaborate mix of public policies operating on different fronts, such as tax concessions, targeted business lending, venture capital programmes, publicly financed construction of industrial facilities, establishment of business incubator sites, information resource centres, land banking for future high-tech expansion and enactment of sectorally favourable regulations - all part of a planned and comprehensive strategy.

Thus, according to Bridge et al. (1998, p. 249), HTSMEs have “particular problems needing tailored solutions”, to maximise their contribution to innovation and their potential for growth.
3.4.2 Malaysia

Many of the policies in support of HTSMEs in Malaysia have been discussed in Chapter Two. The policies formulated under the 7MP and the IMP2 focus on integrating HTSMEs with the activities of large-scale industries. For example the Industrial Linkage Programme (ILP), supervised by SMIDEC, was introduced to enhance the linkages and integration between HTSMEs and large companies. Under the programme, HTSMEs are expected to supply parts and components to larger enterprises. However, as discussed in Section 2.2.4, such a policy may be more appropriate for conventional SMEs. HTSMEs are research intensive, and R&D is the key ingredient for promoting product and process innovation. Furthermore, such support needs to be tailored to specific firms (Bridge et al., 1998).

Other incentives for HTSMEs include the High Technology Incentives (Appendix 3-1), Incentives for Software Development (Appendix 3-2), Incentives for R&D (Appendix 3-3) and incentives for use of IT (Appendix 3-4). However, most of the financial support is short-term, ignoring the fact that HTSMEs are exposed to “long lead times and high up-front costs” (Bank of England, 1996b, p. 8). It is not surprising, therefore, that more than 60 percent of HTSMEs in Malaysia started their business with their own personal funds (Fong, 1990).

Encouraged by the success of Science Parks in the UK and US, Malaysia has taken the initiative in establishing technology parks and incubation centres to promote the growth of HTSMEs. The setting up of the Technology Park and the Kulim High Technology Park are two examples of such initiatives. However, unlike the UK and US, neither of these parks is located close to a university system nor are they linked formally or operationally with a University. Without this interaction, Science Parks in Malaysia might be thought of as “real estate developments primarily designed to accommodate high technology firms” (Monck et al., 1988).

The most recent prominent effort to promote the growth of HTSMEs is the attempt to match the success of Silicon Valley. The MSC (Section 2.2.4) was developed to provide a sophisticated network of IT facilities and services to leapfrog Malaysia’s high technology growth. It also provides the catalyst for IT development; a total of
RM2.3 billion (£426 million) has been allocated to investment in IT-related programmes and projects under the 7MP. Furthermore, Advanced Electronics and Software Engineering, two major IT sectors, are included as promoted activities and products for high technology companies in Malaysia under the PIA (Appendix 2-2). However, as stated in Chapter 2, the MSC is currently facing a number of setbacks, especially a lack of IT manpower (The Star, 12 June 1998). The demand for IT graduates from local universities and technical colleges exceeds the supply. The timescale for establishing the MSC might have been too ambitious - Silicon Valley did not happen overnight.

3.4.3 The UK
The evolution of policies governing HTSMEs in the UK has displayed a similar pattern to those adopted for SMEs in general (Oakey and Mukhtar, 1999). Thus, it is appropriate to examine some of the general policies aimed at SMEs, within this more specific assessment of policies for HTSMEs.

The appointment of the Bolton Committee in 1969 marked the beginning of an official small firm policy in Britain (Beesley & Wilson, 1984). That Report provoked much interest through its assessment of the constraints and disadvantages encountered by small firms and its recommendations for remedial action by the Government. The Government has shifted emphasis from providing direct assistance in the 1970s to 'softer' forms of support. According to Stanworth and Gray (1991):

> Through the 1980s there has been something of a shift in small firm policy, with less emphasis being given to the provision of 'hard' assistance in the form, for example, of financial support and more emphasis being placed in the 'software' elements of business assistance such as information, advice and training.

Policy development towards HTSMEs in the UK has displayed a similar pattern. According to Oakey (p. 1, 1997):

> Such policy has been characterised by long periods of apathy, punctuated by sudden bursts of concern. These concentrated periods of interests have often been marked by subsequent government enquiries.
Government enquiries tend to focus on capital market issues as they affect SMEs, for example, the ‘short-termism’ of financial institutions (Oakey and Mukhtar, 1999). There is very little Government financial support for HTSMEs, since it is assumed that HTSMEs “generally enjoy the high profits that result from free market competition in lucrative areas of high technology” (Oakey, 1997, p.1). However, there are a number of indirect schemes available to assist HTSMEs (Bridge et al., 1998), including:

- The Small Firms Merit Award for Research and Technology (SMART) and the Small Firms Award for Projects Under Research (SPUR) are both competitive schemes that offer assistance towards R&D costs.

- EU assistance for the establishment of Business Innovation Centres (BICs), though BICs are not restricted to HTSMEs only.

Compared to the US, few HTSMEs in the UK achieve the small to large firm transition. The evidence is particularly clear for firms engaged in electronics (Rothwell & Zegveld, 1982; Oakey 1984). The qualification criteria of major innovation support programmes, originally designed for large firms, have not been modified to suit SMEs’ involvement (Oakey, 1996). While the UK Government provides direct support to SMEs, it is reluctant to formulate policies which favour high technology firms. This may have resulted in a poor environment for innovation and growth. Oakey (1991a, p. 144) made the following observation:

The major problem with the ‘free market’ approach to economic development is that unregulated competition is likely to result in a form of economic anarchy in which the goals and needs of individuals are pursued and (occasionally) fulfilled, while there is no provision for the achievement of collective needs of the nation.

The free market approach may have had negative effects for HTSMEs, for example, being acquired by foreign companies (Oakey, 1991b). The lack of an official Government policy towards HTSMEs has led to two major forms of non-governmental support (Oakey, 1997):
a) Private sector financial institutions were pressured by the Government and public media to create a number of venture capital arms. However, venture capital investors (VCI) in the UK tend to use more rigorous criteria for assessing technology-based ventures than VCI in the US. The latter place three times as much finance with new technology-based firms compared to their UK counterparts (Reid, 1998).

b) The emphasis in the UK has been on Science Parks as a vehicle for high technology development (Oakey 1985). It was assumed that interactions between universities and HTSMEs would help to enhance the growth of latter. However, empirical evidence has refuted the impact of such interactions on the growth of HTSMEs (Oakey, 1985; Massey et al., 1992; Oakey, 1996).

3.4.4 The US
Historically, technology policy in the US has been defence-related, and motivated by national security concerns rather than any economic strategy (Ham and Mowery, 1995). By the 1980s, the global technology dominance of the US had been reduced, owing to changes in international technological and economic conditions. According to Guerrieri and Milana (1995), the US share of global high technology exports had declined by 9 percent in the 20 years from 1970, while the Japanese share had more than doubled. It was believed that, without Government support, large firms in the US would not be able to compete on equal terms with their counterparts in the Pacific Rim countries and Western Europe (Oakey, 1991b). The US Government introduced a number of high technology funds, one of which was designed to enable SMEs to learn about new technologies (United States of America, 1991).

Although it generally favours the free market approach, the US Government has experimented with programmes that strengthen civilian technology capabilities through subsidising and promoting joint R&D, and supporting collaboration between US industry and universities, as well as funding federal laboratories (Ham and Mowery, 1995).
State economic development agencies have also been quite active in creating programmes for the development of HTSMEs (Blakely and Nishikawa, 1992). The success of Silicon Valley and Boston's Route 128 have encouraged state governments to create incubators designed for high technology companies, with a special focus towards biotechnology. These incubator programmes provide the infrastructure that facilitates information networks and bring together interested parties such as researchers and venture capitalists. Blakely and Nishikawa (pp. 5) pointed out:

The purpose of the incubation program is to cross-fertilise ideas, to bring together people and resources that can realise the commercial potential of innovations.

These incubation programmes have become increasingly popular in universities across the US and have been adopted by some universities in the UK.

3.4.5 Japan
While the American and British Governments tend to favour a non-interventionist approach, the Japanese Government is very active in ensuring that high technology firms are protected from foreign hands (Patrick, 1986). Over the years, the Japanese Government has formulated policies that are regarded as "verging on the illegal" (Oakey, 1991b), condoning activities such as 'dumping' and obstructing foreign goods from entering the country. Whittaker (1997) pointed out:

.....(Japanese) government support for SMEs is significant, especially when viewed comparatively. In some cases it has been protective......

The majority of SMEs in Japan are subcontractors to larger firms (Bhalla, 1996), thus they have a low level of product invention and innovation (Rothwell & Zegveld, 1982; Oakey 1991a). It is not surprising to find only large firms showing good performance whereas very few HTSMEs do so (Heckle, 1996). To overcome this problem, the Japanese Government launched advisory services for SMEs on topics such as the application of new technology, the attraction of foreign investment and subcontracting. Small firms were encouraged to create new technology as well as use it. Policies and measures were introduced to revitalise small firm industrial zones,
and to encourage start-ups and diversification into new business areas and creative business activities (Whittaker, 1997).

With over six million SMEs in Japan, employing 75 percent of the working population, SMEs are central to the Japanese economy. Thus, the Government has put much effort in ensuring the growth of SMEs. Bernstein (1993) identified the following official support available to Japanese SMEs:

i) Loan opportunities; many low-interest loans are available from the Government for technology development, increasing exports, reducing pollution, etc. These loans are channelled through organisations such as the Chambers of Commerce.

ii) Technology development programmes; loans are exempted from repayment if the technology introduced helps the economy and/or increases employment.

iii) Small business insurance funds, which meet up to 80 percent of loans for SMEs developing new technologies.

iv) Delegated loan funds, where the Government funds trade associations and allow these associations to fund SMEs they believe can bring a product to the market. This scheme is often utilised for technology developed at universities or public research facilities, but where SMEs manufacture and market the product.

The development of Japan's high technology sector has long been a national goal, hence public and private sectors work closely to achieve the objective. According to Ross (1997), no other high technology policy initiated by a government has been as well co-ordinated and effective. A large share of Japan's national budget has been devoted to Government-supported high technology projects. For example, Japan's Council for Science and Technology (CST), allocated £102 billion to R&D over a five-year period. The focus is on the transfer of R&D output to industry, thus enhancing technology diffusion (Ross, 1997).
3.5 SUMMARY

The literature review identified three major reasons why HTSMEs should be the focus of industrial policy in any country: employment creation; generation of wealth; and R&D spillover benefits.

This chapter has reviewed the various definitions of high technology industries, taking in both conceptual and operational definitions. The most frequently used measures are based on the ratio of engineers and scientists to total number of employees, and the ratio of R&D expenditure to total sales. While the most appropriate definition for my study of HTSMEs would have been the RRDET and PSEE criteria, I adopted the Malaysian definition of high technology industries, as set out in Appendix 2-2. I could not compile a sampling frame based on the PSEE and/or the RRDET approach, because it is almost impossible to obtain data on the proportion of skilled employees, and industrial R&D and sales turnover.

It is also important to clarify what is meant by the term ‘SME’, as there is no single, precise and universally-accepted definition. Various definitions of SMEs have been used by researchers and policy makers to differentiate small and medium-sized firms from large enterprises. The literature review revealed a wide variety of definitions across industrial sectors and in different countries. The most common definitional basis is by size of business, and the most common measure of size is employment. For the purpose of this study, the 250 employees cut-off point was adopted because this definition enables me to study larger companies, particularly those engaged in high technology activities.

The final section was devoted to policies governing HTSMEs in Malaysia, the UK, the US and Japan. While the UK and the US Governments provide comparatively minor support for HTSMEs, the Japanese Government provides significant assistance. The efforts by Malaysia to support high technology activities have not been a conspicuous success. The nation is heavily dependent on the US, UK and Japan for assistance in development of its high technology sector.
The next chapter will review the various factors influencing the growth of HTSMEs, and highlight the importance of growth. It then surveys the literature on the stages of growth, before exploring the measures of growth and characteristics of high growth firms. Finally, Chapter 4 examines the determinants and constraints on the growth of HTSMEs.

Notes

1 Scholars differ on whether innovations are the primary cause or whether other mechanisms produce high technology industries (Hall et al., 1987).

2 A definition based on aggregation could include industries that utilise high process technology to produce low technology products or low process technology to produce high technology products. However, it should clearly not include industries that use low technology processes to produce low technology products.

3 According to United Kingdom Science Park Association (UKSPA), a Science Park is a property based initiative which has formal and operational links with a University, other Higher Education Institution or Research Centre (Monck et al., 1988, pp. 64).

4 The move towards science parks emanated from the US; it was assumed in Europe that the growth of Silicon Valley was due to technological interaction between local universities and firms located in Silicon Valley (Oakey, 1997).
CHAPTER 4

LITERATURE REVIEW III: GROWTH OF HTSMEs

4.0 INTRODUCTION

Whilst Chapter Three reviews the literature on defining HTSMEs, this chapter looks at various factors influencing the growth of HTSMEs. The chapter begins by highlighting the importance of growth. It then surveys the literature on the stages of growth, before exploring the measures of growth and high growth firms. Finally, the chapter examines determinants and constraints on the growth of HTSMEs.

4.1 IMPORTANCE OF GROWTH

Growth is a concept that has been used in all areas of human knowledge to 'express changes in size, magnitude, and relationships over time' (Tuene, 1988). According to Tuene, the main preoccupation of growth during the past three or four centuries has been economic. Growth is important for generating national wealth and creating jobs (Oakey, 1981; Markusen et al., 1986; Reid and Garnsey, 1996; Barkham et al., 1996b). Economists and public policy makers are more interested in growth than the financial performance of firms (Barkham et al., 1996b). Growth indicates the ability of a firm to develop a critical base of sales to withstand adverse economic effects in future (Woo et al., 1989). Furthermore, the study of growth can assist policy makers in targeting resources and effort (Bridge et al., 1998). A popular target for support is HTSMEs. Such enterprises, as noted in Section 3.4 (Chapter Three), play a critical role in the business and economic life of a nation. They represent an elite group in the manufacturing and service sectors. As a consequence, potential entrepreneurs, and most governments, have strong interest in discovering the characteristics of growth HTSMEs.

After briefly highlighting the importance of growth, the following section discusses the stages of growth that most HTSMEs go through.
4.2 STAGES OF GROWTH

All businesses pass through various stages as they grow. However, the pattern of growth is not standard. Some businesses move through the various stages at the same speed, while others stay at the same stage for a considerable period. It may be possible for HTSMEs with leading edge technology to progress through certain stages of growth faster than conventional SMEs. Furthermore, a latecomer that acquires, rather than develops, technology can leapfrog to the next stage of growth without having to endure the challenges found in the earlier stages (Byars et al., 1996).

It is important for OMs to have prior knowledge of the challenges to expect at each stage, enabling them to plan effectively for growth (Scott and Bruce, 1987). A knowledge of the stages of growth should also assist governments in evaluating existing (and proposed) policies for HTSMEs (Churchill and Lewis, 1983). A number of models have been developed to explain growth patterns, and these are set out below.

Churchill and Lewis (1983), Scott and Bruce (1987) and Churchill (1997) have described the phases of growth common to most companies. However, Kazanjian and Drazin (1987) proposed a four-stage model applicable specifically to HTSMEs, i.e., Conception, Commercialisation, Growth and Stability. They argued that the problems faced by technology-based enterprises change throughout the various stages of growth, for example, firms face greater problems in securing financial resources during the early stages of growth. Kazanjian and Drazin also discovered that the organisational system changes from an informal to a formal structure as firms grow. Hanks et al. (1993) classified the growth stages of high technology firms as Start-Up, Expansion, Consolidation, Diversification and Decline (implying negative growth). By contrast, Young (1985) identified three growth stages: Seed; Venture; and, Development.

From the literature above, and other studies, a fairly consistent model has emerged (Hanks et al., 1993), despite some disagreement over the number of stages - see Figure 4-1.
This section now explores the characteristics of the four growth stages shown in Figure 4-1.

4.2.1 Conception/Start-Up
This is the ‘concept’ stage, because the firm has not really come into existence (Churchill, 1997). Galbraith (1982) considered this the ‘prototype’ stage because it involves the task of inventing and making the first product. Oakey (1995) suggested that the start-up or formation date of a HTSME start-up would typically be preceded by a period of innovation, until initial sales are achieved.

During this stage, the company is primarily concerned with product development, securing adequate financial backing and the identification of market opportunities (Kazanjian and Drazin, 1989). The organisational structure is simple and the OM typically performs all the important tasks. At this stage, the OM’s business acumen tends to be minimal (Oakey, 1984) and the main concern is finance. HTSMEs are regarded as highly risky investments by financial institutions, hence they are forced to rely more on equity than debt financing in order to develop (Slatter, 1992). As a business develops it will exhaust its initial capital and resources. It also finds that retained profits cannot match its development plans. Thus, external equity is
needed to fill the gap between investment opportunity and internal resources (ACOST, 1990). However, external equity is scarce. In the UK, for example, venture capital (VC) activity is dominated by investments in management buy-outs rather than in start-ups. Furthermore, according to Mason et al. (1996), there are relatively few VC firms that specialise in high technology.

Many HTSMEs have been established when R&D projects provide ideas for spin-off products, but such companies frequently suffer from a lack of marketable products in the initial stages (Churchill and Lewis, 1983; Oakey, 1995). The probability of success for a high tech start-up is extremely low. For example, only six of every million high tech start-ups in the United States go public (Nesheim, 1997). A major problem in new product development is intense competition. To achieve a leadership role, it is imperative for start-ups to have an R&D investment strategy. New product development carries high element of uncertainty. New technologies and markets create risks that are common to all high technology start-ups. These risks can be reduced by developing and marketing a single (or few) products on time and within budget, and gaining market acceptance for them (Deloitte Haskins and Sells, 1984).

The innovation process in HTSMEs starts with the decision to develop the product and ends when successful sales in the marketplace are achieved. In practice, the product cycle has to include a complete innovation cycle that integrates R&D, production and marketing elements (Oakey, 1991b) - see Figure 4-2. This implies the investment of considerable resources in order to make the innovation cycle a success. A failure to fund any part of the innovation cycle may therefore result in the failure of a project. According to Donath (1997), HTSMEs usually face short product life cycles and OMs face persistent demands for investment performance in the short-term (see Figure 4-2). In this situation, HTSMEs may 'crash and burn', as there is too much competitive pressure to build customer loyalty for the long-term.
It has been noted that the timing of the decision to establish a high technology firm is critical, because it affects future growth (Oakey, 1995). Oakey argued that, ideally, HTSMEs should be formed after a new product has been fully developed and is ready for the market. This will ensure that the firm achieves significant immediate sales to fund its future growth. However, in most instances, high technology firms are formed prior to full product development, and the development period depends on the firm’s ability to develop the new product - the longer the development period the higher the risk level. The period before the first product is developed is also known as ‘experimentation’ (Slatter, 1992) or the ‘crafting strategy’ period (Mintzberg, 1987). Figure 4-3 illustrates graphically the formation process when the product is launched after the firm is established. Profits are defined as sales of goods and services minus operating costs, excluding R&D expenditure. It can be seen that the product will not make an overall profit for the firm until the profit generated exceeds R&D costs.
4.2.2 Venture/Commercialisation

Having gained adequate financial backing and demonstrated technical and market feasibility, HTSMEs then focus on commercialising the product (Kazanjian and Drazin, 1989). However, there is no guarantee, as Oakey demonstrated in Figure 4-3, that the new product can be turned into a viable business venture. Technical consulting may not reveal a product’s market potential (Slatter, 1992), and the marketing of a high technology product is costly, with an uncertain outcome (Oakey, 1997). Thus, it is imperative for HTSMEs at the venture stage to have access to sufficient funds to complete the full innovation process, as shown in Figure 4-2 above.

As stated above, an effective marketing strategy is an important factor in the success of HTSMEs at this stage (Barkham et al., 1996b). However, many HTSMEs excel at developing and producing a product rather than marketing it. Many HTSMEs devote too much capital to R&D, leaving insufficient funds to market the final product effectively (Oakey, 1984; Oakey et al., 1988; Oakey, 1997). As illustrated by Oakey’s diagram (Figure 4-2), the product is launched at the time of maximum financial stress, when R&D costs have been incurred, and there may then be limited funds available for marketing purposes.
4.2.3 Growth
By this stage, the firm should be profitable. A period of high growth will typically follow technical and manufacturing feasibility, and successful market acceptance (Kazanjian and Drazin, 1990). Profits will normally be ploughed back into the business for the development of new products. Successful HTSMEs frequently implement a programme that provides for a stream of new innovative products. According to Oakey (1995), high technology firms typically begin conceiving their second product at the launching stage of the initial product.

During the growth phase of HTSMEs, the organisational structure experiences an almost constant state of change as the roles, responsibilities and strategies of the organisation are more defined (Kazanjian and Drazin, 1989). The OM remains central to all decision making, but there is an increasing movement towards professionally trained and experienced personnel.

The major problems in the growth phase are how to manufacture in volume and market the product, while achieving profitability (Churchill and Lewis, 1983). Kazanjian and Drazin (1990) stress the need for production efficiency, high quality output and profits.

4.2.4 Stability
As growth (in terms of both sales and employees) slows to market growth level, HTSMEs enter the stability stage. They are concerned with maintaining market position and ensuring that growth is sustained (Moore and Tushman, 1982), while managing the existing product(s) and simultaneously launching second-generation products (Kazanjian and Drazin, 1987).

During this time, a formal structure will have been established, for example, the venture might have evolved from an R&D laboratory into a stable and bureaucratic company (Kazanjian and Drazin, 1990). To cope with the formalised system, 'professional' managers will be introduced (Scott and Bruce, 1987). The introduction of professional managers will lead to the efficient use of business tools such as budgeting and strategic planning (Churchill and Lewis, 1983). The OM and the business are now quite separate, both financially and operationally (Churchill,
The OM can leave the day-to-day running of the company to the professional manager(s) and turn his/her attention back to product innovation and development.

After discussing the characteristics of the various growth stages, the researcher will now examine various methods of measuring growth and determine the most appropriate measure for this study.

4.3 THE MEASUREMENT OF GROWTH

Researchers use many variables to measure growth, and there is no general agreement on how growth should be measured (O'Farrell and Hitchens, 1988). Some studies refer to growth in employment (Oakey, 1984; Evans, 1987a and 1987b; Woo et al., 1989; Kirchhoff and Phillips, 1989; Variyam and Kraybill, 1994; Barkham et al., 1996b; Gray, 1997), while others use sales turnover (McClelland, 1988; Perry et al., 1988; Traynor and Traynor, 1994; Wijewardena and Cooray, 1995), profits (Birley and Westhead, 1990), number of new products (Gray, 1997) and value added (Romano and Ratnatunga, 1994).

Based on studies by Reynolds (1993) and Barkham et al. (1992 and 1996b), the least problematic measure of growth is sales. This figure is a sound indicator of size and it demonstrates how well a firm is competing within a market. It was argued above (Section 3.3, Chapter Three) that sales turnover is not a good indicator for defining SMEs. However, it provides a sound measure of growth. Gray (1997) found that SMEs in the UK generally prefer to measure growth in term of sales turnover. He argues that SMEs do not use employment as a measure of growth because they regard new employees as an additional cost, rather than an investment. To provide a complete picture of firm growth, both sales and employment are often used together (Lumme et al., 1994; Brown and Kirchhoff, 1997).

It is important to note that the study of growth per se may not necessarily provide much information about performance. According to Barkham et al. (1996b, p.4):

"Growth may imply that a satisfactory level of performance is being achieved but it does not guarantee it."
For example, growth cannot be used to measure an individual firm's performance without considering the general rate of market growth. A firm with an expanding market share is clearly more competitive than rivals with a constant or falling market share (Barber et al., 1989).

Productivity is therefore a key concern in measuring performance. In the US, manufacturing plant in high technology industries records significantly higher productivity growth than conventional industries (IEEE Solutions, 1999). Productivity growth is important because it demonstrates the success of innovation. Furthermore, positive productivity growth (average turnover growth being greater than average employment growth) reflects efficiencies in production, increases in worker skills, technological progress, increased market share and the higher profitability of firms within high technology industries (World Resources Institute, 1996; Arnold and Dennis, 1999).

The issue of productivity is critical for HTSMEs as they seek to remain competitive in the market place. A decline in productivity growth would reflect the fact that companies are slow in adjusting their level of employment in response to falling sales (Barkham et al., 1996b, p. 24):

Marginal changes in sales turnover may be too small to justify laying off or recruiting extra workers or because the balance and variety of skills required may be disturbed.

My study used turnover to measure growth because it is generally preferred over employment. New employees tend to be regarded as an additional cost rather than an investment. Furthermore, turnover is a sound indicator of size and it demonstrates a firm's competitiveness. Sales and employment are often used together in order to provide a comprehensive picture of firm growth. In the programme of research conducted for this thesis, the researcher briefly examined the general level of productivity growth of industries in the high technology sector; this obviously required the use of turnover and employment data.
After reviewing the most appropriate measure of growth, the following section reviews various measures used to define high growth firms.

4.3.1 Measuring High Growth

There are a number of definitions of what constitutes a high growth firm. The American Business Conference defines a high growth firm as one having (Birley and Muzyka, 1995, p. 105):

Annual revenues of at least US$25 million and must be growing in revenues and earnings at a minimum average annual rate of twice the growth of the economy plus inflation.

Most studies of growth use changes in annual sales to define high growth. For example, Siegel et al. (1993) defined high growth as a doubling of sales over the three most recent years of operation. In other words, high growth firms are those which have experienced three consecutive years of compound annual sales growth of at least 26 percent. Todd and Taylor (1993) define high growth as an annual average growth rate for both sales and profit of at least 20 percent a year. Delmar and Davidson (1998), in their study of high growth firms in Sweden, defined high growth firms as those achieving top ten percent status in terms of changes in employment growth or sales volume. Barkham et al. (1996b) relied upon employment as a measure of growth as they were interested in explaining small firm growth in terms of regional differences. They define high growth firms as those experiencing more than 100 percent employment growth over the period 1986-90. This equates to an annual compound growth rate of 19 percent.

Among the definitions mentioned above, Siegel's definition of high growth (based on sales) is judged to be the most appropriate for the purposes of my study. Since the Siegel definition of high growth was based on three consecutive years of growth and my study involved only two consecutive years, a slight modification was made to the criteria for classifying firms as high growth. Instead of the doubling of sales over three years, an equivalent figure for two years was computed. This translates into annual sales growth of 26 percent per annum, or an increase of 59 percent over the period of my study, 1994-1996. The 1994-1996 period was chosen
because it was a period of stability before Malaysia suffered an economic downturn in 1997. The rationale for choosing this measure is discussed in more detail in the subsequent Research Framework and Methodology chapters.

4.4 DETERMINANTS OF GROWTH

This section covers a wide range of factors that have been considered as possible influences on the growth performance of businesses. The same determinants influence both 'conventional' and HTSMEs (Reid and Garnsey, 1996).

In order to understand growth and change in HTSMEs and the factors affecting them, it would be helpful to begin by reviewing a number of small firm growth models. O'Farrell and Hitchens (1988) discuss four such growth models: those derived from industrial economics; stochastic models; stage models; and models that focus on the strategic dimensions of firm growth.

Growth models derived from industrial economics were developed to explain the behaviour of large firms. These models view size as a function of growth, not an influence. According to O'Farrell and Hitchens, such models are based on the fact that firm growth depends on financial and demand factors, i.e., the capital needed to expand capacity and the customers required to absorb production. However, the models are inappropriate for this study as they are concerned primarily with large firms.

Stochastic models assume that firm sizes are randomly distributed (Evans, 1987b), and that the size distribution of firms is derived from a series of random growth patterns, i.e., a stochastic process. In this model, the dependent variable (the size of the firms) is subjected to cumulative random shocks over time. The process of random growth leads to a lognormal distribution known as the 'law of proportionate effect', which postulates that the growth of a firm is made up of a number of elements, such as market growth rate and the initial size of the firm. However, the stochastic model is also unsuitable for this study, as its validity has not been adequately tested; conflicting results as to its value have been produced by statistical analysis (Evans, 1987a).
The stage models of growth assume that all firms pass through a sequence of growth stages, as set out in Figure 4-1, with each stage being characterised by a number of factors. Such models focus upon growth patterns, but offer little insight into the process of growth in firms. Storey (1994b) suggested the following limitations of stage models:

i) Not all firms move through all stages of growth, and a significant number of firms fail early in their lifetime.

ii) Likewise, a firm may achieve a particular stage, but be unwilling or unable to progress; for example, it might choose to be acquired by a larger firm.

iii) According to the proponents of stage models, it is assumed that movements from one stage to the next are ‘triggered’ by a point of crisis (Churchill and Lewis, 1983; Scott and Bruce, 1987). However, according to Storey (1994b) this assumption was never tested and may not be testable.
As a consequence, the stage model alone is also unsuitable for this study.

The fourth (and final) group of models focus on the strategic dimension of achieving growth. Growth is thought to be held in check by a number of internal and external barriers, and the private and public resources available for overcoming the barriers. These models conceptualise the growth of small firms as occurring in increments or stages, with each stage being defined by the emergence and resolution of barriers. A new phase of growth will not commence until the barriers in the previous phase have been overcome. The models concentrate on identifying the OM’s strategies for the growth of the business. These business strategies are determined by the OM’s perceptions on how to conduct and develop the business in light of the opportunities and constraints he/she sees (Milne et al., 1982). According to Milne et al., these perceptions are also determined by personal characteristics. However, the ‘strategic’ model, which focuses on OM characteristics and the strategies adopted is not comprehensive enough for this study because certain company characteristics are not considered as important factors in stimulating growth. Elements such as the size and age of firm are not considered, as the focus of attention is the strategy employed once the OM is in business.
Storey (1994b) developed a growth model similar to the strategic model, but assumes that firms go through certain stages of growth. He identifies a number of OM and firm characteristics, and business policies and strategies as essential for the growth of a business. Storey concludes that growth in every company is determined by the interaction of three basic components, i.e., OM and firm characteristics, and business strategy adopted.

The researcher has adopted Storey's approach in explaining the process of growth in HTSMEs. The reasons for adopting this approach are discussed in more detail in Chapter Five (the Research Framework).

In his comprehensive review of twenty-six studies on small firm growth, Storey (1994b) identified and examined thirty-four elements or determinants of growth: fourteen are related to the background of the OM; six are elements of the firm; and fourteen are concerned with business strategy. However, not all these determinants are relevant for the study of HTSMEs in Malaysia. Moreover, Storey's review did not include a factor that has come into focus in recent studies on high technology growth firms, i.e., research and development (Roberts, 1991; Boer, 1994; McGrath, 1995; Smith, 1996). This additional factor has been included in my study.

The following section will further discuss the seventeen growth determinants (including R&D) chosen for this study, and assess how these three groups of factors influence the growth of HTSMEs. These determinants are categorised under three major groups namely the Entrepreneur/OM (Section 4.4.1), the Firm (Section 4.4.2) and the Business Strategy (4.4.3).

4.4.1 The Owner-Manager (OM)
This subsection will examine the relationship between the characteristics of the OM and growth in HTSMEs.

OMs are regarded as the key to innovation and economic change (Schumpeter, 1969). At firm level, OMs assume risk, perform management tasks, and develop new products and markets (Roberts, 1991). OMs who initiate and manage SMEs in high technology industries are known as 'technical OMs'.
My review of the literature on SMEs identified many studies on the characteristics of OMs, but far fewer empirical studies on how the characteristics of technical OMs affect the growth of HTSMEs (Roberts, 1991; Jones-Evans, 1996). Moreover, Storey’s literature review did not distinguish between technical and non-technical OMs, and none of the studies reviewed by Storey focuses on technical OMs. Thus, my study provides an opportunity to identify the characteristics of technical OMs and how these characteristics affect growth.

Studies conducted on conventional SMEs have shown that growth-oriented OMs have significantly higher levels of energy and risk orientation than those associated with non-growth oriented firms; in addition, growth-oriented technical OMs are characterised by having a greater desire for autonomy and adapting readily to change (Ginn and Sexton, 1990).

The technical capabilities of high-tech OMs are vital for the development of the first product as well as subsequent product development. Hambrick et al. (1990) noted that:

*The chief executives of high technology firms differ from their counterparts in low technology firms in ways that follow logically from the special requirements of the high-technology setting.*

*The OM’s ability to combine technical and market knowledge is one of the most important determinants of success in high technology companies. Neither technical nor market knowledge alone is sufficient. The combination of these two factors helps to understand what the market will want that the technology will be able to produce a few years hence (McCarthy et al., 1987).*

Based on evidence taken from eighteen studies, Storey (1994b) suggested that 15 characteristics of the OM might exert an influence on growth. Table 4-1 reveals that most of these quantitative research studies relate between three and seven characteristics of the OM to growth. Whilst there is a limited direct relationship between growth and some of the characteristics of the OM, there are some consistent results across the various studies. The characteristics most prominently linked to
growth are education, motivation by market opportunities or the desire to make money, managerial experience and age. Notwithstanding its importance, motivation was ignored in my research, owing to the lack of consistent supporting evidence on the most appropriate measure of motivation, as noted by Barkham et al. (1996b). Furthermore, the questionnaire pilot study indicated that the majority of the respondents were not the founder of the company, and thus could not be expected to comment on motivation.

TABLE 4-1 OM Characteristics and Growth

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Key:
+ : Positive relationship between element and growth of the firm.
- : Negative relationship between element and growth of the firm.
( ) : Relationship present in a univariate context.
x : Element not shown to be significant in influencing growth.

Source: Storey (1994b)
It is important to note that most of the empirical studies listed in Table 4-1 refer to conventional SMEs. Table 4-1 shows that the direct relationship between the background of the OM and growth appear to be relatively limited. However, some consistent evidence emerges that, for example, OMs managing rapidly growing firms tend to be relatively well educated, are middle-aged and have held previous managerial positions. The following discussion attempts to relate the growth determinants in Table 4-1 to HTSMEs.

4.4.1.1 Managerial Experience
Table 4-1 suggests that prior managerial experience influences the growth of SMEs. Four studies found a positive relationship, one demonstrated a negative relationship and five failed to find any relationship. Prior managerial experience is thus positively associated with new firm growth (Storey, 1994b). Weinzimmer (1997) subsequently confirmed that the experience and background of the management team influence growth positively in small firms.

According to Cooper (1981), the management experience of the OM is one of the most important determinants of the subsequent success of a new venture. Entrepreneurs with management experience are able to cope with the changes and problems that confront them while running a venture. A study by Westhead et al. (1995) confirmed that the type and quality of management experience is likely to have an impact on the survival of high technology firms.

4.4.1.2 Educational Background
Table 4-1 shows that there is a generally positive relationship between the level of education of the OM and growth. Varyam and Kraybill (1994) also argue that education can develop the human capital needed for business success. Individuals with higher levels of education are also more confident in dealing with customers and financial institutions (Storey, 1994b). In my opinion, many personal characteristics of successful entrepreneurs probably apply to high technology entrepreneurs. However, the most prominent characteristic that differentiates a high technology entrepreneur from other entrepreneurs is a higher level of education (Roberts, 1991); the most likely explanation is that most HTSME OMs had previously worked as scientists,
engineers, or university faculty members, or were technically trained as a requirement for employment.

4.4.1.3 Age of OM

Although Table 4-1 shows that most studies do not indicate any significant relationship between the age of the OM and growth, age does exert some general influence (Storey 1994b). This conclusion is based on three studies (Kinsella et al., 1993; Storey 1994b; Reynolds, 1993) that show older entrepreneurs tend to achieve higher growth. However, other studies have found that age is negatively correlated to growth (Barkham et al., 1996b).

It is believed that the age of high technology entrepreneurs at the time of company start-up is somewhat younger than individuals establishing low technology firms. A study of 300 technology-based companies in the US found that the average age of technical entrepreneurs at the time of company founding was 32 years (Tappan et al., 1987) compared to 35 to 45 years for conventional SMEs (Roth, 1996). One possible explanation suggested by Roberts (1991) is the youthful age structure of the technical organisations in which the entrepreneurs previously worked.

4.4.1.4 Gender

Table 4-1 provides some conflicting evidence on the relationship of gender to growth. Reynolds (1993) found that females were more likely to own rapidly growing firms, while Jones (1991) found the reverse relationship. All other studies in Table 4-1 conclude that gender is not a key influence on growth, although there are very few studies dealing with this relationship. In a study of high technology firms, Smith and Freundlich (1989) found that female OMs suffer because venture capitalists are wary of giving money to them.

4.4.1.5 Career History

The career history of OMs includes number of years in employment or self-employment, and prior experience of the sector and/or firm size.

It can be argued that individuals who have previously been self-employed will have gained valuable experience in the running of a small enterprise (Storey, 1994b).
This experience should enable them to overcome problems associated with business growth. However, Table 4-1 shows that seven studies have examined this issue, and six were not able to identify any significant influence of prior self-employment.

Turning to prior sector experience, Table 4-1 suggests there is no conclusive empirical evidence on this point. Five studies (Reynolds and Miller, 1988; Solem and Steiner, 1989; Storey et al., 1989; Kalleberg and Leicht, 1991; Westhead and Birley, 1993) could not find any association, whereas the other three (Dunkelberg and Cooper, 1982; Jones, 1991; Storey, 1994a) did indicate a relationship. Storey (1994b) pointed out that the duration of experience in the same sector is also important.

Table 4-1 also presents conflicting findings as to the impact of firm size experience on growth. One study on this issue suggests that OMs from a large firm background are more likely to found slow growth firms, while the other suggests the reverse. The four remaining studies were unable to show any relationship between the OMs' experience in firms of a certain size and the growth of their present businesses. However, a study of HTSMEs by Stuart and Abetti (1988) indicates that the entrepreneurial experience of an OM, defined as the number of previous ventures and the role played in such ventures, can significantly affect performance.
### 4.4.2 The Firm

**TABLE 4-2 Firm Characteristics and Growth**

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**Notes:**

- Dunne and Hughes measure growth in terms of net assets
- Kalleberg and Leicht measure growth in terms of business earnings

**Key:**

+ : Positive relationship between element and growth of the firm.
- : Negative relationship between element and growth of the firm.
( ) : Relationship present in a univariate context.
x : Element not shown to be significant in influencing growth.

**Source:** Storey (1994b)

### 4.4.2.1 Legal Form

All four studies in Table 4-2 indicate that legal form does have an impact on growth; studies in the United Kingdom consistently indicate more rapid growth being achieved by limited companies, compared to sole proprietorships or partnerships.
However, Storey (1994b) discovered that limited companies also tend to have a higher failure rate, suggesting they are more risky than sole-proprietorships or partnerships. There are very few studies on the relationship between legal form and growth for HTSMEs. Slatter (1992) found that the better performing UK high technology firms tended to be characterised by high equity participation from the OM and other key employees, which would imply limited company status.

On the same theme of legal form, small firms that are part of larger organisations, but with independent management, tend to have significantly higher growth rates than single establishment firms (Variyam and Kraybill, 1992; Dunne et al., 1989).

4.4.2.2 Location of Business

Table 4-2 suggests that the location of a small firm significantly influences its growth. The majority of UK firms located in Science Parks are high technology in nature and most are small (Brown, 1991). HTSMEs operating in Science Parks have an above average survival rate, and employment growth up to 50 percent higher, than UK small businesses as a whole (Storey and Strange, 1992). According to Monck et al. (1988), HTSMEs operating on Science Parks have already established a solid base, and are encouraged to develop their innovation and marketing abilities in order to achieve higher growth levels.

4.4.2.3 Size of Business

Table 4-2 shows that smaller firms grow more rapidly than their larger counterparts (Hakim, 1989; Johnson, 1989; Kalleberg and Leicht, 1991). These results are confirmed by recent studies by Variyam and Kraybill (1994) and Barkham et al. (1996b).

Figure 4-1 illustrates the relationship between firm size and growth. As the firm moves through the growth stages, the growth rate increases rapidly until it slows at the maturity stage. There are a number of possible reasons why smaller firms achieve higher growth rates. First, as suggested by Storey (1994b), there is the need to achieve a minimum efficient scale (MES) of production. Alternatively, small firms may be more flexible than larger firms. Owing to their size, small firms can react to
changes in the market faster than larger firms (Barkham et al., 1996b). Oakey et al. (1988) have shown that, in general, small high technology firms have performed better than larger firms.

4.4.2.4 Age of Company
Almost all studies in Table 4-2 indicate that younger firms grow more rapidly than older enterprises. As stated above, new ventures need to grow rapidly to achieve the MES. However, once MES has been achieved, the business subsequently grows less rapidly because, for example, the OM has achieved a satisfactory income level and motivation is reduced (Storey, 1994b). Table 4-2 shows that studies by Storey et al. (1987), Dunne, Roberts and Samuelson (1989), Hakim (1989), Jones (1991), UCSBRC (1992), Dunne and Hughes (1992), Variyam and Kraybill (1992) and Variyam and Kraybill (1994) all indicate an inverse relationship between the age of company and growth. By contrast, a study of small Japanese firms by Wijewardena and Cooray (1995) shows no significant relationship between age and growth.

4.4.2.5 Sector
Table 4-2 shows that eight studies, including Reynolds and Miller (1988) and Dunne and Hughes (1992a), demonstrate significant differences between sectors and growth rates, while four others did not indicate any significant differences between sectors. However, the level of data classification in the studies varies noticeably. For example, some researchers make a distinction between manufacturing and service sector firms (UCSBRC, 1992), while others examine the performance of sectors within industries (Dunne and Hughes, 1992).
### 4.4.3 The Business Strategy

**TABLE 4-3 Business Strategy and Growth**

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**Key:**

- +: Positive relationship between element and growth of the firm.
- -: Negative relationship between element and growth of the firm.
- (): Relationship present in a univariate context.
- x: Element not shown to be significant in influencing growth.

(Source: Storey (1994b))
A coherent and effective business strategy is usually considered to be critical for the success of any company. Strategy is defined as the actions taken by a business organisation to pursue its goals, given the threats, opportunities and the environment facing the firm and the resources and the capabilities available to it (Byars et al., 1996).

Table 4-3 shows the fourteen business strategy elements reviewed by Storey (1994b). Barkham et al. (1996b) summarised Table 4-3 into three key areas suggesting that growth can be influenced by strategies to: share equity with an external entity; develop a strong management team; and, occupy and exploit a market niche that is less competitive and where it is possible to maximise quality advantages.

As mentioned earlier, another determinant of growth for HTSMEs, i.e., R&D, is also discussed in this section.

4.4.3.1 External Equity
All of the studies in Table 4-3 indicate that firms accepting external equity investors tend to achieve higher growth than those that do not. An unwillingness to share equity can obviously constrain growth, as the company may have to resort to short-term debt financing. However, many small firms are unwilling to share ownership because entrepreneurs fear losing control of their company (Smith and Fleck, 1987). Furthermore, according to Smith and Fleck, accepting external equity may be perceived to indicate financial difficulties.

Typical sources of external equity include formal venture capital or business angels. However, as Roberts (1991) pointed out, venture capitalists in the US generally prefer later-stage investments. Early stage HTSMEs may have little opportunity to access external equity. There have been very few research studies conducted in Malaysia on this issue. However, Wahab (1996) found that a significant majority of SMEs in Malaysia did not use external equity, preferring to use debt to finance growth. The small percentage of firms that did accept external equity relied on relatives and friends, and the Government-backed Scheme (PUNB), rather than private sector venture capital companies.
4.4.3.2 Marketing Orientation
An important factor in securing a market niche is the quality of the product. HTSMEs producing quality products that meet customers' needs directly tend to perform well (Pavia, 1990). Barkham et al. (1996b) found that many firms rely solely on their reputation to attract customers. However, for those firms actively seeking customers, Barkham et al. found no significant association between growth and the three most frequently used methods of seeking customers, i.e., advertising, personal contact and the activities of sales personnel.

4.4.3.3 Market Research
Many HTSMEs find that their products fail to secure a market niche or achieve the hoped-for level of market success, even where products are the result of many years of scientific and technological effort. Market research is one way to reduce the risks associated with introducing a new product.

LaPlaca (1990) found that products launched after market research were more successful, even though the development stage of the new product was extended. Market research will help to ensure that product development is guided by market opportunities (Monck et al., 1988). An HTSME does not have unlimited financial resources, hence it is important to obtain market information at the lowest possible cost (Parker, 1999). Barkham et al. (1996b) found that market research is positively related to growth and viewed the act of conducting market research in itself as a direct stimulator of growth.

4.4.3.4 Product and Process Innovation
It is not surprising that another determinant of growth for high technology firms is innovation. Storey (1994b) focused only on product rather than process innovation. However, product and process innovation are a major factors behind the success of HTSMEs in the US (Oakey et al., 1988). The introduction of new products and services is critical for many organisations, and product and process innovation enables organisations to adapt to changes in markets, technology and competition (Dougherty and Hardy, 1996). Thus, the effective and deliberate management of innovation is the key to growth in HTSMEs (Schoonhoven & Jelinek, 1990).
A number of studies have confirmed that HTSMEs are significantly more innovative than low technology SMEs (Young and Francis, 1991; Keeble, 1997). Oakey et al. (1988) and Barkham et al. (1996b) observed a positive relationship between product innovation and sales growth, but an inverse relationship between product innovation and employment growth. According to Oakey et al. (1988, p. 76):

> Increased product innovation may result in a higher volume and/or value of sales, without significant employment increases.

Nevertheless, Oakey cautioned that the relationship between product innovation and turnover growth was rather weak, and suggested that a high level of product innovation will not guarantee further growth in sales.

Turning now to process innovation, previous studies have shown that process innovation drives product innovation, despite popular belief that the relationship is the other way around! Process innovation in many high technology markets is becoming an increasingly critical capability for product innovation, owing to the rapid evolution of product technology (Pisano and Wheelwright, 1995). Ramesh and Hynson (1995) argue that the driving force behind most improvements in products are the processes used in their manufacture. However, there seems to be a weak relationship between process innovation and turnover growth (Oakey, 1988). Oakey suggests that market conditions might be beyond a firm's control, even when process innovation has occurred.

4.4.3.5 State Support

High technology firms have generally outperformed those in the traditional sectors. They have generally grown at a faster than average rate, expanded the economic base of certain geographical areas, and thus encouraged federal and state government officials to favour them over other sectors (Phillips, 1991). Table 4-3 shows that three out of five studies (Storey et al., 1987; UCSBRC, 1992; Kinsella et al., 1993) observed that rapidly growing firms were more likely to be in receipt of government support than slow growth firms. White and Reynolds (1996) found that growth was not strongly influenced by government assistance. However, their study only applied to business assistance programmes, not financial support. On balance, Storey (1994b),
argues that state support can cause small firms to grow more rapidly.

State support for HTSMEs in Malaysia, discussed in Chapter Two, comprises loans and grants for R&D (such as the ITAF and IGF Schemes), or information and advice services (offered by MIDA and SMIDEC). The primary objective of the ITAF grant is to induce companies to undertake technological efforts, particularly product development, through adequate incentives and financial support. However, misconceptions among SMEs regarding product development schemes (ITAF 2) and the general lack of awareness of the concept of 'product development' are major barriers to its successful implementation (Kassim, 1991). This failure to utilise Government schemes can constrain growth since product development, as stated above, is an important element of the innovation process in HTSMEs.

4.4.3.6 Research and Development

Storey's literature review did not acknowledge R&D as a determinant of growth. Boer (1994) observed that, although R&D affects only a fraction of a company's growth, it is that fraction which greatly affects the competitive advantage of the firm. R&D is imperative for the long term growth of HTSMEs (Jaskolski, 1996). High technology firms need to devote more resources and attention to R&D, in both the manufacturing and service sectors. R&D is thus one of the key drivers of growth in HTSMEs (Ettlie, 1997; Judge et al., 1997; Jankowski, 1998). According to Wheelwright and Sasser (1989), innovation relies on investments in R&D (explained by Figure 4-2). Since R&D is the creation of the know-how and know-why of new materials and technologies that eventually translate into commercially viable product.

It is argued that successful high technology firms are those with high R&D expenditure (Roberts, 1991), and that increased R&D expenditures are a sign of continuing growth (Smith, 1996). In 1995 alone, overall R&D expenditure in the US was US$40 billion (Levy, 1998). In the US, companies with high R&D investment outperformed the average of all companies in terms of profitability (McGrath, 1995).

By contrast, Oakey et al. (1988), in their study of 131 high technology small firms in the UK and US, were unable to find any relationship between R&D and growth. Oakey (1991b) argued that this conclusion might be attributed to the risk of
failure in product innovation, despite the commitment of considerable resources to R&D.

4.4.4 Summary of Growth Determinants
Tables 4-1, 4-2 and 4-3 set out thirty-four elements thought to affect the growth of SMEs. For the purposes of this study, seventeen elements were identified as determinants of growth affecting HTSMEs in Malaysia. I did not adopt all the 34 elements, but concentrated on the most relevant for the Malaysian context. Certain elements, such as market adjustment and prior business failure, were left out because none of the studies reviewed by Storey focused on these factors. Competition and training were excluded since they were not shown to be significant in influencing growth. The remaining elements were excluded after conducting a pilot study and interviewing key informants from various Government agencies. For example, 'family history' was left out because OMs were very reluctant to reveal such information, especially the ethnic Chinese. Interviews with MITI and SMIDEC officials suggested that very few Malaysian SMEs export their products, which justifies the exclusion of 'exports' from the study. Motivation was also excluded because of the lack of consistent supporting evidence on the most appropriate measure of motivation and the fact that most questionnaire respondents were not the founder of the firm.

The selected elements for the characteristics of the OM are managerial experience, educational background, age, gender and career history. The firm elements are age and size, location of business, sector in which the firm operates and type of ownership. Finally the key components of business strategy are acceptance of external equity, marketing strategy, market research, product and process innovation, state support and R&D.

The analysis above has identified factors that stimulate the ability of HTSMEs, once established, to grow. However, the growth rate of HTSMEs can be hindered by a number of constraints or barriers. The next section discusses these constraints and explores how they might hold back the growth of HTSMEs.
4.5 CONSTRAINTS ON THE GROWTH OF HTSMEs

A number of studies have examined the barriers to growth on small firms, though not all have dealt with high technology firms. In the UK, for example, the Advisory Council on Research and Development (ACARD) summarised the constraints on HTSMEs as the equity gap, an inefficient use of labour and a lack of management skills (ACOST, 1990). Aston Business School (1991) found that the main problem encountered by growth-oriented firms was the recruitment of skilled and qualified labour, especially for 'larger' SMEs. The authors also argued that very few firms experienced problems caused by a lack of management skills and/or raising finance. However, a significant finding in the Aston study (1991) was that firms wishing to invest in innovation experienced more difficulties in raising finance than firms conducting other forms of investment.

The constraints on the growth of HTSMEs found in my literature review are now grouped and examined below. The boundaries between the groupings below are not strict and there are a number of overlapping areas.

4.5.1 Market Constraints

Expansion of the market obviously opens up growth opportunities for HTSMEs. A growing firm should have sufficient competitive advantage relative to its competitors to increase market share at their expense. The growth of small firms tends to be positively related to the expansion of their existing market share or niche (Woo et al., 1989; Solem and Steiner, 1989, Birley and Westhead, 1990; Siegel et al., 1993). However, the diffusion of new products is a problem to most HTSMEs, as the cost of marketing different products to different markets is high (Mayer et al., 1989). McGee (1989) argued that few HTSMEs are able to repeat their earlier success in launching subsequent products. Many HTSMEs often resort to 'easy-to-copy' products in an attempt to grow and subsequent products tend to be only marginally better than those of their competitors.

Another problem faced by HTSMEs is how to develop their export trade (Segal Quince Wicksteed, 1985). HTSMEs are generally highly export-oriented (Oakey et al., 1988), but those with limited financial resources may incur high costs in launching their products in foreign markets.
4.5.2 Labour Constraints

High technology industries tend to create a 'polarised workforce' (Markusen, 1985a), with a small group of highly skilled, highly paid engineers and scientists, whereas the majority of employees are semi-skilled (Forester, 1987). The former group will be mostly male, with the semi-skilled being predominantly female.

The specialised demands of high technology firms have direct implications for their training and human resources policies (Breheny et al., 1985). With limited funds at their disposal, many HTSMEs may not be able to offer specialised training. The need for a specialised labour force suggests that a nation's education policy should include technical knowledge and skills in the school curriculum (Weiss, 1985).

While high technology firms in Malaysia are 10 to 15 percent more likely to train their employees, only 21 percent of all manufacturing firms in Malaysia provide formal training for their employees (World Bank, 1997). These figures suggest that the nation needs to review its existing skills training system. However, Government action is not enough. Malaysia will not be able to produce a workforce to support high technology industries without the involvement of the private sector. A comparative study of education systems has shown that the technical orientation of Malaysian students at tertiary level is lower than other Newly Industrialised Countries, such as Singapore, and also other developing countries. Based on UNDP 1991 statistics, only 30 percent of tertiary level students in Malaysia were in the technical field, compared with 60 percent in Singapore, 43 percent in Brazil and 48 percent in Mexico (Young and Kiat, 1996).

HTSMEs must acquire skilled labour and physical capital to increase their production capacity because their markets grow quickly. However, such firms may encounter labour shortages, particularly for technical and managerial staff (Oakey, 1995; Slatter, 1992). HTSMEs may achieve profits, but they have to pay higher salaries (Bosworth and Jacobs, 1987; Bill, 1996). The attraction and retention of high quality and skilled employees is therefore critical for the growth of HTSMEs (Barber et al., 1989; Slatter, 1992).
4.5.3 Infrastructure Constraints

HTSMEs rely heavily on the technological infrastructure to promote and support their development and growth (Sauer et al., 1988). The following components of the technological infrastructure have been identified as critically important:

i) Applied R&D\textsuperscript{1} activities at nearby universities and other research laboratories (Sauer et al., 1988).

ii) Formal communication networks, such as access to information and technology transfer, a network of consultants, job shoppers\textsuperscript{2} and suppliers (Sauer et al., 1988). The innovative process depends critically on information dissemination (Macdonald, 1988; Clark and Staunton, 1989). Information is gathered mainly during the R&D stage, as the essence of developing a new product or process is the assembly of information from various sources into a new pattern. In order to innovate, firms in high technology industries require more information than other firms, either through internal or external sources (Macdonald, 1988). There are a number of channels through which information travels, for example: formal and informal discussion among practitioners; conference papers; and, articles from journals, books, the internet and trade publications.

iii) Conventional infrastructure, such as transportation and power, is required, as well as technological infrastructure such as research and development inputs, and innovation and technological services (Yeh and Ng, 1994).

iv) Other elements of infrastructure include a technically-educated workforce (as discussed in Section 4.5.2 above) and the availability of grants or venture funds (Taylor 1985; Folta, 1999).

According to Porter et al. (1996), a sound technological infrastructure promotes high technology competitiveness. Start-up firms are more likely to be successful if they are formed in an area where an infrastructure already exists (Rogers and Larsen, 1984). However, a high technology infrastructure is costly to establish and maintain, and it may be beyond the reach of most developing countries (Seitz,
1992). The most prominent initiative taken by many countries, including Malaysia, to provide infrastructure is the establishment of Science or Technology Parks (Macdonald, 1988; Monck et al., 1988; Dierdonck and Debackere, 1992). However, such efforts are costly and they do not produce instant results.

Malaysia does not have a clear definition of a high technology industry, and the definition of a Science or Technology Park is even more problematic. Malaysia is not alone in this respect. Case study analysis in Chapter Eight highlights some of the specific problems faced by HTSMEs operating on Science or Technology Parks.

4.5.4 Resources for Innovation

ACOST (1990) found that smaller firms are less able to bear the risks of innovation than larger firms. To be innovative, HTSMEs require a resource system that channels money, equipment, expertise and information to all innovation activities simultaneously (Dougherty and Hardy, 1996). Unfortunately, resources for innovation do not always flow smoothly to smaller companies. Furthermore, a new venture usually focuses all its resources towards one product, hence it cannot afford to bear the risk of a product failure (Sykes, 1986).

Previous studies suggest that there are a number of problems faced by smaller firms in relation to innovation. These problems include a lack of time, resources and technical skills (Rothwell, 1994), inadequate information on product and process technology (Barkham et al., 1996b), and insufficient financial backing and low market demand (Caird, 1994). In the post-formation period, OMs devote most of their time to the day to day running of the company. This workload can take all the available time and energy, leaving little time for innovation and marketing activities (Barkham et al., 1996b; Pollock, 1999). To overcome such problems, Puhlmann and Gouy (1999) suggest that HTSMEs need to acquire new skills and information sources, but this is rather unhelpful advice in the face of resource constraints!

4.5.5 Managerial Constraints

Constraints relating to the internal organisation and management of the enterprise frequently affect the growth of HTSMEs. With smaller numbers of employees, the management style tends to be informal within a loose organisational structure, since
senior managers may look after several tasks simultaneously. However, as the firm grows, the informal style becomes less effective and the management structure moves towards a full functional form (ACOST, 1990). HTSMEs may encounter constraints if an OM is unwilling to delegate key functions (Bosworth and Jacobs, 1987; Oakey, 1995). Most OMs of HTSMEs are technically-oriented individuals who lack business skills, hence non-technical areas may be badly managed (Oakey, 1997). General management training adapted to the needs of HTSMEs is thus vital to support further growth. In case studies conducted on 30 companies, Slatter (1992) discovered that the principal constraint experienced by HTSMEs was weak general management. This resulted in delays, mistakes and inefficiencies each time OMs come across new management tasks. In a high technology environment, the need for speed to take advantage of market opportunities means that errors are more likely to lead to a management crisis.

4.5.6 Constraints on the Availability of Finance

HTSMEs need sufficient financial resources to fund R&D, launch the product and to cover operating costs (Calori, 1985; Willard and Cooper, 1985; Smith and Cooper, 1988). Availability of finance has been cited as a key constraint to growth of small firms (Hall, 1989; Barber et al., 1989; ACOST, 1990; UCSBRC, 1992; Austin et al., 1993; Bank of England, 1996), and as a factor that particularly affects HTSMEs (Connell, 1985; Storey et al., 1989; Moore, 1994). No matter how attractive the potential return on investment in high technology, most investment support agencies are unwilling to provide financing to high technology small firms. Oakey (1997, pp. 11) suggested:

Most public and private sector funding bodies are reluctant to provide medium to long term support that high technology small firms need, although the long term profits from high technology small firms R & D activities can be very attractive.

Other financial constraints experienced by small firms include liquidity problems (ACOST, 1990), and insufficient cash flows to invest in new product development or the marketing of existing products (Oakey, 1997).

Financing is often a major concern of all types of business enterprises. A
financial crisis can come at any point in a firm’s development, and severe cash flow problems usually lead to a sharp reduction in profits. A major difference between HTSMEs and more conventional SMEs is the speed with which a financial crisis develops; they can appear healthy one day and “heading for oblivion” the next (Slatter, 1992).

Aston Business School (1991) found that 20 percent of start-up firms experienced difficulty in raising finance. Moore (1994) found that high technology firms are more likely to face problems in raising finance than conventional start-ups. To expand into new markets, new products are needed (which means further R&D) and increased investment and output. Thus, growth requires additional finance to support expansion, although the cash demands may be met partly out of retained earnings and partly from external funds (Moore, 1994).

In the early stages, most HTSMEs require access to sources of external capital (Bachher and Guild, 1996). HTSMEs often turn to banks as an initial source of external finance and typically rely upon short-term overdrafts or loans (Houston, 1998). Manigart and Struyf (1997) suggested that most HTSMEs turn to bank loans because they are unwilling to open up their capital to third parties. This short-termist attitude towards financing leads to problems, since most HTSMEs are not fast growing in the early years after their formation (Oakey, 1997). Furthermore, HTSMEs are frequently conducting R&D on their initial product after the start-up of the firm, but before any sales can be made (see Figure 4-2). These R&D efforts often suffer setbacks and tend to over-run (Oakey, 1997). Moreover, most HTSMEs lack tangible collateral, which makes their search for financing fruitless (Bachher and Guild, 1996; Murray, 1996). According to Houston (1998), the difficulty in obtaining finance is exacerbated by the fact that bank personnel and financiers do not understand the technology in question, thus many potential businesses are denied the opportunity to get started.

Low growth HTSME start-ups often face difficulty in obtaining external funding. In their study of new technology-based companies in Sweden, Frederiksen et al. (1989) found that high growth HTSMEs relied upon debt financing in the early stages of development, although liquidity levels were acceptable. According to Slatter
(1992), the availability of external funding is not a constraint to HTSMEs once initial growth has been secured, because venture capitalists are usually willing to support further growth after market success has been achieved.

High technology companies in Malaysia also face difficulty in obtaining external finance, owing to a lack of collateral and the high cost of external financing (M. Hassan and Boocock, 1997). According to Malaysian Technology (1997), high technology ventures in Malaysia fail to take off, not because of a lack of new products, but rather a lack of financing. In seeking capital for business start-up or growth, many OMs think only of debt financing. However, debt can be costly. Furthermore many financial institutions do not want to lend to companies with no assets and are discouraged by the long and uncertain payback periods of HTSMEs. The next possible source of funding that might appeal to entrepreneurs is venture capital (VC).

VC funds are private equity funds that seek to generate a high rate of return by investing in rapidly growing businesses in all stages of development (Ng, 1998). Two major factors that distinguish VC from other forms of finance are its long-term orientation (Busenitz et al., 1997; Houston, 1998) and the direct involvement of financiers in the operations and strategy of investee companies (MacVicar and Throne, 1992; Boocock and Woods, 1996). The introduction of the Malaysian Exchange of Securities and Automated Quotation (MESDAQ), an over-the-counter market for technology-based growth companies in April 1999 may facilitate the development of VC and private equity funds in Malaysia (CNET, 29 April 1999). Through MESDAQ, venture capital companies (VCC) will have an early exit route after investing in HTSMEs in their early growth stages (Corporate World, 1997). However, MESDAQ has had only a stuttering start.

There are other reasons why the VC market has not really taken off in Malaysia. Firstly, non-Bumiputera owned HTSMEs have to relinquish 30 percent of their equity under the NEP. Such firms are reluctant to dilute ownership further, especially when the majority of VCCs in Malaysia are not classified as Bumiputera investors. Secondly there is no culture of individuals investing in venture funds in Malaysia. Only a limited number of wealthy individuals are prepared to invest in
venture funds (Boocock, 1995). Furthermore, the Malaysian tax regime on venture funds offers little incentive for VC compared to other countries in the region, such as Taiwan and Singapore (Santiago, 1997). Finally, the incidence of management buy-outs and buy-ins in Malaysia is low (Boocock, 1995) compared to the UK, where the VCCs have moved away from classic venture capital towards investing in MBOs and MBIs (Bank of England, 1996).

4.6 SUMMARY

Growth is important because it generates wealth and creates employment. Policy makers are interested in growth because it assists them to target support effectively. Support is often directed at high growth firms, frequently an important characteristic of HTSMEs.

HTSMEs generally pass through various stages of growth. Some progress through the stages while others remain at the same stage for a considerable period of time. Prior knowledge concerning the challenges to expect at each stage is important because it helps an OM to plan for future growth. A consensus emerged in the literature review that the conception, commercialisation, growth and stability stages are appropriate for HTSMEs. In addition, HTSMEs with leading edge technology tend to progress faster than conventional SMEs.

The literature review established that there is no general agreement on how to measure growth. It is generally measured in relation to employment, turnover or some other measure of assets. My study used turnover to measure growth because it is generally preferred over employment. (Employment is rarely used as a measure of growth, because new employees tend to be regarded as an additional cost rather than an investment.) Turnover is less problematic to measure. It is also a sound indicator of size and it demonstrates a firm’s competitiveness. This study defined high growth as an increase of sales by 59 percent over the 1994 to 1996 period or compound annual growth in sales of 26 percent over two consecutive years.
A wide range of factors influences the growth of HTSMEs. In order to understand growth and the factors affecting it, the four growth models discussed by O'Farrell and Hitchens (1988) were briefly reviewed. Storey (1994b) developed the strategic growth model. Three major groups of determinants were identified: the entrepreneur and firm characteristics; and, the business strategy adopted. Although Storey (1994b) summarises the literature on small firms in general, HTSMEs also possess many of the characteristics associated with the growth of conventional firms. Although Storey considered thirty-four elements contributing to growth, only eighteen elements were adopted and considered most relevant for the Malaysian context. The selection of variables was made after discussions with OMs of HTSMEs and key informants from various Government agencies involved in providing support to HTSMEs. A number of factors were also discarded after conducting the pilot study.

Six characteristics of the OM are thought to affect the growth of HTSMEs. They are managerial experience, educational background, age, gender, ethnic background and career history. The selected characteristics of the firm are age, sector, legal form, location of business and size of company. The key elements of business strategy include acceptance of external equity, marketing strategy, market research, product and process innovation, and state support. This study also includes R&D as an important factor in the growth of HTSMEs.

The growth rate of HTSMEs could be hindered by a number of barriers. The literature review identified the following constraints on growth: market; labour; infrastructure; resources for innovation; management; and availability of finance. The final section examined these barriers and explored how they might constrain growth.

In the following chapter, a conceptual framework for the determinants of, and constraints on, growth is developed.
Notes

1 Markusen et al. (1986, p. 14) defined applied R&D as "the application of scientific and technical principles with the anticipation of economic returns for the effort". Applied R&D differs from basic R&D. The latter refers to scientific exploration for the sake of advancing knowledge and it involves the development of theory. On the contrary applied research is concerned with the application of theory to the solution of problems (Gay and Diehl, 1992).

2 Job shoppers are specialised small-scale contract manufacturers that produce unusually sized or very complex custom-made parts (Wauryniak, 1999).
CHAPTER 5
THEORETICAL FRAMEWORK AND HYPOTHESIS GENERATION

5.0 INTRODUCTION

The literature survey in Chapters Two to Four started with a review of Malaysia's industrial policies, with particular reference to support given to SMEs and the high technology sector. This was followed by a discussion of the definitions of high technology industries and SMEs, and a brief overview of official support for HTSMEs in the US, UK and Japan. Finally, the determinants of growth of SMEs in general, and HTSMEs in particular, were assessed; the constraints on HTSMEs were also explored.

Based on the literature review, this chapter develops a conceptual framework to explore the relationship between key factors or variables and the dependent variable, the growth of HTSMEs. The framework facilitates the development of a number of hypotheses that are tested empirically in this study. My study also encompasses the constraints or barriers that hinder the ability of HTSMEs to grow.

5.1 CONCEPTUAL FRAMEWORK

The review of the literature demonstrated that HTSMEs, like conventional SMEs, pass through various stages as they grow. The review identified four growth stages: the start-up or conception; venture or commercialisation; growth; and stability (see Section 4.2, Chapter Four). A growth model is needed to explain the relationship between growth and its determinants. For the purpose of this study, a form of the strategic growth model, an extension of the staged model, was adopted. The conceptual framework as a whole incorporates the OM and firm characteristics, and examines the strategies and policies adopted to achieve business growth in the light of the opportunities and constraints faced by the business.
A number of factors that affect the growth of HTSMEs were identified in Chapter Four. Some factors affecting the growth of HTSMEs are within the control of the OM, others are not. For example, the gender and ethnicity of the OM are predetermined. The literature review stressed that many determinants of, and constraints on, growth are common to both 'conventional' SMEs and HTSMEs. The conceptual framework for this study is based on a summary of literature by Storey (1994b), a framework put forward by Barkham et al. (1996b), and other insights from the literature survey in Chapter Four. Storey (1994b) concludes that growth is determined by three basic components: the OM; the firm; and, the business strategy. The three groups of determinants shown in Figure 5-1 are considered as 'independent variables'. These groups of variables are used to explain the growth of HTSMEs, the 'dependent variable'.

As demonstrated by Figure 5-1, the constraints or barriers to growth can also be grouped into three major categories (resources/inputs, products and markets) that
are either internal or external to the firm. There is no definite dividing line between internal and external factors. Internal constraints, such as equipment problems and lack of management time to develop new products and markets, tend to be within the control of the OM. External barriers to growth, such as shortages of labour, a lack of demand, and an inadequate road or rail system, cannot usually be affected by the OM's actions.

5.1.1 Defining High Technology
As highlighted in Chapter Three, a major problem encountered in investigating the high technology sector is that of defining 'high technology'. The definition utilised in Britain or the US may not be applicable in Malaysia. Data may not be available, for example, on the utilisation of skilled human resources or R&D expenditure.

Since this study concerns HTSMEs in Malaysia, it is appropriate to adopt the Malaysian definition of a high technology industry, as defined under PIA 1986 (Appendix 2-2). The Act promoted 11 industries as high technology activities and products.

5.2 DEPENDENT VARIABLE
Growth is important for generating wealth and jobs (Barkham et al., 1996b). Growth indicates the ability of a firm to develop a critical base of sales and resources to withstand adverse economic effects. According to Woo et al. (1989, p. 134):

Hence, growth serves as a measure of past performance as well as indicating the capacity for survival in the future.

According to Tuene (1986) growth can be measured both qualitatively (changes in relationships over time) and quantitatively (changes in size and magnitude). Researchers use many variables to measure growth. However, it is usually measured in terms of resources employed (typically the number of employees) or in terms of output (sales turnover). The latter is generally preferred to the former as a measure of growth. Turnover is less problematic to measure and it demonstrates a firm's competitiveness (Storey et al., 1987; North and Smallbone, 1995; Barkham et
Employment is less frequently used as a measure because new employees tend to be regarded as additional costs. By combining turnover and employment, a complete picture of firm growth may be obtained (Lumme et al., 1994). In this study, I concentrate on turnover as a measure of growth. However, turnover and employment data are used to measure the productivity growth of HTSMEs.

The time period selected for this study was from 1994 to 1996. This period coincided with a period of rapid growth in the Malaysian economy, an average GDP growth of 8.9 percent. Thus, the period provides an excellent opportunity to study growth in HTSMEs. For the purpose of hypothesis testing, this study measured growth by the annual average change in turnover during the period 1994 to 1996. The formula used for measuring growth is:

\[
\text{ATOG}_{1994-1996} = \frac{1}{2} \times \left( \frac{\text{TO}_{1995} - \text{TO}_{1994}}{\text{TO}_{1994}} + \frac{\text{TO}_{1996} - \text{TO}_{1995}}{\text{TO}_{1995}} \right) \times 100
\]

Where,

- \( \text{ATOG}_{1994-1996} \): Average Annual Turnover Growth Rate from 1994 to 1996
- \( \text{TO}_i \): Turnover for year \( i \)

The focus of this study is primarily on growth, rather than profitability or financial performance. According to Barkham et al. (1996a), there is an important distinction between company growth and its financial performance. From a financial perspective, firms may perform well without growing, while a growing firm may be performing badly. On the whole, however, policy makers and economists are more interested in growth than financial performance (Barkham et al., 1996a). I have therefore retained turnover as the measure for this study, with brief reference to productivity growth.
5.3 INDEPENDENT VARIABLES

Storey (1994b) identified thirty-four elements thought to affect the growth of SMEs. For the purposes of this study, seventeen elements were identified as determinants of growth affecting HTSMEs in Malaysia. I did not adopt all 34 elements, but concentrated on the most relevant for the Malaysian context. Factors such as market adjustment and prior business failure were excluded because none of the studies reviewed by Storey focused on these elements. Competition and training were excluded since they were not shown to be significant in influencing growth. The remaining elements were discarded after conducting a pilot study and interviewing key informants from various Government agencies. For example, 'family history' was left out because OMs were very reluctant to reveal such information, especially the ethnic Chinese. Interviews with MITI and SMIDEC officers suggested that insignificant numbers of Malaysian SMEs export their products, which justifies the exclusion of 'exports' from this study. However, exports are considered in the case studies.

Table 5-1 shows the constituents of the three groups of independent variables. The 'OM' refers to the characteristics of the individual or individuals providing the prime managerial resources of the business. The 'firm' refers to the characteristics of the business itself. It should be noted that the factors under this heading reflect the OM's decisions before or upon starting the enterprise, not operational decisions made after the start of business (Storey, 1994b). 'Strategy' in the context of this study refers to the managerial decisions made to achieve higher growth, after taking into account the characteristics of the OM and the firm.

<table>
<thead>
<tr>
<th>The OM</th>
<th>The Firm</th>
<th>The Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Age of the firm</td>
<td>Market research</td>
</tr>
<tr>
<td>Management Experience</td>
<td>Size of the firm</td>
<td>Marketing orientation</td>
</tr>
<tr>
<td>Career history</td>
<td>Legal form</td>
<td>Product innovation</td>
</tr>
<tr>
<td>Age</td>
<td>Location</td>
<td>Process innovation</td>
</tr>
<tr>
<td>Gender</td>
<td>Industrial sectors</td>
<td>External equity</td>
</tr>
<tr>
<td>Ethnic background</td>
<td></td>
<td>State support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R&amp;D</td>
</tr>
</tbody>
</table>
5.3.1 The OM Characteristics

Storey's literature review identified 15 characteristics of the OM that influence growth. These elements were derived from 18 independent studies (refer to Table 4-1 above) conducted over many years. As stated above, I adopted the most relevant characteristics for the Malaysian context.

Of the elements in Table 5-1, a higher level of education is the most prominent characteristic of OMs involved in high technology firms (Roberts, 1991). Most OMs had been employed as scientists, engineers or university faculty members before setting up their own businesses. It is not surprising, therefore, that education tends to have a positive influence on the growth of HTSMEs (Variyam and Kraybill, 1994). Apart from the technical knowledge, education may, for example, give OMs confidence when dealing with customers.

The management experience of the OM is another key variable. With the right type and quality of management experience, OMs are better able to cope with problems and changes encountered while running their businesses (Westhead et al., 1995). On the same theme, career history is another important variable. This includes the number of years in employment and prior sector experience. Many HTSMEs have been established as a result of R&D projects providing ideas for spin-off products, hence the expertise and experience of OMs will contribute to the achievement of growth in their current business (Storey, 1994b).

Management experience and a career history can, by definition, only be acquired over time. These factors will be present in older OMs, yet such individuals may not have the physical attributes of their younger counterparts. In general, the age of an OM is inversely related to growth; younger OMs tend to achieve higher growth rates than older OMs (Barkham et al., 1996b). The former probably have more physical energy and the commitment to work long hours.

Gender and ethnic background are two genetic elements that influence growth. There is conflicting evidence on the relationship of gender to growth. Reynolds (1993) found that females were more likely than men to own rapidly
growing firms, while Jones (1991) found the reverse relationship. Although Storey (1994b) concluded that gender is not a key influence on business growth, this factor is included to provide some insight on the role of women in the growth and development of HTSMES in Malaysia.

Woo et al. (1989) revealed that businesses established by minority races in the US grow less rapidly than those founded by the majority population. However, Storey (1994b) suggests that businesses established by immigrants grow more rapidly than those established by the native population. It appears, therefore, that ethnicity does have some impact on growth. Ethnicity is clearly an important consideration when formulating support policies in Malaysia. The ICA and the NEP (see Section 2.3.2, Chapter Two) were introduced to reduce the corporate ownership imbalance between ethnic groups in Malaysia. This study provides a good opportunity to assess whether official support for Bumiputeras has influenced the growth performance of Bumiputera-owned companies in the high technology field compared to those operated by non-Bumiputeras.

A number of hypotheses regarding the relationships between the characteristics of OMs and growth are set out below.

**Hypothesis 1:** The level of education of the OM is positively correlated to growth in HTSMES.

**Hypothesis 2:** Prior managerial experience is positively correlated to growth in HTSMES.

**Hypothesis 3:** The age of the OM is negatively correlated to growth in HTSMES.

**Hypothesis 4:** The length of the career history of the OM is positively correlated to growth in HTSMES.

**Hypothesis 5:** HTSMES owned by female OMs grow more rapidly than those owned by male OMs.

**Hypothesis 6:** HTSMES owned by Non-Bumiputera OMs grow more rapidly than those owned by Bumiputera OMs.
5.3.2 The Characteristics of the Firm

Five variables relating to the firm were identified (Table 5-1) as determinants of growth. One of the variables (age) is not related to the background of the OM or strategy employed. The other four elements (size, type of ownership, sector and location) depend largely on the decisions of the OM at the time the business started.

Previous empirical studies in Chapter Four reveal that the age of the firm is negatively correlated to growth. Younger firms grow more rapidly than older firms. The size of the firm shows a similar relationship with growth; smaller firms grow more rapidly than larger enterprises (Section 4.4.2, Chapter Four). The need for younger or smaller firms to grow rapidly stems from the requirement to achieve minimum efficient scale, MES (Storey, 1994b). Once MES is achieved, businesses grow less rapidly.

In relation to legal form or status, studies in the UK and the US consistently point to higher growth being achieved by limited companies compared to either sole proprietorships or partnerships (Reynolds and Miller, 1988; Hakim, 1989; Johnson, 1989; Storey, 1994b). Location is another key factor. HTSMEs located on Science Parks have stronger growth and better survival rates than those operating elsewhere (Hauschildt and Steinkuhler, 1994). Science Parks provide accommodation for both start-up and established HTSMEs, and offer access to R&D institutions and a service infrastructure. The final variable is sector; there are significant differences in growth rates between sectors, for example, between manufacturing and service sector firms, or (say) between different sub-sectors in the manufacturing field.

The following hypotheses regarding the characteristics of firms are therefore put forward for testing:

**Hypothesis 7:** The age of the firm is negatively correlated to growth in HTSMEs.

**Hypothesis 8:** The size of the firm is negatively correlated to growth in HTSMEs.

**Hypothesis 9:** Limited companies grow more rapidly than other forms of HTSMEs.
Hypothesis 10: IITSMEs located on a Science Park grow more rapidly than those located elsewhere.

Hypothesis 11: There are significant differences between the electronics sector and other sectors in terms of the growth of IITSMEs.

5.3.3 The Strategy

At start-up, the goals of a small firm tend to be simple, i.e., survival then growth. However, as the company grows, its strategies become more complex and formal (Birley and Mizuka, 1997). Table 5-1 contains the six variables related to strategy that are perceived to affect the growth of HTSMEs.

Market research and marketing orientation reduce the uncertainty attached to new product development, as outlined in Section 4.2.1. Products launched after market research are more successful than those introduced without market research (LaPlaca, 1990). Furthermore, market research is often implemented by growth-oriented and better educated OMs. More generally, firms adopting a marketing orientation generate greater growth (Barkham et al., 1996b).

Product and process innovation also tend to have a positive relationship to growth, although the relationship might not be clear-cut (as discussed in Section 4.4.3.4). The product development strategy of HTSMEs often involves the commitment to introduce a series of new products (Oakey, 1995). Likewise, process innovation is a continuous activity for growth-oriented HTSMEs.

OMs also have key decisions on whether to accept external equity and state support. Growth is strongly associated with a willingness to share equity, particularly with a financial institution or a business angel, and a reluctance to accept external equity can constrain growth (Storey, 1994b). HTSMEs in receipt of state support grow more rapidly than those with no government backing (Kinsella et al., 1993). Such support covers, for example, direct financial assistance or help with accessing information.

To achieve and maintain growth, it is imperative for HTSMEs to invest in R&D. Increased R&D expenditure normally underpins continuous growth (Smith,
1996). R&D is one of the most important components for a successful innovating company and one of the key drivers of growth in HTSMEs (Ettlie, 1997; Judge et al., 1997; Jankowski, 1998).

The following hypotheses regarding 'strategy' are to be tested:

**Hypothesis 12:** HTSMEs that conduct market research grow more rapidly than those that do not.

**Hypothesis 13:** HTSMEs that adopt a marketing orientation grow more rapidly than those that do not.

**Hypothesis 14:** Product innovation is positively correlated to growth in HTSMEs.

**Hypothesis 15:** Process innovation is positively correlated to growth in HTSMEs.

**Hypothesis 16:** HTSMEs that accept external equity grow more rapidly than those that do not.

**Hypothesis 17:** HTSMEs that accept government support grow more rapidly than those that do not.

**Hypothesis 18:** R&D expenditure is positively correlated to growth in HTSMEs.

5.3.4 The Constraints

The literature review examined the barriers to growth affecting small firms in the UK, though not all studies were concerned with high technology firms. The major constraints faced by growth-oriented HTSMEs are summarised as: a lack of suitable finance (ACOST, 1990; Aston Business School, 1991; UCSBRC, 1992; Barkham et al., 1996b); shortages of labour (Barber et al., 1989; Aston Business School, 1991; Slatter, 1992; Barkham et al., 1996b); poor quality labour (Aston Business School, 1991; Barkham et al., 1996b); a lack of demand for products (Aston Business School, 1991; UCSBRC, 1992; Barkham et al., 1996b); and a lack of management time to
develop new products and markets (ACOST, 1990; UCSBRC, 1992; Barkham et al., 1996b).

Other constraints, of perhaps less importance, include: a lack of suitable premises (Aston Business School, 1991; UCSBRC, 1992; Barkham et al., 1996b); equipment problems (Barkham et al., 1996b); insufficient supplies of raw materials (Barkham et al., 1996b); inadequate information on finance (Barkham et al, 1996b), product and process technology (ACOST, 1990; Aston Business School, 1991; Barkham et al., 1996b), or markets (Aston Business School, 1991; UCSBRC, 1992); an inadequate road or rail system (Barkham et al., 1996b); and, problems associated with bad debts or late payments.

All the above constraints can be grouped into three basic components: resources or inputs; products; and, markets. Based on ACOST (1990), Boocock (1994) and Barkham et al. (1996b), the three groups of constraints are subdivided into 15 variables and inserted into an enhanced research framework for this study, Figure 5-1.

Figure 5-1 shows constraints relating to resources or inputs. These include: shortages of, or poor quality, labour; a lack of finance; unsuitable premises; lack of access to raw materials; equipment problems; and inadequate information on finance.

Difficulties in achieving quality standards, a lack of management time to develop new products and markets, and inadequate information on product and process technology are considered as external constraints related to products (Figure 5-1). Lack of demand and inadequate information on markets are two market constraints.

The researcher decided at the outset that a series of case studies would provide useful insights into the barriers to growth faced by HTSMEs. Before the case studies were compiled, the researcher conducted a questionnaire survey to identify the major constraints faced by HTSMEs in Malaysia. The final question in the questionnaire asked respondents to indicate the level of importance attached to a number of constraints. Mean scores based on the Likert Scale for each constraint were computed,
and those with a minimum score of 2.5 were considered as important and worthy of further analysis in the case studies (Chapter Eight). In many cases, however, the answers given in the questionnaire were open to interpretation, as the following examples illustrate.

A lack of finance was the principal constraint, but the questionnaire responses did not indicate whether this problem stemmed from a lack of available funds or proposals being turned down by financial institutions on commercial grounds. The questionnaire responses identified a major constraint as a shortage, and poor quality, of labour. However the responses did not provide any indication as to the cause of the shortage. It was not clear whether there was a shortage in the labour market or whether the OMs refused to pay the market wage rate. The questionnaire also indicated that a lack of management time and information about new products and processes led to innovation constraints. However, the responses did not identify how the OMs overcome these problems. A lack of demand was also identified in the questionnaire, but the survey did not explain why HTSMEs encountered demand constraints. My focus of attention is whether HTSMEs are too reliant on the domestic market rather than exports.

It should be clear, therefore, that it was necessary to conduct a follow-up study to generate more information on the nature of the constraints. The following propositions were explored in the qualitative aspect of the research programme - the case studies.

**Proposition 1:** HTSMEs encounter financing constraints because of a lack of funds from the financial system in Malaysia.

**Proposition 2:** Labour constraints among HTSMEs stem from a shortage of skilled workers in the labour market.

**Proposition 3:** HTSMEs are not able to innovate owing to lack of management time and information on product and process innovation.

**Proposition 4:** HTSMEs encounter demand constraints because they do not export their products.
5.4 THE ENHANCED RESEARCH MODEL

The research model presented in Figure 5-1 can now be modified to incorporate all of the specified variables. The enhanced research model is presented in Figure 5-2.

FIGURE 5-2 Enhanced Research Model

<table>
<thead>
<tr>
<th>The OM</th>
<th>The Firm</th>
<th>The Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Education</td>
<td>- Age of the firm</td>
<td>- Market research</td>
</tr>
<tr>
<td>- Management Experience</td>
<td>- Size of the firm</td>
<td>- Marketing orientation</td>
</tr>
<tr>
<td>- Career history</td>
<td>- Legal form</td>
<td>- Product innovation</td>
</tr>
<tr>
<td>- Age</td>
<td>- Industrial sector</td>
<td>- Process innovation</td>
</tr>
<tr>
<td>- Gender</td>
<td>- Location</td>
<td>- External equity</td>
</tr>
<tr>
<td>- Ethnic background</td>
<td></td>
<td>- R&amp;D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- State support</td>
</tr>
</tbody>
</table>

GROWTH

Barriers to growth

Resources/Input

- Shortage of labour
- Poor quality of labour
- Lack of suitable finance
- Lack of suitable premises
- Lack of raw materials
- Equipment problems
- Inadequate information on finance
- Inadequate road or rail system
- Bad debts or late payments

Products

- Inadequate information on product technology
- Inadequate information on process technology
- Difficulties in achieving quality standards
- Lack of management time to develop new products and markets

Markets

- Lack of demand
- Inadequate information on markets
5.5 SUMMARY

This chapter has put forward a research framework based on the existing literature. This study adopts a modified form of the strategic model of growth to explain the relationship between growth and its determinants and constraints. The conceptual framework incorporates the OM and firm characteristics, and examines the strategies adopted to achieve business growth in the light of the opportunities and constraints faced by the business.

The conceptual framework for this study is based principally on a summary of literature conducted by Storey (1994b) and previous research by Barkham et al. (1996b). Growth, the dependent variable, is measured by the annual average turnover growth over the period 1994 to 1996. The growth determinants, the independent variables, are grouped into three basic components: the OM; the firm; and, the business strategy. Six elements of the OM are considered in this study: education; management experience; career history; age; gender; and, ethnic background. The five selected elements of the firm are its age and size, legal form, location and industrial sector. The chosen strategy elements include market research, marketing orientation, product and process innovation, and acceptance of external equity. Based on this framework, seventeen hypotheses were constructed.

In addition to this, a number of constraints were grouped into three major components, namely, the resources or inputs, and product and market constraints. The enhanced research model incorporates a total of fifteen constraints identified through the questionnaire survey. A number of key propositions were put forward for investigation in the case studies.

The next chapter presents the research design for this study.
CHAPTER 6
RESEARCH METHODS

In the previous chapter, a theoretical framework on which to base this study was developed. Having identified the variables and hypotheses to be tested, this chapter discusses the most suitable method for gathering data to test the hypotheses. The chapter starts by reviewing the research design used in past growth studies, then discusses the rationale for utilising the methods adopted in this study. This is followed by a discussion on data collection and sample selection procedures. The chapter goes on to describe how case studies are used to supplement the qualitative data. Finally, the chapter describes the data analysis techniques used in this study.

6.0 RESEARCH STRATEGIES

In attempting to ascertain the most suitable research methodology, the literature on the development and growth of HTSMEs was reviewed. So far, there have been very few studies that have assessed the growth and constraints of HTSMEs in developing countries. Thus, my research design is based heavily on empirical investigations conducted in the UK, US and Europe.

TABLE 6-1 Summary of Methods Used: Quantitative Methods

<table>
<thead>
<tr>
<th>Authors</th>
<th>Emphasis</th>
<th>Sample Size</th>
<th>Data Gathering Method</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oakey (1984)</td>
<td>Rural development of high technology small firms in the US and UK</td>
<td>174 high technology small firms</td>
<td>Structured Interviews</td>
<td>Chi-square test and percentages</td>
</tr>
<tr>
<td>Fong (1986)</td>
<td>Role of small scale industries in the industrialisation of Malaysia</td>
<td>167 small and medium firms</td>
<td>Interviews</td>
<td>Cross tabulation and percentages</td>
</tr>
<tr>
<td>Evans (1987a)</td>
<td>Relationship between firm size and age, and growth</td>
<td>100 manufacturing companies</td>
<td>Secondary data constructed by US Small Business Admin.</td>
<td>Regression analysis</td>
</tr>
<tr>
<td>Baker et al. (1993)</td>
<td>Relationship between business planning and high success small firms</td>
<td>500 CEOs</td>
<td>Postal questionnaire</td>
<td>Mean rating</td>
</tr>
<tr>
<td>Storey (1994a)</td>
<td>Influence of legal status on bank financing and new growth.</td>
<td>Not stated</td>
<td>Interviews</td>
<td>Multivariate analysis</td>
</tr>
<tr>
<td>Varyiam &amp; Kraybill (1994)</td>
<td>Relationship between managerial inputs and growth</td>
<td>646 firms with fewer than 500 employees</td>
<td>Not stated</td>
<td>Regression analysis</td>
</tr>
<tr>
<td>Reuber &amp; Fischer (1994)</td>
<td>Relationship between founders’ experience and performance of technology-based firms</td>
<td>178 biotechnology firms and 120 telecommunication firms</td>
<td>Postal questionnaire</td>
<td>Mean rating, correlation and regression analysis.</td>
</tr>
<tr>
<td>Wynarczyk &amp; Twaites (1994)</td>
<td>Relation between NTBF financial performance and ownership characteristics.</td>
<td>170 firms</td>
<td>Postal Questionnaire</td>
<td>Regression analysis</td>
</tr>
<tr>
<td>Barkham et al. (1996b)</td>
<td>Causes of growth in small manufacturing firms in the UK</td>
<td>174 small firms located in 4 regions in the UK</td>
<td>Postal Questionnaire</td>
<td>Regression analysis</td>
</tr>
<tr>
<td>Gillin &amp; Hornsby (1997)</td>
<td>Assessment of factors influencing growth of Australian SMEs</td>
<td>180 SMEs</td>
<td>Postal Questionnaire</td>
<td>Correlation analysis</td>
</tr>
</tbody>
</table>

A quantitative investigation looks for “distinguishing characteristics, elemental properties and empirical boundaries” (Horna, 1994, p. 121). It is used when a researcher attempts to measure “how much” or “how often” (Nau, 1995). However, the main argument against the quantitative method lies in its “failure to ascertain deeper underlying meaning and explanations” (Jones, 1997, p.2) of the issue being studied, even when the findings are significant, reliable and valid. On the other hand, qualitative research is used to provide a deep set of knowledge about a particular
phenomenon (Jones, 1997). In the qualitative approach, researchers are more interested in obtaining information on "how things happen" and "how results are produced" (Creswell, 1994).

TABLE 6-2 Summary of Methods Used: Qualitative Methods

<table>
<thead>
<tr>
<th>Authors</th>
<th>Emphasis</th>
<th>Sample Size</th>
<th>Data Gathering Method</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hakim (1989)</td>
<td>Identifying fast growth small firms</td>
<td>2,000 respondents</td>
<td>Short telephone interview</td>
<td>Descriptive statistics</td>
</tr>
<tr>
<td>Litvak (1989)</td>
<td>Export strategies during companies' development</td>
<td>29 small high technology firms</td>
<td>Interviews</td>
<td>Case Studies</td>
</tr>
<tr>
<td>Romano &amp; Ratnatunga (1994)</td>
<td>Relationship between planning &amp; control, and growth</td>
<td>30 small manufacturing firms</td>
<td>Open-ended semi-structured interviews</td>
<td>Case studies</td>
</tr>
<tr>
<td>Brown &amp; Gobeli (1992)</td>
<td>Measurement of R&amp;D activity</td>
<td>1 high technology firm</td>
<td>Interviews &amp; observation</td>
<td>Case study</td>
</tr>
<tr>
<td>Schwartz et al. (1997)</td>
<td>A study of strategy and performance of entrepreneurial high technology firms</td>
<td>62 companies</td>
<td>Observations</td>
<td>Longitudinal study</td>
</tr>
<tr>
<td>Keogh &amp; Evans (1998)</td>
<td>Strategies for growth and the barriers faced by new technology-based SMEs</td>
<td>20 new technology-based firms</td>
<td>In-depth interviews</td>
<td>Case studies</td>
</tr>
</tbody>
</table>

Qualitative methods are employed to address areas identified as potential weaknesses within the quantitative approach (Jones, 1997). For example, Litvak (1996) and Schwartz et al. (1997) adopted the qualitative paradigm in reviewing high technology firms because the quantitative approach allowed them to obtain a deeper understanding of the issues being explored. However, qualitative research does have its drawbacks. The main argument against its use is the concept of validity. It is difficult to determine "the truthfulness of findings" (Jones, 1997, p. 3), which makes it difficult to generalise the views of respondents to the general population. Another disadvantage in using the qualitative approach is that it tends to be very expensive, leading to small sample sizes that increase the problem of sampling error (Tull and Hawkins, 1993). As will be argued later in this chapter, the use of triangulation or the "mixed methods" approach should enable this study to avoid such problems.
TABLE 6-3  Summary of Methods Used: Combination of Quantitative & Qualitative Methods

<table>
<thead>
<tr>
<th>Authors</th>
<th>Emphasis</th>
<th>Sample Size</th>
<th>Data Gathering Method</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oakey et al. (1988)</td>
<td>A general investigation of the link between innovative performance and prosperity</td>
<td>214 small high tech firms</td>
<td>Postal questionnaire and 83 telephone interviews</td>
<td>Chi-square analysis</td>
</tr>
<tr>
<td>A. Wahab, I. (1996)</td>
<td>Financing the growth of small firms: a comparative study of the UK and Malaysia</td>
<td>112 small firms in Malaysia and 228 small firms in the East Midlands</td>
<td>Postal Questionnaire and interviews</td>
<td>Comparative analysis</td>
</tr>
<tr>
<td>Hardill &amp; Wynarczyk (1996)</td>
<td>Relationship between technology, entrepreneurial human capital and company performance</td>
<td>181 SMEs in the British textile industry</td>
<td>Postal questionnaire and semi structured interviews</td>
<td>Regression analysis</td>
</tr>
<tr>
<td>Bantel (1997)</td>
<td>The role of top management in enhancing the growth and performance of technology-based SMEs</td>
<td>160 companies</td>
<td>Postal questionnaire and semi-structured interviews</td>
<td>Correlation analysis</td>
</tr>
</tbody>
</table>

About 90 percent of research studies in the social sciences adopt a single method of investigation, employing either quantitative or qualitative methods (Isaac and Michael, 1981). According to Isaac and Michael, this has led to “self-defeating practice” (p. 92) and they suggested that a triangulation of various methods provides “far more powerful evidence” supporting the research proposition. By triangulation, it is possible to achieve convergence of the results (Greene et al, 1989). According to Nau (1995, p.1), blending qualitative and quantitative methods can produce “a final product which can highlight the significant contributions of both”. Oakey et al. (1988) adopted a multi-method approach in his examination of management approaches to innovation in high technology small firms. In that study, telephone interviews were used to determine the innovation behaviour of the respondents. Quantitative data were then elicited through questionnaires distributed shortly after the telephone interviews. A. Wahab (1996) used questionnaires to gather quantitative data on characteristics of SMEs, followed by in-depth interviews to obtain qualitative data on the financing practices of innovating and non-innovating firms.
The studies reviewed above demonstrate the wide range of survey methods available to gather primary data on HTSMEs (see Tables 6-1, 6-2 and 6-3). However, the most common instruments used by previous researchers in studying SMEs (not just HTSMEs) have been questionnaires and interviews (Oakey et al., 1988; Baker et al., 1993; Reuber and Fischer, 1994; Wynarczyk and Thwaites, 1994, Barkham et al., 1996b; Hardill and Wynarczyk, 1996).

The questionnaire provides a quantitative description of some fraction of the population through a data collection process asking questions of respondents (Fowler, 1988). It also addresses the issue of generalisability by distributing questionnaires to a sample, so that conclusions or inferences can be made about the underlying population (Babbie, 1990). However, a major drawback in using questionnaire surveys is the lack of depth.

Questionnaires can be administered in three different ways: telephone; postal; and, through in-depth-interviews.

**Telephone surveys** are suitable only if the majority of the population can be reached by telephone (Neuman, 1997). In developing countries like Malaysia, telephone interviews can be costly and time consuming. In my experience, respondents sometimes terminate the interview without warning or explanation by hanging up the phone. Another disadvantage of the telephone interview is that the researcher is not able to observe the non-verbal responses of the respondents (Sekaran, 1992). I therefore chose to utilise the other two methods, which are discussed below.

The **postal questionnaire** is best administered if the study involves a large number of respondents dispersed over a wide geographical area (Sekaran, 1992; Nachmias and Nachmias, 1992). My postal survey was used to cover the wide geographical area of Peninsular Malaysia. Furthermore, postal questionnaires are much cheaper than any other method and reduce errors caused by bias on the part of interviewers and the variability of interviewing skills (Nachmias and Nachmias, 1992).
Nevertheless, postal questionnaires have their disadvantages. They usually have a low response rate (Sekaran, 1992). M. Hassan (1996) achieved a low response rate, only 12 percent, from manufacturing firms located in one state of Malaysia. Malaysian companies, especially companies owned by entrepreneurs of Chinese ethnic origin, tend to see researchers as representatives of the Government. Furthermore, there is difficulty in ascertaining who actually answers the questionnaire. Top level management may delegate the questionnaire to subordinates, such as clerks, actions that may have implications for the comparability of the data (Bryman and Burgess, 1989).

Another method of administering a questionnaire is through in-depth interviews. Such interviews have the highest response rates and permit the longest questionnaires (Neuman, 1997). The real advantage of interviews is the depth of information that can be secured. Silverman (1993, p. 15) commented that:

Interview study highlights the advantages of qualitative research in offering an apparently 'deeper' picture than the variable-based correlations of quantitative studies.

Interviewers can observe the surroundings and study non-verbal communication. The main advantage of using in-depth interviews in this study is that I was able to adapt the questions as necessary, clarify doubts and ensure that the responses were clearly understood by repeating or rephrasing the questions. These interviews produced in-depth data that would not have been possible to gather with a questionnaire (Gay and Diehl, 1992). The interviews enabled me to question firms closely on the major constraints encountered, notably a lack of finance. In reviewing the growth determinants and barriers faced by new technology-based SMEs, Keogh and Evans (1998) used in-depth interviews with owners or managers.

While in-depth interviews enable researchers to focus on specific issues, they also have a number of limitations, including:
Interviews are time consuming and costly, partly due to the geographical limitations on the interviews (Gay and Diehl, 1992). This in turn limits the number of respondents that can be interviewed and, as a consequence, the representativeness of the sample might be questionable. It is economical only if the respondents are located in the same geographical area. For example, Westhead and Storey (1997) took more than a year to interview 188 HTSMEs in the UK, while A. Wahab (1996) received 228 usable responses within a few months through a postal questionnaire survey in the UK.

The danger of interviewer bias is greatest in in-depth interviews compared to postal questionnaires and telephone interviews (Tull and Hawkins, 1993). The appearance, tone of voice and question wording may affect the respondent. Furthermore, respondents may feel uneasy about the anonymity of their responses when they are interacting face to face with the interviewer (Sekaran, 1992).

Interviews can be based on structured, semi-structured or unstructured questionnaires. Structured interviews are conducted when interviewer knows exactly what information is needed. At the other extreme, the objective of the unstructured interview is to raise some preliminary issues so that the researcher can formulate a good idea of what variables need further in-depth investigation (Sekaran, 1992). As I had a reasonably clear idea of the issues involved, my study employed the semi-structured approach to explore the constraints on growth in case study firms.

6.1 CHOICE OF METHODS AND RATIONALE
The research methodology adopted for my study involves a combination of a postal questionnaire survey, and in-depth interviews to develop case studies. My rationale for adopting the triangulation approach was:

i) For a rigorous development of the research programme, the quantitative method was used prior to the qualitative stage. Case studies then provide more detailed insights into relevant issues and problems (Silverman, 1993).

ii) Multiple methods tend to have greater validity and reliability than a single methodological approach (Johnson and Gill, 1991).
Malaysia has recently shifted from an agricultural to an industrial base. Thus, very few studies have been conducted on the high technology sector in the country and most of these research studies have been conducted either quantitatively or qualitatively. Brewer and Hunter (1989; p. 48) commented:

The continuing nature of theoretical enquiry most often involves methodological replication - applying the same method in successive studies. However, the very fact that a particular type of method has been used before, and especially its repeated use, may be a good reason to use a different type of method in a new study.

My research was conducted in two stages (Figure 6-1). Stage one involved informal interviews with key informants and postal questionnaires to explore the determinants of growth for HTSMEs in Malaysia and to identify constraints on growth. Using the postal questionnaire, I was able to cover a wide geographical area of Peninsular Malaysia. By adopting sequential triangulation, the questions in the first phase were completed before formulating questions for the second phase (Morse, 1991).

In the second stage, the case study approach was adopted to provide depth to the research. High technology industries are diverse, with differing products, processes and technologies. Hence the case study approach provided an opportunity to strengthen and expand theories in the Malaysian context. It also provided an opportunity to explore contemporary issues, such as how the factors explored in the first stage affect growth, and why these factors are important in facilitating further growth. In general, when "why" and "how" questions are being posed, the case study strategy is preferred (Yin, 1989). The questions explored in my qualitative work included: "Why do HTSMEs face difficulty in obtaining finance?" and "How do HTSMEs overcome the shortages of skilled labour?" According to Yin, case studies can play an important role in formulating policy, but limited generalisation is the chief drawback of this approach.

Having discussed the methodologies adopted for my study, the next section discusses the design of the questionnaire and sample selection.
FIGURE 6-1 The Research Strategy

Define HTSMEs (Literature Review & Informal Interviews)

Identify Growth Determinants & Constraints (Literature Review and Informal Interviews)

- Establish Hypotheses (Literature Review)
- Prepare Questionnaire
- Select Sample

Questionnaire Survey
- Pretesting → Pilot Testing → Distribute

- Questionnaire Analysis
- Hypothesis Testing on Determinants
- Constraints Faced by Respondents

In-Depth Interviews
- Select Sample
- Contact Companies for Interviews

Conduct Interviews

Case Analysis
- Proposition Testing

Conclusions & Recommendations

STAGE 1

STAGE 2
6.2 THE QUESTIONNAIRE SURVEY

It would be impossible for the researcher to contact all HTSMEs in Malaysia, owing to limitations on time, money and access. Thus, a sample was selected for this study. The following section describes the process involved in the questionnaire survey, from designing the questionnaire to selecting the sample.

6.2.1 Questionnaire Design

For the first stage of the study, questionnaires (see Appendix 6-1) were mailed to the sample drawn from the various sources described below in Section 6.2.4. Questionnaires are not appropriate for exploratory research that requires a large number of open-ended questions (Saunders et al., 1997). The questionnaire used in this study contained standardised questions, that (hopefully) all respondents interpreted in the same way. The questionnaire focused on factors affecting growth and touched on the constraints faced by HTSMEs. To this end, my questionnaire was able to draw upon previous work by Barkham et al. (1996b) and Boocock (1994), but it had to be appropriately developed for the needs of this study. The new instrument required refinement and was tested in a controlled way with a subset of early respondents.

As anticipated, a major problem was the difficulty in getting responses from companies in Malaysia (M. Hassan, 1996). This lack of co-operation might have stemmed from suspicions as to the motives of the researcher. The information requested may have also been seen as intrusive, particularly on issues pertaining to the financial performance of the company. However, there were a number of ways to overcome this problem. The ‘rule of thumb’ for gaining access to most organisations is to combine “strategic planning, hard work and luck” (Van Maanen and Kolb, 1985). To ensure an acceptable response rate, especially from companies receiving Government assistance, I had to seek assistance and co-operation from a number of Government agencies responsible for SME development in Malaysia. The agencies include MITI, SMIDEC, Malaysian Entrepreneur Development Corporation (MEDEC), TPM and MTDC. I had also seek assistance from the FMM to ensure good response from non-Bumiputra OMs. To ensure a good response rate from the Chinese,
Indian and Malay ethnic origin respondents, a number of versions of the questionnaire (Malay language – Appendix 6-2, Mandarin – Appendix 6-3) were prepared. A. Wahab (1996) employed the same strategy in his study of small firm financing in Malaysia. I also employed an opportunistic approach by using contacts, friends or relatives to obtain information. To further ensure an acceptable response rate, the three-phase Dillman (1978) and Saunders et al. (1997) follow-up sequence was adopted (Figure 6-2).

**FIGURE 6-2 Three-Phase Follow-up Sequence**

- **Phase-one**
  - Two weeks after the original mailing send out a reminder.

- **Phase Two**
  - Two weeks later, send another reminder and a second copy of the questionnaire

- **Phase Three**
  - Two weeks later, send a final reminder

The whole process of administering the survey took about twelve weeks.

### 6.2.2 Contents of the Questionnaire

Based on the theoretical framework developed in the previous chapter, the questionnaire was designed to capture information on:
Background of the OM
The characteristics examined include age, gender, educational qualifications, previous employment and/or years of management experience.

Background of the Firm
Questions 6 to 19 gather information such as status of company, number of partners, percentage of owner's share in the firm, age of business and number of employees. Respondents were also required to rank a set of attributes that influenced their choice of location.

Business Strategy
Questions 23 - 31 centre on the actions taken by OMs once the business has been established. The issues covered include R&D, marketing strategy, sources of equity, number of new products introduced and the degree of process innovation.

Constraints on Growth
Most of the constraints are external in nature, but a few internal constraints were included. Some of the constraints included were declining markets, shortages of labour and lack of suitable finance for expansion. Respondents were required to rank factors according to their importance.

Measurement of Growth
It was vital for the respondents to give details on growth (the dependent variable). Respondents were required to state the level of turnover and the number of employees in each of three consecutive years (1994 - 1996).

Comments from Respondents
Respondents were allocated space for any additional comments of relevance to this study. Space was also provided to indicate whether they needed a summary of the questionnaire findings.

6.2.3 Pre-testing and Pilot Surveys
Pre-testing was conducted before piloting the questionnaire instrument. Ten questionnaires were distributed to a number of research students from Loughborough
University, lecturers from MEDEC and a senior manager from the Malaysian Technology Development Corporation (MTDC). A number of modifications were made to the format and style of the document. For example, the typeface was changed for easier reading from Times New Roman to Helvetica.

A total of 15 questionnaires were then distributed to firms throughout Klang Valley, mainly SMEs. While collecting the questionnaires in this pilot study, I had informal discussions with some of the respondents and received useful feedback. As a result, minor but necessary modifications were made to certain questions. For example, the question on ethnic background was changed to Bumiputera or non-Bumiputera. In a multi-racial country, the issue of race is quite sensitive. The term SMI (Small and Medium Size Industry) was used instead of SME because SMI is a term more widely used in Malaysia. Based on 12 completed questionnaires, statistical analysis was conducted using SPSS Windows. It was found that all questions yielded data consistent with the objectives of the study. The final questionnaires were then distributed to selected HTSMEs throughout Peninsular Malaysia.

6.2.4 Sampling Frame

A sample selected from a complete or master list of sampling unit is known as sampling frame (Chadwick et al. 1984). To select a good sample frame, the following criteria were used:

i) The sample frame should include all sampling units in the population (Nachmias and Nachmias, 1992).

ii) The sample frame must be updated to include new units joining the population (Foreman, 1991).

iii) Every element of the population is represented once, but only once (Tull and Hawkins, 1993).

A complete physical list of the population seldom exists, thus an "equivalent list" or "suitable list" has to be constructed (Nachmias and Nachmias, 1992; Saunders
et al., 1997). When no equivalent list is available, several lists of the population being studied have to be combined to create a sampling frame. This proved to be the case in my research. The sampling frame was developed from lists of HTSMEs obtained from various Government and non-government sources. The following organisations were approached:

**Malaysian Industrial Development Authority (MIDA)**

MIDA holds a list of 26 high technology companies that qualify for high technology incentives, i.e., companies awarded Pioneer Status, with 100 percent exemption from Investment Tax Allowance for a period of 5 years. Unfortunately, all the companies listed were MNCs. Nevertheless, MIDA provided the names of firms qualifying for R&D incentives. These 33 companies provide R&D services to companies in Malaysia. The list contains contact details, as well as information on the number of employees, equity, capital investment, R&D status (whether contracted or in-house) and industrial sector.

**Malaysian Technology Development Corporation (MTDC)**

Three lists were obtained from MTDC. The first list contains contact details and information on the products of the 31 members of the MTDC technology-based group of companies. The second comprises similar data for 33 companies that have applied for assistance from the Technology Development Fund managed by MTDC. The third consists of 8 companies created for the commercialisation of R&D. However, none of the three lists provides information on the number of employees. Hence it was difficult to determine whether these companies were SMEs.

**Technology Park Malaysia (TPM)**

The list obtained from TPM consists of the name, address, telephone number, contact person and R&D projects of the company. Most of the 65 companies listed are information technology based and some have been awarded MSC status by the Multimedia Development Corporation. Even though information on the number of employees and age of company were not available, this list was found to be useful.
Small and Medium Industries Corporation (SMIDEC)

SMIDEC is a newly established organisation. Thus, most of their databases have yet to be organised. It keeps a list of all companies receiving assistance from various funds made available to SMEs, particularly technology-based recipient companies under the Technology Development, Technology Acquisition and Industrial Technical Assistance Funds (ITAF). However, the records of these companies are considered to be confidential by SMIDEC and therefore were not made available for this study.

Ministry of Science, Technology and the Environment (MOSTE)

In 1994, the Malaysian Science and Technology Information Centre (MASTIC) conducted a national survey on innovation in industry. 815 companies were selected to form a sample and 51 percent responded to a questionnaire survey. The scope of the survey included innovation, R&D activities and the transfer of technology. This database would have been extremely valuable for my study, as high technology SMEs could have been identified, based on R&D expenditure and the employment of engineers, scientist and technologists. However, the respondents' names and addresses were not released on the grounds of confidentiality. Nevertheless, the Science and Technology division of MOSTE is responsible for administering the Industry Grant Scheme (IGS). Currently six companies have been awarded an IGS grant, and contact details were made available.

The National Biotechnology Directorate (NBD), a subdivision of MOSTE, keeps records on biotechnology companies operating in Malaysia. The records contain data on 57 companies, giving data on the year of incorporation, company name, contact details, annual sales, number of employees and products manufactured. While not all companies listed were SMEs, several promising leads were identified.

Standards and Industrial Research Institute of Malaysia (SIRIM)

SIRIM has been appointed by SMIDEC as the implementing agency for the Industrial Technical Assistance Fund 2 (ITAF 2). SIRIM keeps a complete list of all ITAF 2 recipient companies. Again, the information was not released due to confidentiality.
Federation of Malaysian Manufacturers (FMM)

FMM publishes an annual directory of Malaysian manufacturers and exporters. The 1998 directory listed 1,794 registered members from the manufacturing and service sectors. The listing divides the companies into 27 product and service categories. The directory contains the company name, address, contact details, year of incorporation, number of employees, annual sales, products manufactured, current export markets and brand names of products manufactured. After scrutinising the list, I selected 193 companies from three high technology sectors (based on the Malaysian definition of high technology discussed in Chapter Three and outlined in Appendix 2-2), namely biotechnology, telecommunications and electronics. This list includes companies operating in the East Malaysian States of Sabah and Sarawak, as well as large firms, which have more than 250 employees. The directory was therefore very useful, though is confined to FMM members, only 11 percent of whom are SMEs.

The Ministry of Entrepreneur Development (MED)

This Ministry is responsible for administering the Vendor Development Programme (VDP). It keeps records of the anchor and the vendor companies. A list was furnished by the Ministry, containing the names of 50 anchor companies, including some high technology MNCs. However, each anchor company has a number of vendor companies (SMEs) which produce components. A total of 175 vendor companies produce parts and components for the 50 anchor companies. For each of the 175 companies, the list contains contact details and information on components produced. Though confined to Bumiputra entrepreneurs, the list was useful because it provided me with a reliable list of technology-based SMEs - only vendor companies supplying high technology MNCs were selected.

UPM-MDTC Incubation Centre

The UPM-MTDC incubation centre includes seven tenants classed as SMEs. For each of the seven companies, contact information and details of products were obtained. All the companies are IT-based, except for one engaged in biotechnology. The UPM list provided me with a useful set of start-up HTSMEs, as the incubation centre started in 1997 and all companies operating on it are relatively new.
Table 6-4 shows the final composition of companies in the sampling frame.

<table>
<thead>
<tr>
<th>Source</th>
<th>Sample Frame</th>
<th>Survey Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Firms</td>
<td>Percent</td>
</tr>
<tr>
<td>MIDA</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>MTDC</td>
<td>61</td>
<td>11</td>
</tr>
<tr>
<td>TPM</td>
<td>65</td>
<td>12</td>
</tr>
<tr>
<td>MOSTE</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>FMM</td>
<td>193</td>
<td>35</td>
</tr>
<tr>
<td>UPM-MTDC</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Vendor Development Programme (VDP)</td>
<td>175</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>536</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>No. of Firms</td>
<td>Percent</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>86</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>228</td>
<td>100</td>
</tr>
</tbody>
</table>

6.2.5 Sampling Technique

Since the actual population of HTSMEs was not known, I was not able to adopt a random sampling technique. Thus convenience-sampling techniques were used, based on the number of employees (fewer than 250) and whether the company was technology-based (as determined by the respective organisations that provided the company data). After going through the various lists, companies that did not meet the two criteria above were deleted. Finally, 228 companies were selected (Table 6-4) and the questionnaires were sent to these companies.

It is important to note that, since a non-random sampling method was used, the issue of generalisation arises. The issue was addressed by follow-up case study research to provide in-depth analysis of the problems raised in the questionnaire survey (Saunders et al., 1997).

6.3 NON-RESPONSE BIAS

As discussed earlier, one major drawback of postal questionnaires is the low response rate. The respondents either refused to complete the questionnaire or failed to return the completed document. The non-response may introduce an element of bias, as respondents and non-respondents may differ from each other in terms of characteristics relevant to the research (Bryman, 1989). Non-response bias, described as the difference between the answers of respondents and non-respondents, has long
been a concern of researchers employing postal questionnaires (Lambert and Harrington, 1990). The larger the potential bias, the more caution the researcher should exercise in generalising the results of the sample to the entire population.

The methods used to improve response rates include the provision of a cover letter with a clear explanation of the aims and importance of the study, a reply-paid envelope, assurances of confidentiality and anonymity, and systematic following up of non-respondents (Bryman, 1989). All the above measures were carried out during my research.

The final questionnaires were distributed to 228 HTSMEs throughout Peninsular Malaysia. A total of 110 questionnaires (48.2 percent) were returned. Of these, 15 were returned unopened, stamped on the envelope “addressee has moved” or “incomplete address”. Another 8 were no longer considered as SMEs, since their number of employees now exceeds 250, and one had a page missing. The final number of usable responses was 86 (42.2 percent of the survey sample).

According to Lambert and Harrington, potential non-response bias needs to be addressed when response rates fall below 40 percent. My study received a response rate of 42.2 percent, but I judged it important to estimate the effects of non-response bias as it might have affected the generalisability of the survey results.

A variety of ways have been offered to deal with the potential problem of non-response bias. One particular method is to estimate the effects of non-response bias and adjust accordingly - the extrapolation method (Filion, 1976) involves estimating population parameters while correcting for non-response bias. However, the efforts taken to achieve higher response rates are of much greater importance than the procedures used to make adjustments for the non-responses that do occur. For example, some of the best methods to get high response rates include cover letters, first-class outgoing mail and monetary incentives.

Another method proposed by Lambert and Harrington (1990) involves comparing the composition of respondents and non-respondents in relation to
characteristics relevant to the study. If no significant differences are observed between the two groups, the absence of non-response bias is inferred. If significant differences are observed, a note of caution should be included in the conclusions to account for possible bias. I adopted the comparative method to analyse non-response bias. The respondents were divided into two groups comprising the first 30 and the last 30 responses received. The intermediate respondents were excluded in order to clearly separate early and late respondents. The groups were then compared in terms of OM and firm characteristics, business strategy and growth rates.

Lambert and Harrington (1990) argue that a researcher should exercise caution in generalising results from the respondent sample to the entire population when non-response bias is present. However, the results of a two-tailed t-test (Table 6-5) show that none of the key variables tested produced significant differences (at the 5 percent level of significance) between early and late respondents. This suggests that the study is free from non-response bias, which allows me to generalise results from the sample to the population.

### TABLE 6-5 Results of 2-Tailed t-Test Between Early and Late Responses

<table>
<thead>
<tr>
<th>Variables</th>
<th>Degree of Freedom</th>
<th>Observed Significance Level</th>
<th>Significant at 95 % level?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of OMs</td>
<td>58</td>
<td>0.838</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Education level of OMs</td>
<td>58</td>
<td>0.301</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Career history of OMs</td>
<td>58</td>
<td>0.083</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Management Experience of OMs</td>
<td>50</td>
<td>0.456</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Ethnic Background</td>
<td>58</td>
<td>0.305</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Age of company</td>
<td>58</td>
<td>0.272</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Company Size</td>
<td>58</td>
<td>0.274</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Sector</td>
<td>58</td>
<td>0.338</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Location of business</td>
<td>58</td>
<td>0.064</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Turnover growth</td>
<td>31</td>
<td>0.259</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Average R&amp;D expenditure</td>
<td>48</td>
<td>0.185</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Product Innovation</td>
<td>58</td>
<td>0.892</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Marketing Orientation</td>
<td>58</td>
<td>0.726</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Market Research</td>
<td>55</td>
<td>0.710</td>
<td>Not Significant</td>
</tr>
<tr>
<td>External Equity</td>
<td>58</td>
<td>0.125</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Government Support</td>
<td>58</td>
<td>0.779</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>
The next section will discuss the second stage of my research strategy - the case studies.

6.4 THE CASE STUDIES

In the questionnaire survey, the respondents were required, based on a 4-point Likert scale, to indicate the level of importance attached to each of a number of constraints. Mean scores for each constraint were computed, and those with a score of 2.5 or above were considered important and worthy of further analysis. The pyramid below (Figure 6-3) shows that a lack of finance for expansion was considered to be the most important constraint followed by concerns over labour, demand, and innovation and technology. These constraints are not mutually exclusive. For example, a lack of finance may resulted in HTSMEs not being able to attract educated and technically skilled workers, engage in R&D or acquire new technology.

FIGURE 6-3 Major Constraints Faced by HTSMEs in Malaysia (Ranked in order of importance)

<table>
<thead>
<tr>
<th>Financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of finance for expansion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Labour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor quality of labour</td>
</tr>
<tr>
<td>Shortages of labour</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of demand for main products or declining markets</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate information on product and process technology</td>
</tr>
<tr>
<td>Lack of management time to develop new products and markets</td>
</tr>
</tbody>
</table>

6.4.1 Purpose of the Case Study Research

Analysis of the questionnaire data revealed some important relationships among the predetermined variables. However, it yielded little information on the dynamics of the firms. In-depth interviews enabled me to question firms closely on the major
constraints cited in the questionnaire survey. For example, the questionnaire responses identified a lack of finance as a major constraint but did not indicate how the constraint arose - was there a lack of available funds from financial institutions or were proposals being turned down owing to their perceived lack of commercial viability?

The United States General Accounting Office (United States of America, 1990, p. 15) defined case study analysis as:

A case study is a method for learning about a complex instance, based on a comprehensive understanding of that instance obtained by extensive description and analysis of that instance taken as a whole and in its context.

Case studies focus on understanding the dynamics in single settings and may be used to provide description, and test or generate theories (Gill, 1995). In most case study research, the interview is the main data collection method (Marginson, 1998). Dyer and Wilkins (1991) stress that the researcher should consider the following issues:

i) **The in-depth study of a small number of case or the study of a larger number of cases.** My study focused on a smaller number of firms with greater depth because of the diversity of constraints encountered.

ii) **Deep to surface description.** To provide in-depth case material, various data collection methods were triangulated. The methods employed in my study included in-depth interviews with selected OMs and officials from various government agencies, and collection of secondary data such as the company's annual report and information on the website.

iii) **Good stories to good constructs.** According to Dyer and Wilkin, a good case study should focus on the context rather than the constructs of the study. This is to ensure that case studies will create an exemplar, a story against which researchers can compare their experiences and gain rich insights. Through case
study analysis, I was able to achieve greater depth and insight than the questionnaire survey on 'how' and 'why' HTSMEs encounter barriers to growth. I limited the number of questions asked during the interviews to focus on 'how' and 'why' constraints occur.

The case study method was therefore selected for the following reasons:

i) A holistic view of the situation can be obtained (Yin, 1989). The case study approach enabled me to understand the attitudes and actions of OMs in dealing with the constraints encountered. The approach also provided me with a clearer picture on the effectiveness of the assistance offered to HTSMEs by various Government departments and agencies.

ii) Vital information cannot be collected through any other method (Yin, 1989). Through the case study approach, I was able to gain insight on why HTSMEs have not been innovating.

iii) Case studies can follow up questionnaire surveys to provide greater insight (Ellram, 1996). I was able to probe deeper into certain issues. Principally I was able to determine how and why a lack of finance affected HTSMEs in Malaysia.

However, case study research has its disadvantages. Case study results are usually specific to a situation, so the results are not generalisable (MacNealy, 1997). In this thesis, it is not the purpose of the researcher to generalise the case study findings but to expand on the findings of the questionnaire survey. Case studies can also be time consuming and expensive. For example, I spent more time trying to set up appointments with potential respondents than conducting the actual interviews!

6.4.2 Case Study Design

In developing the research design for this element of the research, the researcher was guided by Yin's (1989) programme:
i) The Research Question

The case studies were concerned with the following research question: "What can be done to facilitate the growth of HTSMES in Malaysia?" Before looking at the methods of enhancing growth, it was important to explore the constraints encountered by HTSMES and the value placed by HTSMES on the assistance offered by various Government agencies. Thus, the case study research first tackled the question:

Why and how do HTSMES encounter a range of constraints (financial, labour, demand, and innovation), when the Government has provided numerous support measures to assist HTSMES?

ii) The Research Proposition

According to Yin, the research question (answering "how" and "why") does not point to what a researcher should study. The researcher begins to move in the right direction only when the propositions are stated. Based on the literature review and findings from the questionnaire survey, the propositions for my study were:

**Proposition 1:** HTSMES encounter financing constraints because of a lack of funds from the financial system in Malaysia.

**Proposition 2:** Labour constraints among HTSMES stem from a shortage of skilled workers in the labour market.

**Proposition 3:** HTSMES are not able to innovate owing to lack of management time and information on product and process innovation.

**Proposition 4:** HTSMES encounter demand constraints because they do not export their products.
iii) The Unit of Analysis

This refers to the problem of defining the case. The primary unit of analysis for my study is the organisation, rather than the OM.

Using the questionnaire survey respondents as a sampling frame, 35 companies were contacted. Of these, 24 companies agreed to participate, but later six companies retracted their agreement. The other three companies withdrew on the day of the interview. This was very frustrating and somewhat annoying. Most of those withdrawing cited the prevailing economic and political turmoil in the country as the reason for their non-participation. Table 6-6 shows the characteristics of the selected companies. To maintain confidentiality, each company was assigned a code.

<table>
<thead>
<tr>
<th>Company Code</th>
<th>Turnover Growth (%)</th>
<th>Growth Level</th>
<th>Age of Company (years)</th>
<th>Number of Employees</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>400</td>
<td>High</td>
<td>9</td>
<td>40</td>
<td>Advanced Manufacturing</td>
</tr>
<tr>
<td>2*</td>
<td>276</td>
<td>High</td>
<td>3</td>
<td>59</td>
<td>Advanced Manufacturing</td>
</tr>
<tr>
<td>3*</td>
<td>238</td>
<td>High</td>
<td>4</td>
<td>191</td>
<td>Optoelectronics</td>
</tr>
<tr>
<td>4*</td>
<td>214</td>
<td>High</td>
<td>7</td>
<td>88</td>
<td>Software Engineering</td>
</tr>
<tr>
<td>5*</td>
<td>209</td>
<td>High</td>
<td>4</td>
<td>28</td>
<td>Electronics</td>
</tr>
<tr>
<td>6</td>
<td>145</td>
<td>High</td>
<td>3</td>
<td>27</td>
<td>Advanced Manufacturing</td>
</tr>
<tr>
<td>7*</td>
<td>87</td>
<td>High</td>
<td>11</td>
<td>36</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>8*</td>
<td>80</td>
<td>High</td>
<td>4</td>
<td>350</td>
<td>Electronics</td>
</tr>
<tr>
<td>9</td>
<td>65</td>
<td>High</td>
<td>3</td>
<td>72</td>
<td>Advanced Manufacturing</td>
</tr>
<tr>
<td>10*</td>
<td>58</td>
<td>High</td>
<td>23</td>
<td>156</td>
<td>Advanced Manufacturing</td>
</tr>
<tr>
<td>11*</td>
<td>50</td>
<td>High</td>
<td>5</td>
<td>21</td>
<td>Advanced Manufacturing</td>
</tr>
<tr>
<td>12</td>
<td>41</td>
<td>High</td>
<td>14</td>
<td>13</td>
<td>Software Engineering</td>
</tr>
<tr>
<td>13</td>
<td>37</td>
<td>High</td>
<td>18</td>
<td>69</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>14*</td>
<td>27</td>
<td>High</td>
<td>22</td>
<td>250</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>15*</td>
<td>15</td>
<td>Medium</td>
<td>7</td>
<td>28</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>Static</td>
<td>25</td>
<td>38</td>
<td>Electronics</td>
</tr>
<tr>
<td>17</td>
<td>-8</td>
<td>Declining</td>
<td>4</td>
<td>82</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>18*</td>
<td>-11</td>
<td>Declining</td>
<td>14</td>
<td>115</td>
<td>Software Engineering</td>
</tr>
<tr>
<td>19</td>
<td>-13</td>
<td>Declining</td>
<td>15</td>
<td>79</td>
<td>Advanced Manufacturing</td>
</tr>
<tr>
<td>20</td>
<td>-14</td>
<td>Declining</td>
<td>28</td>
<td>80</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>21</td>
<td>-38</td>
<td>Declining</td>
<td>15</td>
<td>95</td>
<td>Advanced Manufacturing</td>
</tr>
<tr>
<td>22*</td>
<td>-66</td>
<td>Declining</td>
<td>7</td>
<td>149</td>
<td>Software Engineering</td>
</tr>
<tr>
<td>23*</td>
<td>Startup</td>
<td>Startup</td>
<td>2</td>
<td>8</td>
<td>Electronics</td>
</tr>
<tr>
<td>24*</td>
<td>Startup</td>
<td>Startup</td>
<td>2</td>
<td>34</td>
<td>Software Engineering</td>
</tr>
</tbody>
</table>

Note: *: Firms that participated in the interviews.
6.4.3 Focus of the Case Studies

The interview checklists were semi-structured in nature and, on average, each interview lasted for about two hours. The researcher attempted to minimise his influence on the responses obtained during the case study programme. The analysis (and subsequent recommendations) is largely based on the interviewees' own responses. However, to add value to the findings on certain issues, the researcher put his interpretation on events or related the interviewee responses to the literature. These areas of interpretation or clarification are discussed in more detail in Chapter Eight.

Based on the questionnaire responses, the interviews and data gathering centred on the following issues:

i) Background of the Firm
   • main products, components or finished products?
   • markets served, local or export?
   • subcontractors or product-based or both?

ii) Firm Growth
   • static, medium or rapid growth?
   • intending to expand (in term of innovation/investment) over the next three years?

iii) Financing
   • the sources of funding for expansion, whether external (Government and/or private financial institutions) or internal?
   • the sources of financial advice?
   • financing difficulties - reason for refusal?
   • obtaining the right balance between equity and debt.

iv) Labour
   • sources of skilled and unskilled labour?
   • any shortages of labour?
   • assistance from Government agencies in training employees?
v) Demand
- are the products for export or domestic consumption?
- is firm a vendor for a larger firm?
- does the firm receive incentives to export products?; etc.

vi) Innovation and Technology
- source of information on product and process technology?
- outsource innovation and R&D?
- level of information on technological developments, and management time to assess such developments?
- any Government agencies approached?
- assistance offered to the firm to commercialise innovation?

vii) Role of Government
- why have many support measures yet to be taken up from various government agencies? For example, since 1997, the MTDC has allocated RM53m for the development of technology-based SMEs, but only RM6.3m has been given out under the Technology Development Fund (TDF);
- are the criteria for eligibility too stringent?
- or, are companies unaware of the availability of various incentives?

6.5 THE STATISTICAL ANALYSIS
Statistical analysis was conducted on the data collated from the 86 completed questionnaires.

A test was conducted on each independent variable to determine whether it was normally distributed. Most of the variables did not show any evidence of being normally distributed, a prerequisite for using multivariate analysis. Multivariate analysis, using techniques such as factor and cluster analysis, were therefore unsuitable for my study. Bivariate analysis was used instead.

The analysis of the data consists of two parts: descriptive analysis; and, testing of hypotheses. All seventeen hypotheses (except one owing to lack of data) were
tested using non-parametric methods, an approach which is discussed in the following section.

6.5.1 Measurement of Variables and Nonparametric Methods

One unresolved issue in data analysis is the question of when to use parametric or nonparametric tests. A number of researchers have argued that nonparametric procedures have to be applied if any of the following conditions apply (Gibbons, 1976; Bryman and Cramer, 1990; Cramer, 1998):

i) The samples are not normally distributed. Nonparametric tests are statistical techniques that do not make restrictive assumptions about the shape of the population when performing a hypothesis test (Levin and Rubin, 1994). As stated above, normality was not found to be present in my sample data.

iii) The data are measured or analysed using a nominal or ordinal scale. A nominal scale is used only for identification, for example, male or female in order to identify gender. The ordinal scale is used to measure variables whose values indicate ranking or order, for example, high or medium in order to indicate the level of customer satisfaction. Table 6-7 shows that most of the variables for this study are measured using the nominal scale (for example, ethnic background, gender, sector and location of business) or ordinal scale (for example, level of process innovation and importance of constraints).

Since my data satisfied both of the above mentioned criteria, nonparametric techniques were used to analyse the data in my study.
TABLE 6-7 Variables and Level of Measurement

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Independent Variables</th>
<th>Level of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Education</td>
<td>Ordinal</td>
</tr>
<tr>
<td>2</td>
<td>Management experience</td>
<td>Interval</td>
</tr>
<tr>
<td>3</td>
<td>Age</td>
<td>Ordinal</td>
</tr>
<tr>
<td>4</td>
<td>Career history</td>
<td>Interval</td>
</tr>
<tr>
<td>5</td>
<td>Gender</td>
<td>Nominal</td>
</tr>
<tr>
<td>6</td>
<td>Ethnic background</td>
<td>Nominal</td>
</tr>
<tr>
<td>7</td>
<td>Age of the firm</td>
<td>Interval</td>
</tr>
<tr>
<td>8</td>
<td>Industrial Sectors</td>
<td>Nominal</td>
</tr>
<tr>
<td>9</td>
<td>Size of the firm</td>
<td>Interval</td>
</tr>
<tr>
<td>10</td>
<td>Company structure</td>
<td>Nominal</td>
</tr>
<tr>
<td>11</td>
<td>Location</td>
<td>Nominal</td>
</tr>
<tr>
<td>12</td>
<td>External equity</td>
<td>Nominal</td>
</tr>
<tr>
<td>13</td>
<td>Product innovation</td>
<td>Ordinal</td>
</tr>
<tr>
<td>14</td>
<td>Process innovation</td>
<td>Ordinal</td>
</tr>
<tr>
<td>15</td>
<td>Market research</td>
<td>Nominal</td>
</tr>
<tr>
<td>16</td>
<td>Marketing orientation</td>
<td>Nominal</td>
</tr>
<tr>
<td>17</td>
<td>Government Support</td>
<td>Interval</td>
</tr>
<tr>
<td>18</td>
<td>R&amp;D</td>
<td>Interval</td>
</tr>
</tbody>
</table>

One drawback in using the nonparametric approach is that the techniques are not as powerful as those used for parametric tests. Nonparametric techniques ignore some of the available information, because data values are replaced by ranks (Norusis, 1997). However, Norusis pointed that nonparametric procedures are most useful when outliers are present (Appendix 6-4 indicates the presence of outliers in the sample for this study). In using the nonparametric approach, the outlying cases do not influence the results to any significant extent.

6.5.2 Bivariate Relationship Test

Figure 6-4 sets out the tests applied during data analysis and hypotheses testing. The appropriate test depends on the type of variable, whether ordinal or nominal, the number of groups in a variable, and whether the variables are 'mixed' or have the same level of measurement.
Correlation refers to a technique for analysing relationships between variables and it indicates the strength and direction of the relationship. The most common measure of correlation is the Pearson’s Correlation Coefficient, typically used for interval/ratio variables. Often referred to as Pearson’s r, its coefficient ranges from −1 to +1, with −1 as perfect negative and +1 perfect positive correlation. An alternative to the Pearson’s correlation coefficient is Spearman’s rho coefficient. Thus rho measures the association between two variables when only rank-order data (ordinal) are available. For example, the level of education is ranked from primary education to PhD study. Thus the Spearman’s rho is appropriate to measure the association between education and growth.

### 6.5.3 Test For Differences

According to Norusis (1997), it is not possible to measure the direction of the relationship for two nominal variables, such as gender and occupation, since there is
no order to the categories of the variables. That is, the values cannot increase or decrease unless they have an order. It may be possible to measure the strength of their relationship through measures of association. However, only the strength, but not the direction of the two variables is measured. When faced by such a problem, Diamantopoulos and Schlegelmilch (1997) suggest testing for differences in determining the relationship between two variables with a different level of measurement, especially when one of the variables is nominal (Figure 6-4). Tests for differences are used when the researcher splits a single sample into two (or more) sub-samples or groups on the basis of some characteristics (for example, creating sub-samples of male and female OMs and subsequently comparing the growth rate of their companies).

In order to examine the differences between two groups in the sample, I used the Mann Whitney U test. According to Norusis (1997), the computation of the Mann Whitney test is simple and easy to comprehend. The combined data values (in my case, growth) for two groups of interest (for example, entrepreneurs of different ethnic backgrounds) were ranked and the average rank in each group was then computed. The Kruskal-Wallis One-Way Analysis of Variance (ANOVA) test was found to be useful when comparing three or more groups for any particular variable. The two tests were therefore adopted for this study to determine the effect of nominal independent variables on the growth of HTSMEs. The ANOVA test was used, for example, to test for significance differences in growth between HTSMEs in various industrial sectors. The results of the hypothesis testing are discussed in Chapter Seven.

6.6 SUMMARY
This chapter describes the overall approach to gathering data to test the research hypotheses, as well as analysing the constraints faced by HTSMEs. The chapter reviewed the research strategies used in previous growth studies. For this study, the triangulation method was employed to add depth to the research. This involved the use of a questionnaire survey to obtain descriptive and quantitative data, followed by in-depth interviews on which case studies were formulated. The postal questionnaire survey was chosen because of its ability to cover a wide geographical area.
Furthermore, it is cheaper than any other method and reduces error caused by bias on the part of the interviewer. In-depth interviews were chosen because they allowed me to adapt questions when necessary, clarify doubts and ensure that responses were clearly understood by repeating or rephrasing the questions.

This programme of research was conducted in two stages, with stage one involving informal interviews with key informants and the distribution of postal questionnaires to explore the determinants of growth and identify constraints on growth. The second stage involved case studies, which provided an opportunity to explore factors that are important in facilitating further growth. The case studies enabled me to question firms closely on the major constraints cited in the questionnaire survey, and to explore four key propositions.

The data collected through the postal questionnaire survey have been analysed using bivariate analysis in order to establish the relationships between variables and to test the hypotheses set out in Chapter Five.

The next chapter presents the results of the questionnaire survey and an analysis of the findings.

Note

1 Convenience sampling is used when the researcher selects whatever sampling units are conveniently available (Nachmias and Nachmias, 1992).
CHAPTER 7

THE QUESTIONNAIRE SURVEY: RESULTS AND ANALYSIS

7.0 INTRODUCTION

Analysis of the data gathered in the questionnaire survey is presented in this chapter. A brief descriptive analysis of the data collected is followed by a more detailed assessment of the characteristics of high growth HTSMEs. The chapter continues with the testing of the hypotheses. Finally, the research findings are summarised.

7.1 THE SAMPLE CHARACTERISTICS

A total of 228 questionnaires were sent to small and medium sized technology-based firms throughout Peninsular Malaysia; 110 questionnaires (48.2 percent) were returned. Of these, 15 were returned unopened, stamped on the envelope “addressee has moved” or “incomplete address”. Another 8 were no longer considered as SMEs, since their number of employees now exceeds 250, and one had a page missing. The final response rate was 86 responses or 42.2 percent. SPSS for MS windows was used to analyse the data.

7.1.1 Profile of Respondents

Table 7-1 shows the basic characteristics of respondents. The majority of respondents are male and more than 50 percent are below the age of 40, with the average age being approximately 39.4. This age profile was expected, since entrepreneurs will generally acquire appropriate knowledge and skills before venturing into their own business. The average age of the sample is consistent with previous research by Roberts (1991).

Table 7-1 demonstrates that over 90 percent of the respondents had some prior employment before starting or managing the current business. The sample comprises entrepreneurs who are generally well educated and technically trained, and would be expected to enhance the growth of technology-based SMEs. Table 7-1 shows that 78 percent of the respondents have a first degree or equivalent academic qualification.
This is generally high in comparison to a study by Fong (1990) where only 24 percent of surveyed SMEs were owned or managed by university graduates. Table 7-1 also shows that 54.7 percent of the companies are Bumiputera owned, demonstrating the high participation of Bumiputeras in the high technology sector.

**TABLE 7-1**  Characteristics of Respondents

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>No. of Respondents</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age Group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 or less</td>
<td>49</td>
<td>57.0</td>
<td>57.0</td>
</tr>
<tr>
<td>41 - 54</td>
<td>32</td>
<td>37.2</td>
<td>94.2</td>
</tr>
<tr>
<td>55 or more</td>
<td>5</td>
<td>5.8</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of respondents</strong></td>
<td>86</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>82</td>
<td>95.3</td>
<td>95.3</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>4.7</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of respondents</strong></td>
<td>86</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td><strong>Company Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bumiputera Company</td>
<td>47</td>
<td>54.7</td>
<td>54.7</td>
</tr>
<tr>
<td>Non-Bumiputera Company</td>
<td>39</td>
<td>45.3</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of companies</strong></td>
<td>86</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td><strong>Highest Educational Qualification Achieved</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diploma or lower</td>
<td>12</td>
<td>14.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Degree or Equiv.</td>
<td>55</td>
<td>64.0</td>
<td>78.0</td>
</tr>
<tr>
<td>MBA/Ph.D./Prof. qualifications</td>
<td>19</td>
<td>22.0</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of respondents</strong></td>
<td>86</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td><strong>Employed Prior to Current Business</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previously Employed</td>
<td>75</td>
<td>90.4</td>
<td>90.4</td>
</tr>
<tr>
<td>No Previous Employment</td>
<td>8</td>
<td>6.6</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of respondents</strong></td>
<td>83</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

### 7.1.2 Profile of the Firms

The vast majority of sample firms are private limited companies. In terms of company structure, 40.5 percent of the responding firms are part of a Malaysian group and almost 12 percent are subsidiaries of an international group. However, many respondents preferred their business to be independently owned (38.1 percent), reflecting the independence and dynamism of entrepreneurs whose operations are limited by small amounts of capital (Fong, 1990).
Table 7-2 shows that one-half of the responding companies were less than 5 years old. The sample includes a large number of start-up companies mostly aged 3 years or less. These companies were formed after 1995, during the period of IMP2 (see Table 2-1), i.e., during the fourth phase of Malaysia’s Industrialisation process. This is an important limitation, as the researcher does not have sufficient information on the growth of these young firms. The study requires turnover data for 1994, 1995 and 1996 to compute growth rates, but firms that started operation from 1995 onwards were not able to furnish such data.

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In terms of company size, Table 7-4 shows that more than half of the firms employ 50 workers or fewer, and only nine companies had more than 150 employees.
By the new definition of an SME in Malaysia, companies with fewer than 150 employees are considered small or medium-sized. As a consequence, 75 companies in the sample can now be considered as an SME. As discussed in Chapter Three, this study has adopted the EU and UK definition of SME to allow wider coverage of companies, hence nine more companies can be included.

Table 7-4 shows the number of firms operating in various regions and locations in Peninsular Malaysia. As expected, the majority of the responding firms prefer to be located in the western part of Peninsular Malaysia. According to Sauer et al. (1988), see Section 3.3.1, high technology industries rely heavily on infrastructure to promote and support their growth. Since major infrastructure elements such as highway networks, airports, ports and industrial estates are located in this part of Malaysia, most firms prefer to be located there. The development of infrastructure, including the completion of the 848-kilometre North-South Expressway along the western region of Peninsular Malaysia, has had an enormous impact on the commercial and economic profile of the country. In addition, the development of major ports, a new international airport, rail networks and uninterrupted power supply, have greatly enhanced the region as a major industrial hub. It is also evident that the majority of sample firms operate from Private Industrial Estates or SIEs (Table 7-5).

<table>
<thead>
<tr>
<th>Number of Employees</th>
<th>No. of Firms</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–50</td>
<td>52</td>
<td>61.9</td>
<td>61.9</td>
</tr>
<tr>
<td>51–150</td>
<td>23</td>
<td>27.4</td>
<td>89.3</td>
</tr>
<tr>
<td>151–250</td>
<td>9</td>
<td>10.7</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of companies</strong></td>
<td><strong>84</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 7-5 Characteristics of the Firm: Location of Business

<table>
<thead>
<tr>
<th>Region of Firm Located</th>
<th>No. of Firms</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Part of Peninsular Malaysia</td>
<td>64</td>
<td>74.4</td>
<td>74.4</td>
</tr>
<tr>
<td>Eastern Part of Peninsular Malaysia</td>
<td>0</td>
<td>0.0</td>
<td>74.4</td>
</tr>
<tr>
<td>Northern Part of Peninsular Malaysia</td>
<td>12</td>
<td>14.0</td>
<td>88.4</td>
</tr>
<tr>
<td>Southern Part of Peninsular Malaysia</td>
<td>10</td>
<td>11.6</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of companies</strong></td>
<td><strong>86</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location of Business</th>
<th>No. of Firms</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Development Corporation Industrial Estate</td>
<td>19</td>
<td>22.1</td>
<td>22.1</td>
</tr>
<tr>
<td>Private Industrial Estate</td>
<td>23</td>
<td>26.7</td>
<td>48.8</td>
</tr>
<tr>
<td>Specialised Ind. Estate (Sci &amp; Tech Parks)</td>
<td>26</td>
<td>30.2</td>
<td>79.0</td>
</tr>
<tr>
<td>SME Industrial Site</td>
<td>6</td>
<td>7.0</td>
<td>86.0</td>
</tr>
<tr>
<td>Others</td>
<td>12</td>
<td>14.0</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of companies</strong></td>
<td><strong>86</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7-1 helps to explain why most HTSMEs have chosen to be located in the western part of Peninsular Malaysia. Ample and uninterrupted power supplies, the availability of skilled workers and professionals, and good transportation systems are the main strengths of this region. Moreover, it is important for subcontracting firms to be located close to their anchor company, mostly MNCs based in the Klang Valley. The eastern region of Peninsular Malaysia remains underdeveloped with below standard infrastructure. Figure 7-1 confirms that the availability of energy supplies is the top-ranked reason for choosing a business location.

According to Breheny et al. (1985), see Section 3.3.2, high technology industries have specialised demands for labour, thus the ability to recruit technical, professional and skilled workers is the second-ranked concern of most respondents (Figure 7-1). An interesting point to emerge from Figure 7-1 is that most respondents do not consider proximity to a university system to be a major factor in deciding the location of their business operation. This implies that, at present, there is minimal interaction between universities and high technology industries. Further discussion of this issue can be found in Chapter Eight.
Over 80 percent (83.3%) of sample firms employ at least one engineer or scientist, with 61 percent employing between one and five. This indicates the relatively high level of technical know-how that exists among these firms.

TABLE 7-6  Characteristics of Firm: Number of Engineers and Scientists

<table>
<thead>
<tr>
<th>Range of Numbers</th>
<th>No. of Firms</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>14</td>
<td>16.7</td>
<td>16.7</td>
</tr>
<tr>
<td>1 - 5</td>
<td>51</td>
<td>60.7</td>
<td>77.4</td>
</tr>
<tr>
<td>6 - 10</td>
<td>10</td>
<td>11.9</td>
<td>89.3</td>
</tr>
<tr>
<td>more than 10</td>
<td>9</td>
<td>10.7</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of firms</strong></td>
<td><strong>84</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
7.1.3 Measurement of growth

Respondents were given a number of measurements that could be used to define growth. They were asked to indicate the level of importance they attached to each measurement. Figure 7-2 shows that turnover seems to be perceived as the most appropriate choice, with a mean score of 3.16, followed by profits, employment and assets. The results tend to support the utilisation of sales turnover as the measurement of growth for this study (see Section 4.3, Chapter Four).

A critical objective of this study is to determine the factors affecting the growth of HTSMEs and to develop a profile of high-growth HTSMEs. According to Oakey (1981) and Rothwell (1984), high technology industries achieve higher levels of job creation (see Section 3.4, Chapter Three). In terms of employment growth, 30.4 percent of the respondents had experienced static or negative growth for the past three years, 25.0 percent medium and 44.6 percent high growth (Table 7-7). In line with the findings of Oakey and Rothwell, this study demonstrates that the high technology sector has the potential to be a major contributor to employment in Malaysia. Expressed in terms of turnover growth, 15.1 percent of the respondents experienced static or negative growth, 26.4 percent medium and 58.5 percent rapid growth. Table 7-7 also indicates that more companies in the sample have experienced negative employment growth (30.4 percent) than declining sales (15.1 percent) over the last three years.
TABLE 7-7 Growth Performance

<table>
<thead>
<tr>
<th>Growth Category</th>
<th>No. of Firms</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Annual Employment Growth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 percent or less</td>
<td>17</td>
<td>30.4</td>
<td>30.4</td>
</tr>
<tr>
<td>1 to 18 percent</td>
<td>14</td>
<td>25.0</td>
<td>55.4</td>
</tr>
<tr>
<td>19 percent or more</td>
<td>25</td>
<td>44.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Total number of companies</td>
<td>56</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

| Average Annual Turnover Growth   |              |         |                    |
| 0 percent or less                | 8            | 15.1    | 15.1               |
| 1 to 25 percent                  | 14           | 26.4    | 41.5               |
| 26 percent or more               | 31           | 58.5    | 100.0              |
| Total number of companies*       | 53           | 100.0   |                    |

* Three companies did not provide the turnover data.

An important element of the sample selection for this study was to ensure that all categories of growth were represented. Table 7-8 confirms that all growth categories were present in the sample.

As discussed in Section 4.3.1, Chapter Four, I adopted the Siegel et al. (1993) categorisation of growth, with some modification, where growth was categorised as:

- high-growth (26 percent annual growth in turnover or more)
- medium- or slow growth (1 to 25 percent annual growth)
- static or declining turnover (0 percent or less)

Siegel et al. (1993) acknowledge that any distinction between the high- and medium-growth categories is somewhat arbitrary. However, they propose that HTSMEs doubling their turnover over three years duration constitute high growth firms. In my study, I use a shortened time frame but adopt the 'Siegel' classifications by calculating annual growth in turnover. High growth firms experience annual increases in turnover of 26 percent or more. Table 7-8 presents data on the average annual growth rates in each of the growth categories.
TABLE 7-8 Growth Category and Measurement

<table>
<thead>
<tr>
<th>Growth Category</th>
<th>Turnover %</th>
<th>Employment ** %</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>static or declining</td>
<td>-14.3</td>
<td>-12.3</td>
<td>Negative</td>
</tr>
<tr>
<td>medium or slow</td>
<td>13.6</td>
<td>14.4</td>
<td>Positive</td>
</tr>
<tr>
<td>high growth</td>
<td>80.7</td>
<td>103.8</td>
<td>Negative</td>
</tr>
<tr>
<td>Sample</td>
<td>48.7</td>
<td>46.2</td>
<td></td>
</tr>
</tbody>
</table>

Note: * The average annual growth rate for the last two consecutive years, for all firms in the sample, in each growth category.

** Employment growth is based on Barkham et al. (1996b) category. They defined high growth as firms which have experienced four consecutive years of annual employment growth of more than 19 percent, or in my case, an increase of 42 percent over the 1994-1996 period.

An interesting point to emerge from Table 7-8 is that average annual turnover growth is lower than average annual employment growth in both the high and static or declining categories, implying negative productivity growth (see Section 4.3, Chapter Four). It should be noted that the productivity growth calculation is confined to firms providing turnover and employment data and that the calculation of growth rates differs for the two factors. Any conclusions on this point, therefore, can only be tentative.

7.1.4 Business Strategy

The questionnaire focused on six components of business strategy that are believed to affect growth. They are the acceptance of external equity and state support, and the implementation of marketing strategy, market research, product and process innovation, and R&D (see Section 4.4.3., Chapter Four).

TABLE 7-9 Business Strategy: External Equity

<table>
<thead>
<tr>
<th>Source of Capital</th>
<th>No. of Companies</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raise capital outside company</td>
<td>42</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Did not raise capital outside company</td>
<td>42</td>
<td>50.0</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of companies</strong></td>
<td>84</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Table 7-9 indicates that 50 percent of responding firms raised capital outside the company to finance growth, with the other 50 percent using internally generated funds for expansion. The case studies (in Chapter Eight) and the literature review (in Chapter Four) suggest that some firms do not accept external equity because they are subsidiary companies to MNCs. Thus, most funding for innovation and investment is provided by the parent company. The reluctance of independent companies to accept external equity may have led such firms to resort to short-term financing. Indeed, the case studies confirm that much of the finance utilised by HTSMEs is short-term in nature.

As emphasised in the literature review, product and process innovation is a major factor behind the success of HTSMEs (Oakey et al., 1988). HTSMEs are significantly more innovative than conventional SMEs. Following the lead of Storey (1994b), this study measures product innovation in terms of new products introduced and process innovation in terms of the number of process improvements adopted. This study found that almost 82 percent of sample companies had introduced at least one new product, while 16.7 percent of the respondents had launched more than 10 new products (Table 7-10). As more than 75 percent of the sample had also implemented moderate or significant improvements in production processes, employment expansion and turnover growth would be expected (Oakey, 1984). Such an outcome appears to be confirmed by the growth figures cited above in Table 7-7.
### Business Strategy: Incidence of Product & Process Innovation

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>No. of Companies</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of New Products</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>15</td>
<td>17.9</td>
<td>17.9</td>
</tr>
<tr>
<td>1 - 4</td>
<td>38</td>
<td>45.2</td>
<td>63.1</td>
</tr>
<tr>
<td>5 - 10</td>
<td>17</td>
<td>20.2</td>
<td>83.3</td>
</tr>
<tr>
<td>More than 10</td>
<td>14</td>
<td>16.7</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of companies</strong></td>
<td>86</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Extent of Production Process Improvement</strong></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No improvement at all</td>
<td>3</td>
<td>3.9</td>
<td>3.9</td>
</tr>
<tr>
<td>Slight improvement</td>
<td>15</td>
<td>19.8</td>
<td>23.7</td>
</tr>
<tr>
<td>Moderate improvement</td>
<td>33</td>
<td>43.4</td>
<td>67.1</td>
</tr>
<tr>
<td>Significant improvement</td>
<td>25</td>
<td>32.9</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of companies</strong></td>
<td>76</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Method of Improving Production Process</strong></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New Machines</td>
<td>8</td>
<td>10.3</td>
<td>10.3</td>
</tr>
<tr>
<td>Training of staff</td>
<td>9</td>
<td>11.5</td>
<td>21.8</td>
</tr>
<tr>
<td>Recruitment of new staff</td>
<td>4</td>
<td>5.1</td>
<td>26.9</td>
</tr>
<tr>
<td>Reorganisation of work pattern</td>
<td>9</td>
<td>11.5</td>
<td>38.4</td>
</tr>
<tr>
<td>Other means</td>
<td>2</td>
<td>2.6</td>
<td>41</td>
</tr>
<tr>
<td>Combination of any of the above methods</td>
<td>36</td>
<td>46.2</td>
<td>87.2</td>
</tr>
<tr>
<td>All 4 methods together</td>
<td>10</td>
<td>12.8</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number of companies</strong></td>
<td>78</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 7-10 also shows that 59 percent of sample firms had used various combinations of the four principal methods of improving production processes. Further analysis of the findings revealed that training of staff and reorganisation of work patterns seemed to be the most popular combination for enhancing production capability.
TABLE 7-11 Business Strategy: R&D

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>No. of Companies</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companies Engaged in R&amp;D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engage in R&amp;D</td>
<td>54</td>
<td>66.7</td>
<td>66.7</td>
</tr>
<tr>
<td>Do not engage in R&amp;D</td>
<td>27</td>
<td>33.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total number of companies</td>
<td>81</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Percentage of Turnover Spent on R&amp;D*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 - 5</td>
<td>21</td>
<td>56.8</td>
<td>56.8</td>
</tr>
<tr>
<td>6 - 10</td>
<td>9</td>
<td>24.3</td>
<td>81.1</td>
</tr>
<tr>
<td>11 - 15</td>
<td>7</td>
<td>19.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total number of companies</td>
<td>37</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

*17 companies engaged in R&D did not provide data on percentage of turnover spent on R&D

Under the PIA 1986, only research activities (Developmental R&D) that lead to the development of new products, processes or services are considered as R&D (Appendix 2.8). My intention was to adopt this definition of R&D in the questionnaire survey, and it was anticipated that all of the sample firms would conduct R&D. However, Table 7-11 shows that two-thirds of the sample engage in some form of R&D and the remainder do not. Of those engaged in R&D, only 16 firms spend more than 5 percent of their turnover on R&D. There are a number of possible explanations for these findings. First, those firms not engaged in R&D are subcontractors to an anchor MNC that performs R&D on their behalf. Secondly, respondents may encounter difficulties in measuring R&D because of the highly uncertain nature of many R&D activities, especially during the experimentation stage (Figure 4-2, Chapter Four). Third, respondents may have not understood the definition of R&D suggested by the PIA and have classed only basic research only as R&D. For example, some firms may have excluded applied research from their responses. It is difficult to be certain of the impact of the three factors above. However, I would suggest that the figures for R&D in Table 7-11 may be understated.

Apart from the problems of inaccurate reporting, the findings in Table 7-11 may also reflect the inadequacy of Malaysia's industrial policy in promoting R&D activities to the private sector. The literature review in Chapter Two, Section 2.2.3, discussed this issue at length. As suggested by Gwynne (1997), Malaysia lacks the
necessary know-how and the scientifically trained manpower to stimulate R&D from scratch. Thus, Malaysia needs to develop a series of initiatives to promote and enhance R&D while, at the same time, increasing its supply of engineers and scientists.

**FIGURE 7-3 R&D by Location of Business**

![Median RRDET by Location of Business](image)

Figure 7-3 shows the breakdown of median ratio of R&D expenditure to turnover (RRDET) by location of business. As expected, firms operating on Specialised Industrial Estates have the highest RRDET (4.0 percent), demonstrating the fact that such companies are at the forefront of R&D. Firms operating from Private Industrial Estates have the next highest median RRDET (1.1 percent) followed by ‘other’ locations at 1.0 percent.
Table 7-12 reveals that 89 percent of respondents seek customers actively. However, the majority of the firms (71.3 percent) do not use market research. The latter figure is unexpected, as market research is a means by which HTSMEs can reduce the risk associated with the introduction of new products (Parker, 1999). When asked to state how products were marketed, 54 percent relied upon direct or face-to-face contact - personal contact is a major source of informal market research available without any extra cost (Oakey et al., 1988).

![Diagram of Product/Process Strategy](image)

**FIGURE 7-4 Product/Process Strategy**
Respondents were asked to indicate which product/process factors were important for the survival or growth of their HTSMEs. Figure 7-4 indicates that producing high quality products is the most important strategy, with a mean score of 3.71, followed by product innovation (3.36) and low production cost (3.31). As discussed in the literature review, HTSMEs that focus on producing quality products tend to outperform those that do not (Pavia, 1990), because they are able to secure a market niche (Section 4.4.3., Chapter Four).

Increased per capita incomes, standards of living and levels of education have caused Malaysians to be more quality-oriented. Customers no longer buy new products to impress friends and neighbours. Instead they ask for better products because they know that there is enough competition to provide what they want. HTSMEs therefore have to introduce not only new products, but also quality new products. Product innovation is another important factor that affects the growth of responding companies. The proportion of innovating companies in the sample is high (Table 7-10), with 82.6 percent of companies producing at least one new product over the past 3 years, compared to a national percentage of 65.6 percent (Malaysia, 1994b).

High technology ventures require high investment in acquiring technology, upgrading and maintaining skilled labour, and R&D, thus pushing up the cost of production. To be competitive, HTSMEs need to contain production costs but at the same time remain innovative (Oakey et al., 1988).

**TABLE 7-13** Government Agencies Supporting HTSMEs

<table>
<thead>
<tr>
<th>Agency</th>
<th>Percent Aware</th>
<th>Percent Using</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIDA</td>
<td>92</td>
<td>56</td>
</tr>
<tr>
<td>MTDC</td>
<td>81</td>
<td>16</td>
</tr>
<tr>
<td>Bank Pembangunan</td>
<td>71</td>
<td>11</td>
</tr>
<tr>
<td>Bank Industri</td>
<td>67</td>
<td>6</td>
</tr>
<tr>
<td>SIRIM</td>
<td>81</td>
<td>44</td>
</tr>
<tr>
<td>SMIDEC</td>
<td>72</td>
<td>20</td>
</tr>
<tr>
<td>MIGHT</td>
<td>54</td>
<td>16</td>
</tr>
<tr>
<td>MITIC</td>
<td>44</td>
<td>4</td>
</tr>
<tr>
<td>PUNB</td>
<td>62</td>
<td>4</td>
</tr>
<tr>
<td>MEDEC</td>
<td>40</td>
<td>9</td>
</tr>
</tbody>
</table>
State support was identified in the literature review as a key determinant of growth. HTSME start-ups require state support because of the high initial costs, and start-ups seeking to introduce product and process innovation are more likely to face difficulty in raising finance (Aston Business School, 1991). Government support may also be in the form of business advice, technology transfer centres and industrial sites (Phillips, 1991). In the questionnaire, respondents were asked whether they were aware of, and use, assistance offered by the ten government agencies responsible for providing support to HTSMEs in Malaysia. Table 7-13 shows that more than 80 percent of the respondents have some knowledge about the assistance offered by MIDA, MTDC and SIRIM, but the take-up of such assistance is quite disappointing. This result is important. It may be because the HTSMEs choose not to utilise the assistance offered by these agencies, or perhaps applications for assistance have been rejected. The discussion of hypothesis 17 below, and analysis of the case studies in Chapter Eight, provides more discussion of this issue.

7.1.5 Growth Constraints

The literature review identified a number of constraints faced by HTSMEs, notably a lack of finance and skilled labour (ACOST, 1990; Aston Business School, 1991; UCSBRC, 1992). Other constraints identified in the literature review include a lack of resources for innovation, and managerial and market constraints (Section 4.5, Chapter Four).

Respondents were given a list of probable constraints that might affect the growth of their company and asked to indicate the level of importance attached to each of the listed constraints. The importance was measured on a simple 4-point scale. A score of '4' indicates a very important constraint, '3' important, '2' moderately important and '1' not important at all. The mean scores for each of the potential constraints to growth are presented in Figure 7-5.
FIGURE 7-5 Constraints on Growth

<table>
<thead>
<tr>
<th>Constraints</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of finance</td>
<td>2.96</td>
</tr>
<tr>
<td>Poor quality labour</td>
<td>2.81</td>
</tr>
<tr>
<td>Lack of mgt. time for prod. Devt.</td>
<td>2.69</td>
</tr>
<tr>
<td>Labour shortages</td>
<td>2.68</td>
</tr>
<tr>
<td>Inadequate prod. techno. Info</td>
<td>2.61</td>
</tr>
<tr>
<td>Demand</td>
<td>2.59</td>
</tr>
<tr>
<td>Inadequate proc. Techno info</td>
<td>2.56</td>
</tr>
<tr>
<td>Difficulty in achiev. standards</td>
<td>2.44</td>
</tr>
<tr>
<td>Bad debts/late payments</td>
<td>2.44</td>
</tr>
<tr>
<td>Inadequate mkt. info</td>
<td>2.44</td>
</tr>
<tr>
<td>Inadequate fin. info</td>
<td>2.28</td>
</tr>
<tr>
<td>Equipment problems</td>
<td>2.28</td>
</tr>
<tr>
<td>Lack of raw mat/supply def.</td>
<td>2.25</td>
</tr>
<tr>
<td>Lack of suitable premises</td>
<td>2.13</td>
</tr>
<tr>
<td>Inadequate road/rail system</td>
<td>1.61</td>
</tr>
</tbody>
</table>

Based on a mean score ranking above 2.5, the following constraints affect growth: lack of finance for expansion; poor quality of labour; lack of management time to develop new products and markets; shortage of labour; inadequate information on product technology; a lack of demand; and inadequate information on developments in process technology.

7.2 HIGH TECHNOLOGY CHARACTERISTICS

As discussed in Section 2.1.2, it is possible to identify the characteristics of high technology companies/industries. Certain characteristics had to be present before a company could be included in the sample (Hall et al., 1987):

- employment of highly skilled employees, many of whom are scientists and engineers
- high ratio of R&D expenditure to turnover
- high growth rate.
This section will confirm that these three characteristics are present in the sample companies.

### 7.2.1 Highly Skilled Employees

Table 7-14 shows that the sample companies employ 27.9 percent skilled workers and technicians. This is 6.3 percent higher than the percentage of skilled and technical workers across Malaysia as a whole in mid 1997 (Malaysia, 1998i). In terms of Engineers and Scientists, the sample figure of 13.1 percent is higher than the national average of 1.1 percent (interpolated from information provided in the Seventh Malaysia Plan). Table 7-6 in Section 7.1.2 indicated that 83.3 percent of the sample employ at least one engineer or scientist.

**TABLE 7-14 Sample Companies: Type of Employees**

<table>
<thead>
<tr>
<th>Types of employee</th>
<th>Number in sample companies</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled</td>
<td>872</td>
<td>18.7</td>
<td>18.7</td>
</tr>
<tr>
<td>Technicians</td>
<td>432</td>
<td>9.2</td>
<td>27.9</td>
</tr>
<tr>
<td>Semi-skilled &amp; unskilled</td>
<td>1,485</td>
<td>31.8</td>
<td>59.7</td>
</tr>
<tr>
<td>Clerical &amp; administration</td>
<td>479</td>
<td>10.2</td>
<td>69.9</td>
</tr>
<tr>
<td>Marketing &amp; sales staff</td>
<td>317</td>
<td>6.8</td>
<td>76.7</td>
</tr>
<tr>
<td>Engineers and scientists</td>
<td>610</td>
<td>13.1</td>
<td>89.8</td>
</tr>
<tr>
<td>Management and professionals</td>
<td>479</td>
<td>10.2</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total number in sample</strong></td>
<td><strong>4,674</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>

Turning to the questionnaire respondents, Table 7-15 shows that 12 (14.3 percent) of them have a diploma or lower qualification and 45 (50.5 percent) have a degree in science and engineering, with almost 12 percent having a degree in business and management. In addition, 19 OMs (22 percent) had achieved post degree qualifications.
Thus, the sample firms are owned or managed by generally well educated entrepreneurs, and the firms also employ skilled staff.

7.2.2 R&D to Turnover Ratio

Table 7-16 demonstrates the median R&D to turnover ratio of companies undertaking R&D, according to sector grouping. The electronics sector has the highest R&D investment and the median R&D to turnover ratio for all firms undertaking R&D is 2.7 percent. The overall percentage of turnover spent on R&D is shown in Table 7-11.
Combining the data from the last two sub-sections, Figure 7-6 reveals that the median ratio of R&D expenditure to turnover (1.2 percent) for the sample is higher than MITI’s high technology incentive criteria (1.0 percent). However, some firms spend as much as 70 percent of turnover on R&D. The data in Table 7-14, summarised in Figure 7-6, reveal that the median measure of engineers and scientists is 8.7 percent of the sample firms’ workforce, compared to the MITI criterion of 7 percent of the workforce.

7.2.3 High Growth Rate

In terms of annual growth rates, the sample firms as a whole experience a much higher annual growth rate than the national annual average. Figures on the annual turnover growth rate of HTSMEs in Malaysia were not available, hence the researcher compared the annual turnover growth rate of sample companies (only 53 companies provided turnover data - Table 7-7) with GNP and GDP annual growth for the relevant years. Table 7-17 shows that the annual growth rate in sample companies is over three times the annual growth rate of GNP/GDP. Likewise, the annual
employment growth rate (only 56 companies provided employment data as indicated by Table 7-7) in sample firms is about 12.4 times the annual national average and more than six times the annual average growth for the manufacturing sector.

Thus the sample companies, in general, meet the three criteria for high technology firms – a high proportion of skilled employees, high R&D in relation to turnover, and high growth.

7.3 PROFILE OF HIGH GROWTH FIRMS

It is widely recognised that high growth firms are major sources of additional sales, employment and out-of-region exports (White and Reynolds, 1996). As a consequence, OMs and governments alike have a strong interest in discovering the ingredients of high growth trajectories. This section analyses data obtained from the questionnaire survey and develops a profile of high growth HTSMEs.

The definition of high growth technology-based SMEs was discussed in the literature review (Section 4.3.1, Chapter Four). 'High growth' is based on the Siegel et al. (1993) definition of such firms (an increase of more than 59 percent over the 1994-96 period or compound annual sales growth of 26 percent for two consecutive years).

Fifty-three companies provided turnover data for the years 1994 to 1996. Of these, 58.5 percent (31 HTSMEs) are high growth, 15 percent are companies with static or declining sales, and 26.4 percent are medium or slow growth firms (see Table 7-7). Given the small number of firms in the sample, definite conclusions on growth cannot be put forward. However, the questionnaire survey has enabled the researcher to generate a profile of high growth firms. The survey revealed that the average annual

<table>
<thead>
<tr>
<th>Growth</th>
<th>Sample Mean (Average annual growth for the past two years)</th>
<th>Average Annual National Growth for the past two years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnover</td>
<td>48.7 percent</td>
<td>14.7 percent (GDP) 14.8 percent (GNP)</td>
</tr>
<tr>
<td>Employment</td>
<td>46.2 percent</td>
<td>3.6 percent (overall) 7.3 percent (manufacturing sector)</td>
</tr>
</tbody>
</table>
turnover growth rate of the 31 high growth firms is 80.7 percent (see Table 7-8), a figure that is more than 1.6 times the average of all firms in the sample (48.7 percent, Table 7-8).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>No. of Respondents</th>
<th>Average Annual Growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 or less</td>
<td>17</td>
<td>98.6</td>
</tr>
<tr>
<td>41 - 54</td>
<td>13</td>
<td>59.8</td>
</tr>
<tr>
<td>55 or more</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Highest Educational Qualification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diploma or lower</td>
<td>4</td>
<td>94.4</td>
</tr>
<tr>
<td>Degree or Equiv.</td>
<td>19</td>
<td>83.6</td>
</tr>
<tr>
<td>MBA/Ph.D./Prof. qualifications</td>
<td>8</td>
<td>67.0</td>
</tr>
</tbody>
</table>

Table 7-18 shows that one half of the respondents from high growth organisations are younger entrepreneurs or managers aged 40 or less. There was one in the '55 and above age' group, and 13 from the '41 to 54 age' group. This is expected since younger entrepreneurs or managers have the energy and the commitment to work long hours. These two criteria are necessary for a business to achieve high growth. Older entrepreneurs or managers may lack the physical energy for such strenuous work or may be getting close to retirement (Storey, 1994b). Table 7-18 also illustrates that OMs with a diploma achieved higher growth than those who are more academically successful or those with the highest academic attainment. Section 7.4 discusses this issue in more detail.

According to Siegel et al. (1993), most high growth firms are managed by OMs or managers with considerable experience in the same industry. The average employment experience of high growth entrepreneurs is 8 years compared to 10 years for the sample as a whole (Table 7-19). However, further analysis of the previous experience of high growth respondents indicates that all but four previously worked in the industry where they are now based. This tends to suggest that OMs’ experience in the same sector does enhance the growth of their HTSMEs.
Table 7-19 summarises the characteristics of high-growth HTSMEs in the sample. OMs of high growth firms have the lowest average number of years in employment prior to the current business. As demonstrated by Table 4-2, younger and/or smaller firms tend to achieve higher growth rates than larger and/or older enterprises. The average age and size of high-growth HTSMEs is 10 years and 70 employees respectively, while firms in the other categories are older and larger. As suggested by Storey (1994b), younger firms grow rapidly to achieve a minimum efficient scale (MES) of production. Furthermore, smaller firms may be more flexible than larger firms and can react to changes in the market faster than larger firms (discussed in Section 4.4.2).

Table 7-19 also suggests that high-growth firms are the largest contributors towards employment. The average employment growth of high-growth firms was more than twice the employment growth of sample firms as a whole. High-growth firms are also a major employer of engineers and scientists, and invest more in R&D compared to other firms in the sample.

Summarising the information from various Tables above (and incorporating further analysis of the data), only three family-owned sample firms qualified as high growth. Twenty-one of the 31 rapid growth companies are located in the western part of Peninsular Malaysia, and twelve of them operate on Private Industrial Estates. Seven of the high-growth firms operate on a Specialised Industrial Estate or the
Technology Park. (It should be noted that most firms operating on the Technology Park are relatively new and not able to furnish the turnover data needed to compute growth rates.) All high-growth firms, except five, employ at least one engineer or scientist, with the majority employing between 1 to 5 engineers or scientists. Somewhat to my surprise, ten high growth firms did not engage in R&D, and only four companies conduct market research. However, twelve high growth firms seek customers informally through direct contact ('informal' market research). This confirms that high growth HTSMEs develop close customer contacts (Siegel et al., 1993).

Based on the above analysis, the study offers some hints as to the characteristics of high growth HTSMEs in Malaysia. These necessary ingredients may assist the policy makers and practitioners in the creation of new HTSMEs with high growth potential and help to formulate support programmes for existing HTSMEs to attain high growth status. The high growth HTSMEs identified above have the following attributes: owned or managed by young entrepreneurs with less work experience, but having at least a university degree; younger and small firms; employing a considerable number of engineers and scientists; engaged in R&D; and, operating on the Western part of Peninsular Malaysia.

The implications of this profile for targeting support at HTSMEs are explored in Chapter Nine.

7.4 TESTS OF HYPOTHESES
A total of 17 hypotheses formulated in Section 5.1.3 were tested. The results are as follows:
Hypothesis 1: The level of education of the OM is positively correlated to growth.

<table>
<thead>
<tr>
<th>TABLE 7-20 Correlation between Growth and Level of Education</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Growth</td>
</tr>
<tr>
<td>Education Level</td>
</tr>
</tbody>
</table>

(p > 0.05)

Education can develop the human capital needed for business success (Variyam and Kraybill, 1994). Furthermore, OMs with higher levels of education are more confident in dealing with customers and financial institutions (Storey, 1994b). To test this hypothesis, Spearman’s correlation coefficient was utilised. The result in Table 7-20 provides no real evidence of a positive relationship between growth and level of education. At the 0.05 level of significance, the hypothesis is rejected.

<table>
<thead>
<tr>
<th>TABLE 7-21 Average Annual Turnover Growth and Level of Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest Education Qualification</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Diploma or Lower</td>
</tr>
<tr>
<td>Degree or equivalent</td>
</tr>
<tr>
<td>MBA/Phd/Prof. Qualifications</td>
</tr>
<tr>
<td>Sample</td>
</tr>
</tbody>
</table>

To explore this hypothesis further, a breakdown of turnover in relation to the level of education was conducted (see Table 7-21). As might be expected, those entrepreneurs with a degree are associated with higher growth companies than those with a Diploma. The majority of OMs with a first degree are young and have the physical energy and commitment required for rapid growth. However, the entrepreneurs with the highest qualifications are associated with the lowest growth companies. (This explains why the hypothesis is rejected). It might be that the Diploma holders see business as an opportunity to earn higher incomes (Storey, 1994b) and are more committed than the most well-educated OMs. The latter might be older and (possibly) more complacent. Overall, nonetheless, the results are
inconclusive. Other factors are clearly more important in securing growth than the level of education.

**Hypothesis 2:** *Prior managerial experience is positively correlated to growth.*

<table>
<thead>
<tr>
<th>TABLE 7-22</th>
<th>Correlation between Growth and Managerial Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Growth</td>
</tr>
<tr>
<td>Growth</td>
<td>1.000</td>
</tr>
<tr>
<td>Managerial Experience</td>
<td>0.038</td>
</tr>
</tbody>
</table>

\((p > 0.05)\)

According to Cooper (1981), the prior managerial experience of the OM is an important determinant of the success of a firm. OMs with management experience are able to cope with the changes and problems that confront them while running a business venture. Spearman's correlation coefficient was again utilised to test this hypothesis. Table 7-22 provides no evidence of a positive relationship between prior managerial experience and average growth, hence, at the 0.05 significance level the hypothesis is rejected. Thus prior management experience has no significant effect on the growth of HTSMEs - an unexpected finding.

A possible explanation may be that those with prior management experience had been employed in the Civil Service and seized the opportunity to start a business after being informed of government incentives made available to HTSMEs.

**Hypothesis 3:** *The age of the OM is negatively correlated to growth.*

<table>
<thead>
<tr>
<th>TABLE 7-23</th>
<th>Correlation between Growth and Age of OM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Growth</td>
</tr>
<tr>
<td>Growth</td>
<td>1.000</td>
</tr>
<tr>
<td>Age of OM</td>
<td>-0.220</td>
</tr>
</tbody>
</table>

\((p < 0.05)\)
The results in Table 7-23 are consistent with the findings of Dunkelberg and Cooper (1982); Kalleberg and Leicht (1991); and Barkham et al. (1996b) - Table 4-1 of Section 4.4.1 - that suggest the age of OM is negatively correlated to growth. The results in Table 7-23 confirm that younger OMs achieve higher growth than older OMs. According to Storey (1994b) younger OMs have the physical energy and commitment to work the long hours that are generally necessary for a business to grow. Thus, the hypothesis is substantiated.

Hypothesis 4: The length of the career history of the OM is positively correlated to growth.

**TABLE 7-24** Correlation between Growth and Career History

<table>
<thead>
<tr>
<th>Growth</th>
<th>Career History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>1.000</td>
</tr>
<tr>
<td>Career History</td>
<td>-0.245</td>
</tr>
</tbody>
</table>

(p < 0.05)

Table 7-24 illustrates that career history and growth are negatively correlated, implying that OMs with shorter careers have achieved higher growth than OMs with longer working experience. Thus, the results reject the above hypothesis.

Further analysis of the survey results reveals that more than 65 percent of the OMs have had the same sector experience throughout their career history. Therefore, this finding contradicts previous studies (for example, Dunkelberg et al., 1987; Jones, 1991; Reynolds, 1993). The contradiction may stem from the fact that most the studies listed in Table 4-1 measure growth in terms of employment whereas my study uses turnover. The more likely explanation, however, is that the drive and energy of younger OMs outweighs the experience of older individuals. The essence of HTSMES is the development of new products and/or processes, hence the value of prior experience might be somewhat negated. Furthermore, Table 7-19 demonstrates that OMs of high growth firms have the lowest average number of years in employment prior to the current business. The data for the sample as a whole, and the subset of high-growth firms confirm that the value of a long career history is perhaps overrated.
Hypothesis 5: **HTSMEs owned by female OMs grow more rapidly than those owned by male OMs.**

Jones (1991) found that men are more likely than females to own rapidly growing firms, while Reynolds (1993) found the reverse relationship. Storey (1994b) concluded that gender is not a key influence on business growth. The purpose of including this determinant in this study was to provide some insight on the role of women in the development and growth of HTSMEs in Malaysia. However, only three female OMs responded and none provided the turnover data needed to compute growth rates, hence the hypothesis is neither proven nor disproved.

Hypothesis 6: **HTSMEs owned by Non-Bumiputera OMs grow more rapidly than those owned by Bumiputera OMs.**

**TABLE 7-25** Mann-Whitney Test: Average Growth by Ethnic Background

<table>
<thead>
<tr>
<th>Ethnic Status</th>
<th>No. of Firms</th>
<th>Mean Rank of Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bumiputera</td>
<td>24</td>
<td>27.73</td>
</tr>
<tr>
<td>Non-Bumiputera</td>
<td>29</td>
<td>26.40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>53</strong></td>
<td></td>
</tr>
</tbody>
</table>

(p > 0.05)

Although Table 7-25 demonstrates that Bumiputera OMs achieved growth slightly higher than the non-Bumiputera, the difference is not significant enough to support the above hypothesis. Thus, the hypothesis is rejected. This result supports the findings of previous studies in Table 4-1, whereby Dunkelberg et al. (1987) and Westhead and Birley (1993a) found that ethnicity had no significant influence on growth.

Although the hypothesis is rejected, my research does suggest that the aims of the NEP (Section 2.2.1, Chapter Two) are being achieved in the high technology sector. Bumiputera participation is high and the performance of such firms is on a par with their non-Bumiputera counterparts. While this outcome is pleasing for the Malaysian Government, one could argue that the Bumiputera firms should have outperformed those run by other ethnic communities, given the degree of official
backing for the Bumiputra population. However, it has to be acknowledged that the
Bumiputra community started from a very low base in terms of entrepreneurial
expertise and official support was judged to be essential to kickstart the move to
equality.

Hypothesis 7: The age of the firm is negatively correlated to growth.

| TABLE 7-26 Correlation between Growth and Age of Firm |
|-----------------------------------|-----------|-----------------|
|                                   | Growth    | Age of the firm |
| Growth                            | 1.000     | -0.354          |
| Age of the firm                   | -0.354    | 1.000           |

($p < 0.01$)

Table 7-26 provides evidence that there is negative correlation between growth and age for HTSMEs. As illustrated by Figure 4-1, HTSMEs move through the various growth stages; the growth rate of younger firms increases rapidly to achieve the MES minimum efficient scale (MES), but slows down in the later stages once MES has been achieved (Storey, 1994b). The results are also consistent with the findings of UCSBRC (1992), Dunne and Hughes (1992a), Variyam and Kraybill (1992), Hakim (1989), Jones (1997), Dunne, Roberts and Samuelson (1989), Storey et al. (1987), Variyam and Kraybill (1994) and Wijewardena and Cooray (1995). Thus, the hypothesis is substantiated.

Hypothesis 8: The size of the firm is negatively correlated to growth.

| TABLE 7-27 Correlation between Growth and Size of the Firm |
|-----------------------------------|-----------|---------------|
|                                   | Growth    | Size of the Firm |
| Growth                            | 1.000     | -0.247        |
| Size of the Firm                  | -0.247    | 1.000         |

($p < 0.05$)

Table 7-27 reveals a negative correlation between size of company and growth rate. This indicates that smaller HTSMEs grows more rapidly than their larger counterparts. Once again, the results support the findings of previous studies by Oakey et al. (1988), Storey (1994b) and Barkham et al. (1996b). The need to achieve (MES) was noted
above. In addition, small firms may be more flexible than larger firms, and small firms can react quickly to changes in the market (Barkham et al., 1996b). Thus, the hypothesis is substantiated.

**Hypothesis 9:** Limited companies grow more rapidly than other forms of ITSMES.

<table>
<thead>
<tr>
<th>TABLE 7-28</th>
<th>Kruskal-Wallis Test: Average Growth by Legal Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legal Form</td>
<td>No. of Firms</td>
</tr>
<tr>
<td>Partnership</td>
<td>6</td>
</tr>
<tr>
<td>Private Limited Company</td>
<td>46</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>53</strong></td>
</tr>
</tbody>
</table>

Table 7-28 demonstrates significant differences in growth between private limited companies (PLCs) and other legal forms. The growth of PLCs is significantly lower, hence the hypothesis is rejected. This is somewhat surprising, given the expectation that PLCs would achieve more rapid growth than other legal forms (Table 4-2). However, analysis of the characteristics of PLC firms (Table 7.29) illustrates that PLCs are older and larger than firms of other legal forms. The age and size factors (Hypotheses 7 and 8 respectively) appear to outweigh the potential benefits of PLC status.

<table>
<thead>
<tr>
<th>TABLE 7-29</th>
<th>Characteristics of PLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legal Form</td>
<td>Average Age of Companies</td>
</tr>
<tr>
<td>Private Limited Company</td>
<td>8.2 years</td>
</tr>
<tr>
<td><strong>No. of Firms</strong></td>
<td><strong>73</strong></td>
</tr>
<tr>
<td>Others</td>
<td>5.4 years</td>
</tr>
<tr>
<td><strong>No. of Firms</strong></td>
<td><strong>13</strong></td>
</tr>
</tbody>
</table>
Hypothesis 10: *HTSMEs located on a Science Park grow more rapidly than those located elsewhere.*

**TABLE 7-30** Mann-Whitney Test: Average Growth by Location

<table>
<thead>
<tr>
<th>Location</th>
<th>No. of Firms</th>
<th>Mean Rank of Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Park</td>
<td>10</td>
<td>25.80</td>
</tr>
<tr>
<td>Other locations</td>
<td>43</td>
<td>27.28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>53</strong></td>
<td></td>
</tr>
</tbody>
</table>

($p > 0.05$)

Table 7-30 demonstrates some slight differences in growth between HTSMEs located in Technology/Science Parks and those operating in other locations. Nevertheless, the differences are not significant enough to substantiate the hypothesis. *The hypothesis is thus rejected.*

This outcome was expected for Malaysia: companies operating on the various science parks are mostly start-ups, still to achieve the level of growth secured by firms operating elsewhere. For example, in the UK, annual employment growth for firms located on science parks is more than 50 percent (Storey and Strange, 1992), but companies located on the TPM in this study managed to achieve only 21 percent in annual employment growth. The results may reflect the lack of effective measures by the TPM management to assist tenant companies, or simply granting space to companies that would not normally be classed as high technology elsewhere.

The case studies in Chapter Eight (Section 8.3.2) highlight some of the problems faced by companies operating on science parks in Malaysia.
Hypothesis 11: There are significant differences between the electronics and other sectors in terms of the growth of HITSMEs.

**TABLE 7-31** Mann-Whitney Test: Average Growth by Sector

<table>
<thead>
<tr>
<th>High Technology Sector</th>
<th>No. of Firms</th>
<th>Mean Rank of Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics</td>
<td>19</td>
<td>28.13</td>
</tr>
<tr>
<td>Other</td>
<td>34</td>
<td>26.37</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>

(p > 0.05)

Table 7-31 demonstrates slight differences in growth rates between sectors. However, the differences are not statistically significant, thus the hypothesis is rejected. The result demonstrates that sales growth in the other high-technology sectors matches that in the long established electronics sector (Section 2.2.2, Chapter Two). However, my study (Table 7-32) does show that the electronics sector's contribution (49.5 percent) towards employment growth is higher than the other sectors (43.2 percent). The Government's efforts to sustain growth in the electronics sector are justified if employment creation remains as a main goal of Government policy.

**TABLE 7-32** Average Annual Employment Growth According to Sectors

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Average Annual Employment Growth</th>
<th>No. of Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics</td>
<td>49.5</td>
<td>27</td>
</tr>
<tr>
<td>All other Sectors</td>
<td>43.2</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>46.2</td>
<td>56</td>
</tr>
</tbody>
</table>

Hypothesis 12: HITSMEs that conduct market research grow more rapidly than those that do not.

**TABLE 7-33** Mann-Whitney Test: Avg. Growth by Incidence of Market Research

<table>
<thead>
<tr>
<th>No. of Firms</th>
<th>Mean Rank of Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduct market research</td>
<td>9</td>
</tr>
<tr>
<td>Do not conduct market research</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>51</td>
</tr>
</tbody>
</table>

(p > 0.05)
Table 7-33 demonstrates some differences in growth between the two groups, but the differences are not significant enough to substantiate the hypothesis. The hypothesis is therefore rejected.

The result contradicts the findings of Barkham et al. (1996b), but the small number of firms conducting market research may have influenced my results. One possible explanation for the low level of market research undertaken by HTSMEs includes consumers’ resistance to being interviewed and a shortage of people to conduct the market research.

**Hypothesis 13:** HTSMEs that adopt a marketing orientation grow more rapidly than those that do not.

**TABLE 7-34** Mann-Whitney Test: Average Growth by Incidence of Strong Emphasis on Marketing

<table>
<thead>
<tr>
<th>No. of Firms</th>
<th>Mean Rank of Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actively seek customers</td>
<td>45</td>
</tr>
<tr>
<td>Do not actively seek customers</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>52</td>
</tr>
</tbody>
</table>

\( p > 0.05 \)

Table 7-34 indicates some differences in growth between HTSMEs that consider marketing as an important strategy and those that do not. Once again, the difference is not significant enough to substantiate the hypothesis. The hypothesis is thus rejected. Barkham et al. (1996b) suggest that firms actively-seeking customers will generate greater growth, although this growth is not guaranteed. However, it seems self-evident that firms producing good quality products that meet their customers’ needs will perform well (Pavia, 1990). The most likely explanation for my counter-intuitive findings for Hypotheses 12 and 13 is that the firms lacking a marketing orientation have a secure outlet for their products, perhaps under the Vendor Development Programme.
**Hypothesis 14:** *Product innovation is positively correlated to growth in HTSMEs.*

**TABLE 7-35** Correlation between Growth and Product Innovation

<table>
<thead>
<tr>
<th></th>
<th>Growth</th>
<th>Product Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>1.000</td>
<td>-0.025</td>
</tr>
<tr>
<td>Product Innovation</td>
<td>-0.025</td>
<td>1.000</td>
</tr>
</tbody>
</table>

*(p > 0.05)*

Table 7-35 shows a very weak negative correlation between product innovation and growth. At the 0.05 significance level, the hypothesis is rejected.

Although this result is consistent with findings by Birley and Westhead (1990), Kalleberg and Leicht (1991) and Kinsella et al. (1993), there are other studies in Table 4-3 that indicate otherwise (for example, Dunkelberg et al., 1987; Woo et al., 1989). What remains unclear is whether growth is a result of product innovation or vice versa. The most likely explanation for the above result is, once again, that the sample contains a considerable number of subcontracting firms that achieve high sales turnover but rely on their anchor company under the VDP to introduce new products.

**Hypothesis 15:** *Process innovation is positively correlated to growth in HTSMEs.*

**TABLE 7-36** Correlation between Growth and Process Innovation

<table>
<thead>
<tr>
<th></th>
<th>Growth</th>
<th>Process Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>1.000</td>
<td>0.222</td>
</tr>
<tr>
<td>Process Innovation</td>
<td>0.222</td>
<td>1.000</td>
</tr>
</tbody>
</table>

*(p < 0.05)*

Table 7-36 shows a positive correlation between process innovation and turnover growth. Thus, the hypothesis is accepted. Process innovation in many HTSMEs has been the driving force in product innovation, and it is becoming an increasingly critical capability for product innovation (Pisano and Wheelwright, 1995). Table 7-36 confirms Oakey et al. (1988) findings that turnover growth and process innovation are
related, though the relationship is weak; he suggested that market conditions might be beyond a firm’s control, even though it has been undertaking process innovation.

**Hypothesis 16:** *HTSMEs that accept external equity grow more rapidly than those that do not.*

**TABLE 7-37** Mann-Whitney Test: Average Growth and External Equity

<table>
<thead>
<tr>
<th>Accept external equity</th>
<th>24</th>
<th>29.19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not accept external equity</td>
<td>29</td>
<td>25.19</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>

\((p > 0.05)\)

Table 7-37 demonstrates that firms accepting external equity do achieve higher growth rates than those that do not, confirming Table 4-3. An unwillingness to accept external equity can constrain growth, as the company may have to resort to short-term debt financing. (The case studies confirm that this happens in practice.) As discussed in Section 7.1.4, some firms do not accept external equity because they are subsidiary companies to larger MNCs and thus receive funding from the parent company. An unwillingness to accept outside funding, however, does not appear to have put sample firms at a significant disadvantage.

Table 7-37 shows some differences in growth between HTSMEs accepting external equity and those that do not, but the differences are not significant enough to substantiate the hypothesis. *Thus the hypothesis is rejected.*

It could be that the external equity is generally provided by Government bodies, rather than commercially-oriented venture capital funds. The latter would be much more concerned to support firms in their ambitions to grow rapidly and (say) float the company.
**Hypothesis 17:**  
*HTSMEs that accept Government support grow more rapidly than those that do not.*

**TABLE 7-38**  
Mann-Whitney Test: Average Growth by Incidence of Government Support

<table>
<thead>
<tr>
<th></th>
<th>No. of Firms</th>
<th>Mean Rank of Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use some kind of Government support</td>
<td>40</td>
<td>25.42</td>
</tr>
<tr>
<td>Do not use Government support</td>
<td>13</td>
<td>31.85</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>53</strong></td>
<td></td>
</tr>
</tbody>
</table>

($p > 0.05$)

Table 7-38 demonstrates modest differences in growth between HTSMEs that use some kind of Government support and those that do not. At the 0.05 significance level, *the hypothesis is rejected.* This finding might make depressing reading for the Government, as its efforts to support HTSMEs have not led to superior growth rates. The explanation for this anomaly is not obvious. It might be that the statistical test was based on the number of support measures used, rather than the type of assistance. It might simply be that young and small companies (that tend to grow quickly) have placed less reliance on Government support, or that official bodies tend to target more established companies whose initial growth spurt is slowing down.

**Hypothesis 18:**  
*R&D expenditure is positively correlated to growth in HTSMEs.*

**TABLE 7-39**  
Correlation between Growth and R&D

<table>
<thead>
<tr>
<th></th>
<th>Growth</th>
<th>R&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>1.000</td>
<td>0.192</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>0.192</td>
<td>1.000</td>
</tr>
</tbody>
</table>

($p < 0.1$)

Table 7-39 indicates a positive relationship between growth and R&D expenditure. Thus, there is evidence to substantiate the hypothesis. R&D is one of the key drivers of growth in HTSMEs (Ettlie, 1997; Judge et al., 1997; Jankowski, 1998). Successful HTSMEs are those with high R&D expenditure (Roberts, 1991), and increased R&D
expenditures are a sign of continuing growth (Smith, 1996). Nevertheless, the relationship set out in Table 7-39 is not powerful. Further analysis of those sample companies engaged in R&D reveals that almost 50 percent of firms are less than five years old. While young, small firms might be expected to grow rapidly, there is a possibility that the amount invested in R&D has not yet been translated into sales.

The understatement of the R&D figures in Table 7-11 (Section 7.1.4) may have had an impact on this final hypothesis. The test result would have been even more significant if true figures on R&D expenditure were obtained, and the current evidence indicating that growth companies are spending more on R&D than non-growth companies would have been stronger.

7.5 SUMMARY
This chapter presented a summary of the respondents’ characteristics, a profile of the firms involved in the survey, and summary data on growth, business strategy adopted and growth constraints. Descriptive analysis confirmed that the sample does consist of high technology companies. A profile of high growth firms was then compiled. This profile is important as it could assist policy makers and practitioners in the creation of new HTSMEs with high growth potential or help to formulate support for existing HTSMEs.

The chapter then related the questionnaire data on entrepreneur/firm characteristics and strategy (the independent variables) to the growth experience of HTSMEs. The hypotheses were tested and a summary of the results is shown in Table 7-40.

It is evident that the majority of the hypotheses are rejected by the questionnaire data. Some of the reasons for this lack of association between the variables identified in the literature and the growth of the HTSMEs in my sample were explored in this chapter. However, many questions were left unanswered. It was evident that the qualitative data gathered in the case studies are critical for exploring these questions. Analysis of the case studies follows in the next chapter, and the focus of attention is the constraints faced by HTSMEs.
### TABLE 7-40  Factors Affecting Growth of HTSMEs

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Independent Variable</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics of the Entrepreneurs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Education</td>
<td>Rejected</td>
</tr>
<tr>
<td>2</td>
<td>Management experience</td>
<td>Rejected</td>
</tr>
<tr>
<td>3</td>
<td>Age</td>
<td>Substantiated</td>
</tr>
<tr>
<td>4</td>
<td>Career history</td>
<td>Rejected</td>
</tr>
<tr>
<td>5</td>
<td>Gender</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>6</td>
<td>Ethnic background</td>
<td>Rejected</td>
</tr>
<tr>
<td>Characteristics of the Firm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Age of the firm</td>
<td>Substantiated</td>
</tr>
<tr>
<td>8</td>
<td>Size of the firm</td>
<td>Substantiated</td>
</tr>
<tr>
<td>9</td>
<td>Legal Form</td>
<td>Rejected</td>
</tr>
<tr>
<td>10</td>
<td>Location</td>
<td>Rejected</td>
</tr>
<tr>
<td>11</td>
<td>Industrial Sectors</td>
<td>Rejected</td>
</tr>
<tr>
<td>Business Strategy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Market research</td>
<td>Rejected</td>
</tr>
<tr>
<td>13</td>
<td>Marketing orientation</td>
<td>Rejected</td>
</tr>
<tr>
<td>14</td>
<td>Product innovation</td>
<td>Rejected</td>
</tr>
<tr>
<td>15</td>
<td>Process innovation</td>
<td>Substantiated</td>
</tr>
<tr>
<td>16</td>
<td>External equity</td>
<td>Rejected</td>
</tr>
<tr>
<td>17</td>
<td>Government Support</td>
<td>Rejected</td>
</tr>
<tr>
<td>18</td>
<td>R&amp;D</td>
<td>Substantiated</td>
</tr>
</tbody>
</table>

**Notes**

1 Basic or pure research does not involve specific application toward processes or products, while developmental or applied research is designed to deliver in useful materials, products, processes or services.
CHAPTER 8

CASE ANALYSIS

8.0 INTRODUCTION

The findings of the questionnaire survey were analysed in Chapter Seven. The survey helped to determine factors that affect the growth of HTSMEs, as well as identifying barriers to growth. However, the survey did not provide sufficient qualitative data on how and why constraints occur, and what could have been done to overcome such constraints. Thus, in-depth interviews were conducted with fifteen HTSMEs in Malaysia. The focus of attention was not only the constraints, but also the steps taken by companies to overcome them. Information gathered through interviews and observation was used to test the propositions put forward in Chapter Five. Detailed case studies were compiled — refer to Appendix 8-1. The interviews provided a valuable opportunity to explore issues covered in the questionnaire survey, and also to gather information on factors not addressed in that survey. The qualitative studies probed a number of answers obtained in the quantitative study. For example, the questionnaire studies identified a lack of finance as a major constraint encountered by HTSMEs. However, the qualitative studies were able to provide more depth to the analysis and helped to explain why a lack of collateral did not seem to appear as an explicit financing problem.

The case study discussions enabled me to evaluate the effectiveness of a variety of public policies, and to suggest how it might be possible to formulate proposals to overcome the constraints identified.

The chapter starts with a brief overview of the characteristics of the interviewees and their companies. It then analyses the four major constraints identified in Chapter Seven, namely: lack of finance; shortages of skilled labour; difficulties in product and process innovation; and, lack of demand. The analysis also describes the ways in which such constraints have been overcome. The chapter then tests four key
propositions derived from the principal constraints. It concludes with an evaluation of Government support and sets the scene for the recommendations in Chapter Nine.

As stated in Chapter Six, the analysis of the case studies (and subsequent recommendations) is largely based on the interviewees' own responses. However, on certain occasions, it was necessary for me to add my interpretation to the data gathered. For example, interviewees sometimes failed to address certain issues in a comprehensive manner; the interviewees did not refer explicitly to a lack of collateral as a problem in securing finance. The literature review leads me to suggest that, in many cases, inadequate security is the real reason for a failure to obtain funding. Nevertheless, the interviewees were generally able to furnish clear information that clarified the questionnaire findings. In particular, constraints on finance do not seem to stem from a shortage of funds in the financial market – see Section 8.2.1.2 below.

In other instances, I had to use my experience as a lecturer in a Technological University to analyse events in case study firms. For example, in Companies M and O, I was conscious that entrepreneurship training would have assisted growth and development and I could see where my university could have provided such training. This led to one of the recommendations in Chapter Nine.

Finally, interviews with key informants provided another source of useful data, especially in assessing the effectiveness of Government policy towards HTSMEs and in framing suitable recommendations on this score.

8.1 BACKGROUND OF THE FIRMS

In-depth interviews were conducted with fifteen of the companies that participated in the questionnaire survey. The basis for selecting the sample was explained in Chapter Six. Thirty-five companies were contacted initially; twenty-five agreed to participate. However, ten decided to withdraw prior to the interviews. This was disappointing. A condition for each company agreeing to participate in the research was that the information provided would be treated in confidence. Thus, the names of the companies and individuals involved in the interviews are disguised. In addition to the interviews, the case material (Appendix 8-1) for each company was compiled from
brochures and company reports provided by the companies. For example, a number of interviewees did not detail their external sources of financing, but I was able to obtain this information from the company's report.

8.1.1 Types of Product

<table>
<thead>
<tr>
<th>Company</th>
<th>Components</th>
<th>Type of Firm</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Yes</td>
<td>SC</td>
<td>Plastic motor components</td>
</tr>
<tr>
<td>D</td>
<td>Yes</td>
<td>SC</td>
<td>High precision tools, stamped metal components &amp; spiral wound gaskets</td>
</tr>
<tr>
<td>F</td>
<td>Yes</td>
<td>SC</td>
<td>Rubber moulded parts for the automotive industry</td>
</tr>
<tr>
<td>J</td>
<td>Yes</td>
<td>SC</td>
<td>Manufacture &amp; assembly of Printed Circuit Boards &amp; manufacturing services</td>
</tr>
<tr>
<td>G</td>
<td>No</td>
<td>PB + SVC</td>
<td>Information system and IT consultancy, and executive desktop</td>
</tr>
<tr>
<td>K</td>
<td>No</td>
<td>SVC</td>
<td>IT infrastructure maintenance &amp; system integration and maintenance</td>
</tr>
<tr>
<td>M</td>
<td>No</td>
<td>SVC</td>
<td>Systems integration &amp; design consultancy</td>
</tr>
<tr>
<td>N</td>
<td>No</td>
<td>SVC</td>
<td>Managed services and Net-media i.e. virtual marketing</td>
</tr>
<tr>
<td>B</td>
<td>No</td>
<td>PB + SVC</td>
<td>Electronic alarm systems &amp; engineering services</td>
</tr>
<tr>
<td>C</td>
<td>No</td>
<td>PB + SVC</td>
<td>Scientific laboratory equipment &amp; end servicing</td>
</tr>
<tr>
<td>O</td>
<td>No</td>
<td>PB + SVC</td>
<td>Flat antenna &amp; R&amp;D services</td>
</tr>
<tr>
<td>E</td>
<td>No</td>
<td>PB + SC</td>
<td>Pharmaceutical, health &amp; food supplements</td>
</tr>
<tr>
<td>H</td>
<td>Yes</td>
<td>PB + SC</td>
<td>Photo-optic sensors, x-ray scanners</td>
</tr>
<tr>
<td>I</td>
<td>No</td>
<td>PB</td>
<td>Agrochemical products such as insecticides and fungicides</td>
</tr>
<tr>
<td>L</td>
<td>No</td>
<td>PB</td>
<td>Animal vaccines</td>
</tr>
</tbody>
</table>

Note:
PB: Product Based Firm
SC: Subcontracting Firm
SVC: Service Based Firm

As illustrated in Table 8-1, the companies are involved in a variety of sectors, and it is difficult to classify their activities into discrete categories. Under the VDP discussed in Chapter Two, four companies (A, D, F and J) produce components for anchor companies. Four companies (G, K, M and N) are principally involved in Information Technology (IT) services. Three companies (B, C and O) produce finished products and supply services, including engineering services and R&D consulting. The remaining companies manufacture finished products and/or subcontract to a number of MNCs.
8.1.2 Characteristics of Interviewees

Table 8-2 Interviewee Characteristics

<table>
<thead>
<tr>
<th>Company</th>
<th>Age Group</th>
<th>Ethnic Status</th>
<th>Status</th>
<th>Highest Educational Qualification</th>
<th>Previously Employed?</th>
<th>Years of Management Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Under 30</td>
<td>B</td>
<td>OM</td>
<td>Dip.</td>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>31-40</td>
<td>B</td>
<td>OM</td>
<td>Deg. (S/T)</td>
<td>Yes</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>31-40</td>
<td>B</td>
<td>OM</td>
<td>Deg. (O)</td>
<td>Yes</td>
<td>5</td>
</tr>
<tr>
<td>D</td>
<td>41-54</td>
<td>B</td>
<td>OM</td>
<td>Dip.</td>
<td>Yes</td>
<td>15</td>
</tr>
<tr>
<td>E</td>
<td>41-54</td>
<td>NB</td>
<td>M</td>
<td>Prof.</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>F</td>
<td>41-54</td>
<td>NB</td>
<td>OM</td>
<td>Deg. (S/T)</td>
<td>Yes</td>
<td>2.5</td>
</tr>
<tr>
<td>G</td>
<td>31-40</td>
<td>B</td>
<td>M</td>
<td>Deg. (S/T)</td>
<td>No</td>
<td>15</td>
</tr>
<tr>
<td>H</td>
<td>31-40</td>
<td>NB</td>
<td>M</td>
<td>Deg. (B/M) &amp; Prof.</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>I</td>
<td>41-54</td>
<td>NB</td>
<td>OM</td>
<td>Deg. (S/T)</td>
<td>Yes</td>
<td>5</td>
</tr>
<tr>
<td>J</td>
<td>41-54</td>
<td>B</td>
<td>OM</td>
<td>Deg. (B/M)</td>
<td>Yes</td>
<td>19</td>
</tr>
<tr>
<td>K</td>
<td>31-40</td>
<td>B</td>
<td>M</td>
<td>Deg. (S/T)</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>L</td>
<td>31-40</td>
<td>B</td>
<td>M</td>
<td>Deg. (S/T)</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>M</td>
<td>31-40</td>
<td>B</td>
<td>OM</td>
<td>Deg. (S/T)</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>N</td>
<td>31-40</td>
<td>B</td>
<td>M</td>
<td>Deg. (S/T)</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>O</td>
<td>31-40</td>
<td>B</td>
<td>M</td>
<td>Deg. (S/T)</td>
<td>No</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note:

- B: Bumiputra
- NB: Non-Bumiputra
- N/A: Not available
- OM: Owner-Manager
- M: Manager
- Dip.: Diploma
- Deg. (S/T): Degree (Science/Technical)
- Deg. (B/M): Degree (Business/Management)
- Deg. (O): Degree (Ordinary)
- Prof.: Professional qualification

Eight of the fifteen interviewees were OMs, seven were managers with the principal responsibility for running the company. Table 8-2 summarises the characteristics of interviewees. All were male. (I did ask a number of female OMs to participate, in an effort to explore the role of women in Malaysian business, but the invitees declined to...
All but two are graduates. Nine interviewees hold an engineering or science degree, indicating technical competence.

The management experience before setting up (or securing employment with) the company ranged from 2 to 19 years. Two interviewees had no previous experience. Although Table 8-2 suggests that interviewee G had not previously been employed, he had operated as an independent consultant for 15 years before setting up his current business. With ten of the interviewees aged below forty, the participants are relatively youthful.

8.1.3 Firm Characteristics
All of the firms in the sample are private limited companies, except for Company O that is a partnership. Eleven of the fifteen are Bumiputra-owned. In terms of location, eleven are based on the western side of West Malaysia, three in the south and one in the north.

Table 8-3 shows that the sample consists of a mixture of older and younger firms, with two start-ups. The ages of the companies range from 2 to 24 years. The 15 companies operate from various locations, including State or Federal Agency industrial estates, incubation centres, retail centres and the Technology Park (TP). Table 8-3 confirms that the companies are involved in a variety of sectors, but all are classed as high technology under the definition used in Malaysia.
### Case Analysis

#### Table 8-3 Firm Characteristics

<table>
<thead>
<tr>
<th>Company</th>
<th>No. of Full-time Employees</th>
<th>Age of Company (years)</th>
<th>Region</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>19</td>
<td>4</td>
<td>Southern</td>
<td>UIC</td>
</tr>
<tr>
<td>B</td>
<td>35</td>
<td>5</td>
<td>Western</td>
<td>RC</td>
</tr>
<tr>
<td>C</td>
<td>40</td>
<td>9</td>
<td>Western</td>
<td>PIE</td>
</tr>
<tr>
<td>D</td>
<td>60</td>
<td>4</td>
<td>Northern</td>
<td>SDC</td>
</tr>
<tr>
<td>E</td>
<td>250</td>
<td>24</td>
<td>Western</td>
<td>SDC</td>
</tr>
<tr>
<td>F</td>
<td>160</td>
<td>23</td>
<td>Western</td>
<td>PIE</td>
</tr>
<tr>
<td>G</td>
<td>165</td>
<td>7</td>
<td>Western</td>
<td>TP</td>
</tr>
<tr>
<td>H</td>
<td>195</td>
<td>5</td>
<td>Southern</td>
<td>SDC</td>
</tr>
<tr>
<td>I</td>
<td>36</td>
<td>11</td>
<td>Western</td>
<td>SMI</td>
</tr>
<tr>
<td>J</td>
<td>250</td>
<td>5</td>
<td>Western</td>
<td>MIER</td>
</tr>
<tr>
<td>K</td>
<td>115</td>
<td>14</td>
<td>Western</td>
<td>TP</td>
</tr>
<tr>
<td>L</td>
<td>28</td>
<td>7</td>
<td>Western</td>
<td>PIE</td>
</tr>
<tr>
<td>M</td>
<td>88</td>
<td>9</td>
<td>Western</td>
<td>TP</td>
</tr>
<tr>
<td>N</td>
<td>34</td>
<td>2</td>
<td>Western</td>
<td>UIC</td>
</tr>
<tr>
<td>O</td>
<td>8</td>
<td>2</td>
<td>Southern</td>
<td>UIC</td>
</tr>
</tbody>
</table>

**Note:**

SMI: *SMI Industrial Site*  
RC: *Retail centre*  
MIER: *MIER Industrial Site*  
PIE: *Private Industrial Estate*  
UIC: *University incubation centre*  
SDC: *State Dev’t. Corp’n. Industrial Estate*  
TP: *Technology Park*

#### 8.1.4 Growth Characteristics

Figure 8-1 shows that sample companies can be classified into four groups comprising: high growth companies (ten, with an average annual turnover growth of 26 percent or more); medium (one, between 0 and 25 percent); declining (two, with declining sales); and two start-up firms. The annual growth rate for the two start-up companies could not be ascertained.
Table 8-4 presents the average annual growth in turnover of each company.

<table>
<thead>
<tr>
<th>Company</th>
<th>Turnover Growth Rate (%)</th>
<th>Employment Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>50</td>
<td>67</td>
</tr>
<tr>
<td>B</td>
<td>209</td>
<td>118</td>
</tr>
<tr>
<td>C</td>
<td>400</td>
<td>273</td>
</tr>
<tr>
<td>D</td>
<td>276</td>
<td>131</td>
</tr>
<tr>
<td>E</td>
<td>27</td>
<td>36</td>
</tr>
<tr>
<td>F</td>
<td>58</td>
<td>-16</td>
</tr>
<tr>
<td>G</td>
<td>-66</td>
<td>24</td>
</tr>
<tr>
<td>H</td>
<td>238</td>
<td>N/A **</td>
</tr>
<tr>
<td>I</td>
<td>87</td>
<td>37</td>
</tr>
<tr>
<td>J</td>
<td>80</td>
<td>208</td>
</tr>
<tr>
<td>K</td>
<td>-11</td>
<td>47</td>
</tr>
<tr>
<td>L</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>M</td>
<td>214</td>
<td>170</td>
</tr>
<tr>
<td>N</td>
<td>Start-up (established in 1997)</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>Start-up (established in 1997)</td>
<td></td>
</tr>
</tbody>
</table>

Note:
* Average annual growth between 1994 and 1996
** Not Available
The average annual growth for the two years from 1994 to 1996 across all fifteen companies was 121 percent which is almost 2.5 times the sample annual average of 48.7 percent (Table 7-8). Employment grew by 92 percent per annum on average.

The high turnover growth companies (A, B, C, D, E, F, H, I, J and M) had growth rates ranging from 27 percent to an impressive 400 percent! The medium growth company (L) achieved 15 percent. The two companies showing negative trends (G and K) declined by 66 percent and 11 percent respectively. Companies N and O were established after 1996.

8.1.5 Growth Orientation

Table 8-5 Growth Orientation of Companies

<table>
<thead>
<tr>
<th>Company</th>
<th>Growth Orientation</th>
<th>Last 3 years</th>
<th>Next 3 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>GO</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>B</td>
<td>GO</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>C</td>
<td>FGO</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>D</td>
<td>GO</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>E</td>
<td>GO</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>F</td>
<td>GO</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>G</td>
<td>GO</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>H</td>
<td>GO</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>I</td>
<td>GO</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>J</td>
<td>GO</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>K</td>
<td>GO</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>L</td>
<td>GO</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>M</td>
<td>RGO</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>N</td>
<td>RGO</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>O</td>
<td>FGO</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Note:
✓ Yes
X No

GO: Growth Oriented
RGO: Recent Growth Oriented
FGO: Future Growth Oriented
Interviewees were asked to state whether they had carried out investment in process improvements (new buildings and/or machinery) or product innovations over the past three years, and questioned about their plans for the future. If the responses were positive in either category for both past and future time periods, the firm was classed as 'growth oriented' (GO). Eleven firms are in this category (Table 8-5). Companies that had achieved process or product innovation over the last three years, but had no plans to do so in future are referred to as recent growth oriented (RGO) companies (M and N). Firms C and O are classed as future growth oriented (FGO) companies, as they had not conducted investment or innovation in the past, but intend to invest in process and product innovation over the next three years.

Table 8-6 Growth Achieved by Firms

<table>
<thead>
<tr>
<th>Company</th>
<th>Past Growth Achieved</th>
<th>Productivity Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Turnover</td>
<td>Employment</td>
</tr>
<tr>
<td>B</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>C</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>D</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>F</td>
<td>High</td>
<td>Declining</td>
</tr>
<tr>
<td>I</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>M</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>L</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>A</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>E</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>G</td>
<td>Declining</td>
<td>High</td>
</tr>
<tr>
<td>J</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>K</td>
<td>Declining</td>
<td>High</td>
</tr>
<tr>
<td>H</td>
<td>High</td>
<td>N/A</td>
</tr>
<tr>
<td>N</td>
<td>Start-up</td>
<td>Start-up</td>
</tr>
<tr>
<td>O</td>
<td>Start-up</td>
<td>Start-up</td>
</tr>
</tbody>
</table>

The rationale for the calculation of turnover and employment growth rates was set out in Section 5.2, Chapter Five.

Section 7.1.3 highlighted the important issue of productivity growth (and also see Section 4.3, Chapter Four). This factor indicates the level of investment in technology and reflects the competitiveness of a firm (Barkham et al., 1996b).
Productivity growth also affirms that the skills base of a company is increasing. A company will suffer a decline in productivity when employment growth exceeds turnover growth. Table 8-6 shows that seven companies (B, C, D, F, I, L and M) achieved productivity gains. The growth orientation of these companies does not appear to have a great influence on the productivity achieved. By contrast, companies A, E, G, J and K experienced negative productivity growth; not unexpectedly, two of them (G and K), had also suffered from declining sales.

According to Oakey et al. (1988), increases in sales for subcontracting firms (Companies A, D, F, J, E and H) will normally lead to the employment of additional workers. Companies D and F had managed to improve productivity, whereas A, E and J had not done so. The recent profile of Company J, in particular, confirms that subcontracting firms can be labour intensive. Over the period 1994-6, Company J (Table 8-7) recruited rapidly and also invested in new technology. However, demand was not as high as anticipated, and it was vital for Company J to place emphasis on upgrading skills in the face of falling productivity. Table 8-7 indicates that the situation improved over 1997 - demand soared and investments in technology and human resources started to pay off (Arnold and Dennis, 1996).

Table 8-7 Company J: Annual Turnover and Employment Growth (1994-1997)

<table>
<thead>
<tr>
<th>Year</th>
<th>Turnover (RM million)</th>
<th>Employment</th>
<th>Turnover growth rate</th>
<th>Employment growth rate</th>
<th>Productivity Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>3.8</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>Negative</td>
</tr>
<tr>
<td>1995</td>
<td>5.8</td>
<td>120</td>
<td>53%</td>
<td>100%</td>
<td>Negative</td>
</tr>
<tr>
<td>1996</td>
<td>6.5</td>
<td>250</td>
<td>12%</td>
<td>108%</td>
<td>Negative</td>
</tr>
<tr>
<td>1997</td>
<td>10.9</td>
<td>350</td>
<td>67%</td>
<td>40%</td>
<td>Positive</td>
</tr>
</tbody>
</table>

8.2 RESEARCH FINDINGS

8.2.1 Growth Constraints

As outlined in Chapter Seven, respondents were asked to rank (on a scale of 1 to 4) thirteen constraints that might hinder growth. The rankings were normalised by averaging the rank score for all constraints. The mean score ranking for all constraints was 2.5. Using 2.5 as cut off point, the questionnaire survey revealed the following
major constraints: lack of finance for expansion; poor quality of labour; lack of management time to develop new products and markets; shortage of labour; inadequate information on product technology; a lack of demand; and inadequate information on developments in process technology. These constraints can be grouped into four major categories, relating to finance, labour, demand and innovation.

It should be noted that five of the above constraints (except inadequate information on product technology and inadequate information on developments in process technology) featured in Barkham et al. (1996a). This indicates that cultural differences between my respondents and those in the Barkham et al. study do not appear to have a significant influence on the findings.

However, the questionnaire survey yielded little information on why and how these constraints affect growth, and what has, or can be done, to overcome these barriers. The analysis here provides a more detailed evaluation of the problems encountered.

**8.2.1.1 Availability of finance**

As discussed in the literature review, HTSMEs require sufficient financial resources to fund R&D and innovation activity (Houston, 1998), and to cover operating costs (Calori, 1985; Willard and Cooper, 1985; Smith and Cooper, 1988; Ryne, 1990). The importance of finance was confirmed by my questionnaire responses. In the case studies, interviewees were asked to indicate sources of external and internal financing—see Table 8-8.
**Table 8-8 Sources of Financing for Expansion**

<table>
<thead>
<tr>
<th>Company</th>
<th>External Sources of Financing</th>
<th>Internal Sources of Financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Commercial banks (Islamic financing)</td>
<td>Major shareholder</td>
</tr>
<tr>
<td>C</td>
<td>Commercial banks (Islamic financing)</td>
<td>Major shareholder</td>
</tr>
<tr>
<td>H</td>
<td>Commercial bank</td>
<td>Parent comp. &amp; major shareholder</td>
</tr>
<tr>
<td>I</td>
<td>Commercial banks, Finance companies, Merchant banks &amp; VCC</td>
<td>Major shareholder &amp; retention of profits</td>
</tr>
<tr>
<td>J</td>
<td>MIDF, ASEAN sources, PUNB venture capital &amp; Commercial banks</td>
<td>Parent comp. &amp; major shareholder</td>
</tr>
<tr>
<td>K</td>
<td>Commercial banks</td>
<td>Major shareholder &amp; retention of profits</td>
</tr>
<tr>
<td>L</td>
<td>Development Bank</td>
<td>Parent comp. &amp; major shareholder</td>
</tr>
<tr>
<td>M</td>
<td>Commercial banks (Islamic financing) &amp; Merchant banks</td>
<td>Major shareholder &amp; retention of profits</td>
</tr>
<tr>
<td>O</td>
<td>IGS Fund</td>
<td>Nil</td>
</tr>
<tr>
<td>A</td>
<td>Nil</td>
<td>Major shareholder</td>
</tr>
<tr>
<td>E</td>
<td>Nil</td>
<td>Parent comp. &amp; retention of profits</td>
</tr>
<tr>
<td>F</td>
<td>Nil</td>
<td>Parent comp. &amp; retention of profits</td>
</tr>
<tr>
<td>G</td>
<td>Nil</td>
<td>Parent company</td>
</tr>
<tr>
<td>D</td>
<td>PUNB venture capital &amp; Commercial bank (BDF)</td>
<td>Major shareholder &amp; own savings</td>
</tr>
<tr>
<td>N</td>
<td>PUNB Nomura (VCC)</td>
<td>Major shareholder &amp; own savings</td>
</tr>
</tbody>
</table>

### 8.2.1.2 Sources of Finance

Table 8-8 shows that firms rely on both internal and external sources for financing their expansion. As discussed in Chapter Four, HTSMEs often turn to banks, especially at the initial stage, as a source of external finance (Houston, 1998). In eight cases (Companies B, C, D, H, I, J, K and M), commercial banks are major sources of external financing. Other sources include merchant banks (I and M), venture capital companies (I and N) and Government agencies such as the PUNB (D and N), MIDF (J) and the IGS Fund (O). Table 8-8 also highlights the importance of Islamic financing, as three companies (A, C and M) chose to utilise Islamic facilities from commercial banks. Internal sources of financing include internal equity (principally finance from the shareholders or retention of profits) and financial backing from the parent company.

The most common facilities offered by commercial banks were overdrafts and short-term loans, i.e., short-term financing commitments. This is consistent with findings by Houston (1998). Somewhat to my surprise, the interviewees even regarded venture capital funding and Government grants as relatively short-term in nature. This
seems a dangerous strategy, as HTSME investments are high risk, with payback periods that may be longer than three to five years (Oakey, 1997).

Company D illustrates how short-term finance can hinder the development of an HTSME. That Company started developing a spiral wound gasket in 1993, with 30 percent of the funding coming from the OM’s savings, 30 percent from PUNB, and the remaining 40 percent from the Bumiputra Development Fund (BDF) offered through a commercial bank. However, by early 1995, production of the product was still delayed and PUNB was extremely reluctant to provide further funding to a project it perceived as non-viable. The OM had to borrow from family members and friends. When the first product was successfully completed, the company managed to secure a contract from PETRONAS, Malaysia’s largest oil company. Company D was able to break even just one year after launching the first product.

The heavy reliance on commercial banks generally reflects good relations with those institutions and a successful track record in repaying borrowing. There are also difficulties in getting funds (debt and/or equity) from other sources. Company C approached Bank Industri, a major development bank in Malaysia, but found that its SME Fund has been exhausted. Company C then applied for ITAF 1 funding but was awarded only a nominal amount, insufficient for its purposes. It therefore declined to take up this offer. Company B relies on commercial banks, because finance companies charge higher interest rates.

The sample companies are generally not attractive to merchant banks, as these institutions concentrate on large facilities with the prospect of substantial returns. However, two companies (I and M) had used merchant banks to finalise a funding package. The merchant banks also offer specialist financial advice.

Another potential source of finance is venture capital. HTSMEs refused bank funding should, in theory, be able to approach venture capital companies (VCCs) to obtain long-term, equity-based funding (Boocock, 1996). Five companies (B, D, I, J and N) had approached VCCs for funding. Company B’s request was turned down, although the VCC had previously shown some interest in the venture. Company B
suspected that the VCC was not convinced of its profit forecasts, even though the company achieved its target sales. The development of Company D’s first product was 30 percent financed by a PUNB loan. PUNB also provided a RM3m loan to finance Company J’s start-up, and Company N received RM10m from PUNB Nomura in the form of loan stock, to finance the purchase of its computer hardware.

However, it has to be acknowledged that PUNB is not a genuine VCC. It is a Government agency providing assistance and support to Bumiputra entrepreneurs. Although it does provide limited financial support (including seed money to start-up companies), a number of interviewees felt that PUNB has a hidden political agenda and only assists companies with strong political connections. Furthermore, PUNB does not meet the criteria for a VCC discussed in Chapter Four: long-term financing (Busenitz et al., 1997; Houston, 1998); and direct involvement in the operations and strategy of investee companies (MacVicar and Throne, 1992; Boocock and Woods, 1996). Company D’s experience above demonstrates PUNB’s short-term orientation.

Company N, by contrast, received funding from PUNB Nomura, a much more commercially-oriented partnership between PUNB and a private sector institution. This injection of funds is much more akin to VC finance found in countries where VC is more established.
My case studies also confirm that subsidiary companies rely heavily on the parent company not just for funding, but also for financial advice (Table 8-9). Most of the parent companies are MNCs with a vast amount of funds to support long term R&D or new product development. In the case of Company E, the parent company, a well-established chemical company with a group turnover of RM568 million, provides financing and also appropriate technology. Company F relies upon its parent company for funding, and it has refused assistance from a syndicate of banks. Company G’s parent company is the largest telecommunications conglomerate in Malaysia, with ample financial resources and a vast R&D network at its disposal. The parent company enabled Company G to conduct significant investment in R&D to develop its first product in 1993.

It is not always the case, however, that subsidiary companies rely entirely upon the parent company for funding. Although Company H is a subsidiary to a large MNC, the company is exploring research funding with the IGS to develop local technology in optoelectronics. Company L receives advances from its holding company for trade
financing and other needs, yet it has also received a RM3m term loan from Bank Pembangunan.

### 8.2.1.3 Refused Funding for Expansion

<table>
<thead>
<tr>
<th>Company</th>
<th>Growth Orientation</th>
<th>Refused Funding?</th>
<th>Reasons for Refusal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>GO</td>
<td>No</td>
<td>Not Applicable (N/A)</td>
</tr>
<tr>
<td>E</td>
<td>GO</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>F</td>
<td>GO</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>G</td>
<td>GO</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>H</td>
<td>GO</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>I</td>
<td>GO</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>J</td>
<td>GO</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>L</td>
<td>GO</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>M</td>
<td>RGO</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>O</td>
<td>FGO</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>B</td>
<td>GO</td>
<td>Yes</td>
<td>Development Bank did not approve facilities sought &amp; VC funding turned down owing to project deemed no viable</td>
</tr>
<tr>
<td>C</td>
<td>FGO</td>
<td>Yes</td>
<td>Not given full amount by Bank Pembangunan &amp; Company C declined nominal amount offered</td>
</tr>
<tr>
<td>D</td>
<td>GO</td>
<td>Yes</td>
<td>Project not judged to be viable by PUNB</td>
</tr>
<tr>
<td>K</td>
<td>GO</td>
<td>Yes</td>
<td>Project not judged to be viable by PUNB</td>
</tr>
<tr>
<td>N</td>
<td>RGO</td>
<td>Yes</td>
<td>Project not considered as technology-based by IGS</td>
</tr>
</tbody>
</table>

The next stage of the analysis was to determine whether the companies interviewed had been refused funding and, if so, for what reason. My purpose was to assess whether financing problems stemmed from market failure or legitimate decisions by financiers. According to Aston Business School (1991), market failure refers to a refusal to finance a project for reasons other than its commercial viability. An example of market failure might be a potentially viable project that is refused because the firm lacks a track record or has insufficient security to offer. Of the 15 case study companies, Companies B, C, D, K, and N had been refused funding (Table 8-10).

The ‘refused’ category includes the project being considered not viable, not meeting the requirements of the Fund, or approving only part of the amount sought. One surprising finding in Table 8-10 is that a lack of collateral did not appear to be an
explicit problem, contrary to the findings of Bachher and Guild (1996), Murray (1996) and M. Hassan and Boocock (1997). This point is explored below.

The case of Company B reveals inconsistencies in the information provided by a development bank. Company B approached Bank Pembangunan to access its Special Development Fund. The Bank advised Company B to submit an application for RM2m. However, the application was rejected, without giving any specific reason. On further enquiry, Company B was told that Bank Pembangunan did not offer such facilities to HTSMEs. The Bank's officials were clearly not well versed in the facilities available. Company B also applied for funding from a VCC, but was turned down, as the project was not considered viable.

Company C applied for RM22,000 from the ITAF 1 Scheme (Consultancy Service Scheme - Appendix 2-4) managed by Bank Pembangunan. However, it was awarded only RM6,000. No explanation was forthcoming from the Bank. The amount was insufficient to purchase specialised computer software and provide appropriate training for its workforce.

Company N's application to the IGS Fund to develop its virtual marketing concept was rejected as not complying with the Fund's investment criteria. On further enquiry, Company N was told that its IT project was not technology-based! When Company N forwarded the same application to the Multimedia Development Corporation, the application was again rejected, this time on the grounds that it was not R&D-based or the subject of a self-contained project. Both of these refusals might indicate a bias against the service sector.

As stated above Company D was refused credit facilities by PUNB, because the project was not considered viable. Company K was refused funding by PUNB for the same reason. However, the interviewee from Company K argued that both the banks and government agencies are incapable of evaluating the commercial potential of a project, confirming Houston (1998). Company K clearly felt that its application was unfairly rejected. The interviewee complained that the banks and government agencies lack technical or entrepreneurial expertise and adopt a 'wait and see' attitude.
to R&D ventures. In other words, banks provide funding to high technology ventures only when sales start to take off and the product shows encouraging returns. This would equate to the post conception/start-up phase.

In summary, the case studies reveal that firms rely on both internal and external sources of financing. Bank finance is prevalent, and the most common facilities offered by commercial banks are overdrafts and short-term loans. Parent company support is also available. However, market failure does seem to be present, as market participants turned down propositions (Companies B, C and N) for reasons other than perceived commercial viability. There is no excuse for failing to provide correct information on facilities available, or offer an adequate explanation of why a project is refused funding. Although a lack of collateral was not mentioned explicitly as a problem, the literature suggests that the increased risk stemming from a lack of security might be the ‘real’ reason for refusing to supply funds to Companies C, D and K.

The evidence from the questionnaire responses seems clear-cut - there is a lack of finance for HTSMEs in Malaysia. However, the evidence from the case studies is not conclusive. Most firms have obtained finance from internal or private sector sources, with an important contribution from Government bodies. This apparent paradox was also present in a UK study conducted by the UCSBRC, 1992; firms responding to a questionnaire claimed that finance was a major problem, whereas follow-up interviews failed to confirm this finding - firms could generally find finance from somewhere. The case studies discussed here might not be representative of the underlying population - perhaps they are more established and hence less risky, or there are too many subsidiary companies that distort the true picture. While there is no evidence of a ‘credit crunch’ (insufficient supply to meet legitimate demands for finance), there are certainly cases where the financial market does not function effectively and efficiently - leaving HTSMEs to face a frustration in their search for funding.
At this stage, Proposition 1 (HTSMEs encounter financing constraints because of a lack of funds from the financial system) cannot be substantiated by the evidence gathered from the case studies.

8.2.1.4 Labour Problems

The questionnaire responses identified two major constraints faced by HTSMEs in relation to their employees: shortages of labour; and the poor quality of (potential) employees. In practice, these problems are difficult to separate. For example, Aston Business School (1991) found that the main problem experienced by SMEs in the UK was an inability to recruit skilled workers.

My case studies also reveal that the majority of companies had experienced problems in recruiting sufficient numbers of staff. Figure 8-2 and Table 8-11 suggest that most companies experienced labour shortages owing to the market’s inability to supply skilled labour. With the exception of Company H, all these companies are located in the Klang Valley. Over the period of this study, Malaysia was experiencing high economic growth and the Klang Valley was the fastest growing area in the country. A number of major projects had mushroomed within this area, including the Kuala Lumpur International Airport and the PETRONAS twin towers, both highly labour-intensive projects.
Shortages of skilled workers in the labour market have undoubtedly led to an increase in the cost of acquiring and retaining skilled workers. This may pose serious problems to HTSMEs with limited funds at their disposal. Table 8-11 reveals that four companies (M, K, N, and N) agree there is a shortage of skilled workers in the market and are unable to pay market wage rates. A quick check back to Table 8-10 confirms that Companies B, K and N have been refused funding by a number of financial institutions. Thus, they have had to resort to internal sources of funding which limits their ability to pay the market rate for skilled workers. Moreover, Company N’s inability to pay the market rate stems from its cashflow problems (refer to Appendix 8-1). Given the financial constraints experienced by HTSMEs, one might have expected an inability to pay premium salaries to be more of a problem. However, the previous sub-section suggests that growth-oriented HTSMEs can usually tap funding sources, and the marginal additional cost of enhanced salaries for skilled workers does not seem to constitute a general constraint in Malaysia.
Concentrating on the problems of labour shortages, Table 8-12 shows that four firms chose to bring in workers from neighbouring countries, especially Indonesia and the Philippines. However, this policy has not always been successful; my case study interviewees explained that the imported workers often lack basic skills and require time for training. They generally have a low educational background, and are unable to speak or understand English.

Table 8-12 Sources of Labour

<table>
<thead>
<tr>
<th>Company</th>
<th>Sources of Labour</th>
<th>Skilled</th>
<th>Unskilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Universities &amp; local training institute</td>
<td></td>
<td>Open market</td>
</tr>
<tr>
<td>B</td>
<td>Open market</td>
<td>Workers from neighbouring countries</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Open market, families and personal contacts</td>
<td>Open market, families/personal contacts and workers from neighbouring countries.</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Open market</td>
<td>Surrounding areas</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Open market</td>
<td>Open market</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Open market</td>
<td>Open market &amp; Workers from neighbouring countries</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Expatriates from overseas countries such as India</td>
<td>Open market</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Informal training and open market</td>
<td>Contract out to employment companies and open market</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Open market</td>
<td>Workers from neighbouring countries</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>Open market</td>
<td>Open market</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>Local universities</td>
<td>Open market</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>In-house training</td>
<td>Open market</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Open market and local universities</td>
<td>Open market</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>Open market &amp; training programme with university students</td>
<td>Open market</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>Local &amp; Australian universities</td>
<td>Open market</td>
<td></td>
</tr>
</tbody>
</table>

Four companies (A, D, I, O) had not experienced labour shortages. These are all smaller companies, ranging from 8 to 60 employees. Company A is a manufacturing company that benefits from a continuous flow of students undergoing
industrial training. Most of these students are employed as engineers after completing their studies. Companies D and I are situated in an area with an ample supply of both skilled and unskilled workers. Company O had not yet begun production, but it did not anticipate any recruitment problems because of the links with universities.

Section 4.5.2 emphasised the importance of private sector involvement in achieving a skilled workforce. Table 8-12 shows that only one of the 15 case study companies provides in-house training, although a significant minority have training links with local universities. The findings in Table 8-12 are based on a small sample, but, with the questionnaire responses, they do suggest that Malaysia needs to review its existing skills training. The specialised demands of HTSMEs have direct implications for their training and human resources policies (Breheny et al., 1985). However, with limited funds at their disposal, many HTSMEs may not be able to offer specialised training. Furthermore, the 7MP approach, discussed in Section 2.2.4, seeks to enhance skills training by granting financial assistance to large corporations rather than HTSMEs. This is supported by discussions with a key informant from MITI.

Table 8-12 also indicates that university graduates are a major source of skilled manpower. However, as pointed out in Section 4.5.2, the technical orientation of Malaysian students at university level is still low compared to other developing countries (Young and Kiat, 1996). Furthermore, local universities have, historically, not been able to meet the demand for engineers in Malaysia. Towards the end of the 7MP period there was a shortage of approximately 7,300 engineers in Malaysia (Malaysia, 1999a).

Given the current shortages confirmed by this study, it would certainly be difficult for Malaysia to achieve the acknowledged PSEE level for a high technology industry, as defined in Section 3.2.3. It is very important for the Government to address the shortage of skilled manpower, because a failure to tackle this problem will surely lead to other constraints. For example, my interviewees argued that many HTSMEs were hindered in their plans to innovate because skilled human resources were not available. Chapter Four (Section 4.5.2) discussed at great length the problems stemming from shortages of skilled labour. When there is a shortage of
skilled workers OMs have to defer development of new products or services. Furthermore, to attract and retain skilled labour, HTSMEs have to pay higher salaries, leading to an increase in production costs. Three case companies were not able to pay current market rates for skilled labour. However, I am convinced that, even if funds had been available to these firms, they would still have encountered skilled labour shortages, as there is just not enough skilled labour in the market.

Overall, my case studies indicate that larger HTSMEs are more likely to experience labour shortages than smaller ones, especially where there is a strong growth orientation. Whatever the size of the firm, the experience of case study firms in recruiting unskilled labour suggests that the market for less educated workers generally functions effectively.

On balance, Proposition 2 (Labour constraints among HTSMEs stem from a shortage of skilled workers in the labour market) is substantiated by the case studies.

8.2.1.5 Constraints on Product and Process Innovation
As discussed in the literature review, product and process innovation is critical for HTSMEs. The questionnaire responses (Figure 7-5) suggested that a lack of management time, coupled with inadequate information on new product and process technology, were the two most important constraints faced by HTSMEs in their efforts to innovate. This led to the formulation of Proposition Three. However, the interviews conducted for the case studies imply that companies fail to innovate for other reasons, an anomaly that is explained below. This section presents some of the innovation practices of case study companies then examines the ways in which companies have accessed resources to enhance R&D capability or gained the information necessary to underpin R&D activity.

**Current Innovation Practices Among Interviewed Firms**
Table 8-1 summarised the activity of case study companies and Table 8-5 summarised their growth orientation. Using information from Appendix 8-1, some key aspects of their innovation activities are now presented.
Company A has never introduced a single product. As a subcontractor, it relies heavily on its anchor company for new product development. Most of its limited resources have been focused towards training students. Despite these links with local universities, the experience of Company A helps to explain why proximity to a university system is the least important reason for choice of location. According to the interviewee:

As far as new product development is concerned, we have never been approached by any of the academic staff of the University.

Although previously located on a university campus, interaction between the Company and academic staff has been minimal. Faults may lie on both sides; Company A has not approached university staff to ask for assistance, and academic staff may not been proactive or simply had nothing to contribute. However, Company A has just moved its entire production plant to an incubation centre next to the same university, offering the opportunity of access to R&D facilities. Company A plans to produce a Malaysian version of one of the anchor company’s products under its own brand name. However, Company A feels that it now needs to upgrade its production facilities. Thus, it intends to focus on process innovation, by developing its mould-making process.

Company J is also a subcontracting firm. It is a vendor company to several Japanese electronics companies and relies heavily on its anchor companies for new product development. While the anchor companies have guaranteed a market for its products, Company J does have its own in-house R&D team devoted to process innovation. Indeed, the Company has won numerous awards for its efforts to improve its manufacturing processes, including the Quality Achievement and Excellent Entrepreneur Awards awarded by MITI. On the basis of these achievements, Company A plans to develop its own product over the next three years (see Appendix 8-1).

Company D exemplifies the lengthy product development period faced by start-up HTSMEs. As pointed out by Oakey (1995), product development normally
takes three to five years before sales are achieved. Although Company D does not intend to introduce new products over the next three years, it plans to improve the production process of its spiral wound gasket by utilising the latest technology, such as laser cutting machines, to improve precision and quality.

Company K is a good example of a service-based company that fails to comprehend the concept of service innovation. Being an IT company, the OM considers that service-based 'products' are intangible and innovation should take a back seat. The company does not consider developing new services as innovation. Unlike manufactured products, services are simultaneously produced and consumed and this may lead to problems when developing new products (Chan et al., 1998). However, according to Chan et al., innovation is concerned not only with new products, but also with the development of new services and concepts that are critical to a company's growth. Furthermore, service innovation involves a highly systematic approach to the design and manufacture and integration of various pieces and parts (Meyer and DeTore, 1999). The opinion of Company K may therefore be misguided. Government agencies responsible for supporting IT companies, such as MDC and MIMOS, should promote service innovation to such companies.

Companies K and N both encountered a barrier affecting IT companies in Malaysia. Although these companies had introduced new products or processes over the past three years, they cited a lack of computer and software engineers as the major factor that affects innovation. As discussed in Section 2.2.4, Malaysia is facing a shortage of skilled IT workers, especially in system and software development. Without these knowledge-based skills, IT-focused SMEs in Malaysia will not be able to keep pace with foreign competitors in terms of technology and product development.

Company M has been experiencing high growth for the last three years and expects the same results over the next three years. Given this performance, the company sees no reason to deviate from its current approach of providing IT services. The company is not ready to venture into new product or service development because it lacks employees with the highly specialised IT skills required. The
company has invested heavily in employing new programmers and IT technicians for the past three years, but it is unable to pay the market rate to employ the specialised software and computer engineers to expand into new areas. In my judgement, Company M would also have benefited from a programme to develop entrepreneurship skills. These comments also apply to Company O below.

Companies C and O had not undertaken any major innovation over the last three years.

Company C initially acquired the technology to produce equipment for scientific laboratories from a company in New Zealand. After years of manufacturing the standard product, the company was recently able to adapt the technology to local customer needs. It formulated its own design, and materials are also being sourced locally. Currently, the company is focusing on improving and promoting these newly-designed products to its existing customer base, and there are also plans to expand into other markets.

Company O has not conducted major innovation over the last three years because it started out in 1997 as the commercial arm of a local university, offering R&D services. However, it diversified into manufacturing after receiving an IGS grant from the Ministry of Science and Technology. Currently it is working with an Australian University to produce its first product (see Appendix 8-1).

In the interviews for the case study phase of the research programme, none of the participants cited a lack of management time as a reason for the failure to innovate. Innovation is clearly linked to R&D activity. The main problem seems to be a lack of skilled human capital to undertake R&D (Companies K, M and N) or a reliance on the parent company (for example, Company A). Table 8-13 sets out the ways in which case study companies resource their R&D activity. A minority of companies undertake in-house R&D, the majority collaborate or outsource this function.
The measures adopted include: subcontracting R&D to local universities (Company K); using research centres, such as SIRIM (Companies C and D), collaborative research with research organisations such as the Veterinary Research Institute (Company L), and the Rubber Research Institute (Company F); using foreign consultants (Company L); conducting collaborative research with local and foreign universities (Companies L and O respectively); and, establishing links with larger firms such as Telekom Malaysia (Company B) and Microsoft (Company N). This is important information to supplement the questionnaire survey. Although new product ideas may come from the OM, responsibility for turning the idea into a commercially viable product has typically been transferred to another party either by collaboration or contracting out R&D.

**Information and Innovation**

To enable a firm to innovate, a great deal of information is needed on current market developments, new technological developments, the nature and availability of
Government assistance, etc. The questionnaire survey indicated that this lack of information was the second major constraint on innovation faced by HTSMEs. Case study companies were therefore questioned closely about their sources of information, to establish whether they encountered problems in this respect.

Table 8-14 Information for Innovation

<table>
<thead>
<tr>
<th>Company</th>
<th>Growth Orientation</th>
<th>Source of Information on Product &amp; Process Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>GO</td>
<td>Local universities and anchor company</td>
</tr>
<tr>
<td>B</td>
<td>GO</td>
<td>Technology Transfer</td>
</tr>
<tr>
<td>C</td>
<td>FGO</td>
<td>Technology Transfer</td>
</tr>
<tr>
<td>D</td>
<td>GO</td>
<td>Anchor company, circle of manufacturers, internet and machines supplier</td>
</tr>
<tr>
<td>E</td>
<td>GO</td>
<td>Transfer of technology from an Australian company by the parent company</td>
</tr>
<tr>
<td>F</td>
<td>GO</td>
<td>Rubber Research Institute (RRI), supplier and through strategic alliances</td>
</tr>
<tr>
<td>G</td>
<td>GO</td>
<td>Technology transfer, Dun &amp; Bradstreet through its intelligence report, and technology forecasting with partners</td>
</tr>
<tr>
<td>H</td>
<td>GO</td>
<td>Parent company in the USA</td>
</tr>
<tr>
<td>I</td>
<td>GO</td>
<td>Department of Environment (DOE)</td>
</tr>
<tr>
<td>J</td>
<td>GO</td>
<td>Anchor company and machines supplier</td>
</tr>
<tr>
<td>K</td>
<td>GO</td>
<td>Internet, suppliers and partners such as Digital Corporation</td>
</tr>
<tr>
<td>L</td>
<td>GO</td>
<td>Local universities and research centres, foreign consultant, and technology transfer</td>
</tr>
<tr>
<td>M</td>
<td>RGO</td>
<td>Internet, journals and suppliers</td>
</tr>
<tr>
<td>N</td>
<td>RGO</td>
<td>Internet, journals and suppliers</td>
</tr>
<tr>
<td>O</td>
<td>FGO</td>
<td>Foreign University Partner</td>
</tr>
</tbody>
</table>

Table 8-14 reveals that the case study companies have found ways to acquire information on new products and developments in process technology. The sources include: technology transfer (Companies B, C, E and G); suppliers (Companies D, F, J, K, M and N); the Internet (Companies D, K, M and N); strategic alliances (Company F); local universities and research centres (Companies A, F and L); foreign consultants (Company G and L); partners, parent or anchor company (Companies A, D, E, H, K and O); journals (Company M and N); and, Government agencies (Company I).

The Internet and suppliers were the most common sources of information. The former has become a standard element of modern society, with more information
targeted at entrepreneurs (Brown and Wright, 1998). With the improved availability of technical services on the web, entrepreneurs, engineers, and other professionals in Malaysia should be able to gain access to valuable information at a fraction of the former cost. In a competitive environment, suppliers are an increasingly important resource for manufacturers and they can play a significant role in reducing the cost and time-to-market of new products (Handfield et al., 1999). It is worth noting that such information is vital during the ideas generation stage of product development, suppliers can frequently make available new product and process technologies that are critical to the development effort. Through contract or collaborative R&D these ideas can be tested for commercial viability.

The analysis in this section suggests that case study firms have not innovated, and/or will not innovate, for two principal reasons: they suffer from a shortage of skilled human resources; or, they are subcontracting firms. The issue of a lack of management time did not surface directly in the case studies. Harassed OMs might have used the availability of this response on the questionnaire as a ‘catch-all’ reaction to the pressures of running their own company! Likewise, a ‘lack of information’ does not seem to present major problems to the case study participants - various sources of information are available to them. The case studies are generally more established organisations with a stronger network of contacts.

Overall, therefore, the case analysis did not substantiate Proposition 3 (HTSMEs are not able to innovate owing to a lack of management time and a lack of information on product and process information).

8.2.1.6 Demand
The questionnaire survey revealed a ‘lack of demand for major products’ as the fifth-ranked constraint faced by HTSMEs. However, Table 8-15 shows that the opinions of the interviewees are much more diverse on this issue.
Table 8-15  Demand Constraints

<table>
<thead>
<tr>
<th>Company</th>
<th>Growth Orientation</th>
<th>Importance of Demand</th>
<th>Type of Firm</th>
<th>Exporting (% of Sales)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>GO</td>
<td>Not important</td>
<td>PB + SC</td>
<td>80</td>
</tr>
<tr>
<td>J</td>
<td>GO</td>
<td>Not important</td>
<td>SC</td>
<td>80</td>
</tr>
<tr>
<td>F</td>
<td>FGO</td>
<td>Not important</td>
<td>SC</td>
<td>90</td>
</tr>
<tr>
<td>A</td>
<td>GO</td>
<td>Moderately Important</td>
<td>SC</td>
<td>95</td>
</tr>
<tr>
<td>I</td>
<td>GO</td>
<td>Moderately important</td>
<td>PB + SC</td>
<td>95</td>
</tr>
<tr>
<td>B</td>
<td>GO</td>
<td>Moderately important</td>
<td>PB + SVC</td>
<td>No</td>
</tr>
<tr>
<td>C</td>
<td>FGO</td>
<td>Important</td>
<td>PB + SVC</td>
<td>No</td>
</tr>
<tr>
<td>D</td>
<td>GO</td>
<td>Important</td>
<td>SC</td>
<td>No</td>
</tr>
<tr>
<td>E</td>
<td>GO</td>
<td>Moderately important</td>
<td>PB</td>
<td>No</td>
</tr>
<tr>
<td>G</td>
<td>GO</td>
<td>Important</td>
<td>PB + SVC</td>
<td>No</td>
</tr>
<tr>
<td>K</td>
<td>GO</td>
<td>Important</td>
<td>SVC</td>
<td>No</td>
</tr>
<tr>
<td>L</td>
<td>GO</td>
<td>Moderately important</td>
<td>PB</td>
<td>No</td>
</tr>
<tr>
<td>M</td>
<td>RGO</td>
<td>Moderately important</td>
<td>SVC</td>
<td>No</td>
</tr>
<tr>
<td>N</td>
<td>RGO</td>
<td>Very Important</td>
<td>SVC</td>
<td>No</td>
</tr>
<tr>
<td>O</td>
<td>FGO</td>
<td>Not Applicable*</td>
<td>PB + SVC</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

Note

PB: Product Based
SC: Subcontracting
SVC: Service
* Has not started production, only at product development stage

Companies F, H, and J thought that a lack of demand was not affecting their business: F and J are vendor companies, where the market is guaranteed by the anchor company; Company H’s market is assured by its parent company. Companies J and H are Licensed Manufacturing Warehouses (LMWs)\(^1\). Company J exports 100 percent of its products through its anchor company, a MNC from Japan, and Company H exports 90 percent of output through its American parent. With MITI's assistance, Company J is planning to enter the European market. Company F supplies 90 percent of its output to its anchor company, EON (a manufacturer of Proton cars), and exports the remaining 10 percent.

Ten companies cited demand as either 'important' or 'moderately important'. As illustrated by Table 8-15, only two of these companies (A and I) export their products overseas.
Of the non-exporters, Companies D, E and L have definite plans to enter foreign markets. Company D has a secure local market, but sees bigger potential in South Africa and the Middle East. Company E's pharmaceutical products have been widely accepted in Malaysia and it plans to increase exports to the ASEAN countries and the Middle East. It also intends to enter the US, European and the Japanese markets, but faces difficulties owing to the stringent Food and Drug Administration requirements in these countries. Currently, Company L is the sole producer of animal vaccines in Malaysia. Having monopolised the local market, the company wishes to export its vaccines to the US and Europe, but those markets are virtually closed to foreign-based companies.

Company B considers demand as moderately important; it has the competitive advantage of being the sole manufacturer and supplier of electronic security systems to Telekom Malaysia, as well as ongoing projects with other organisations, such as the Multi-Media University and a number of MSC companies. However, as the company expands its product range (see Appendix 8-1) to compete in the open market, demand may then become very important. Overall, Company B demonstrates the defining characteristics of high growth firms, constantly expanding its product range and looking for new market opportunities (Siegel et al., 1993).

Company N, the sole interviewee to categorise demand as 'very important', foresees declining demand for its major product. It is critical to recoup the high initial investment involved in high technology ventures, as discussed in Section 4.2.1. Company N operates and manages a mirror site\(^2\) in the Asian region for a major US search engine. The Company has invested RM13m on computer hardware, including an advanced server and a high-speed digital network. The company has also designed and introduced a Malaysian version of the search engine. However, it has not been generating sufficient revenue from its advertising business because its product is not widely accepted. E-commerce has yet to become established in Malaysia. The company forecasts declining turnover if e-commerce does not pick-up over the next few years. (With the benefit of hindsight, this looks a forlorn hope!) To overcome this constraint, the company is planning to enter regional markets in surrounding ASEAN...
countries, while trying to enhance the use of e-commerce by business enterprises in Malaysia.

Table 8-15 indicates that most firms that do not currently export consider a lack of demand as 'important' (Companies C, D, G and K), 'moderately important' (Companies B, E, L and M) or 'very important (Company N discussed above). However, companies that do sell overseas either do not consider demand as an important factor (Companies H, J and F) or rate this factor as only moderately important (Companies A and I).

The evidence is not strong, but it does point to the fact that exporting HTSMEs face fewer demand constraints. The issue is clouded, however, because the exporters discussed here are mainly subcontracting firms (Table 8-5) whose markets have been guaranteed by the anchor company. Moreover, it is important to note that the interviews were conducted in 1998, when Malaysia was in the midst of the Asian Financial Crisis. During this period, local demand dropped significantly, and only companies with overseas outlets for their products escaped the full impact of the crisis.

The evidence from the questionnaires is quite powerful in support of the proposition, yet demand is less of a concern for the case study companies. This anomaly hints again at differences between the case study companies and the underlying population as a whole. On balance, therefore, it is not possible to substantiate Proposition 4 (HTSMEs encounter demand constraints because they do not export their products).

8.2.2 Government Support
The questionnaire survey (Table 7-13) established that a high percentage of HTSMEs are aware of the existence of some form of Government assistance. However, the number of HTSMEs utilising of Government support is much less extensive. Furthermore, Chapter Seven revealed no significant relationship between the use of government assistance and growth. The case studies now provide an opportunity to probe this issue.
Table 8-16 shows the assistance granted to case study firms. It is interesting to note that, of the ten high turnover growth firms identified in Table 8-6, only four (C, D, F and J) are currently receiving assistance from the Government. (Company B did apply for the Technology Development Programme, but the amount received was nominal and the offer was declined). This indicates that HTSMEs are able to achieve high growth without much Government support.

However, the situation might not always be clear-cut. For example, Company M has been able to achieve excellent growth and the OM sees no need for official assistance. The unknown factor is whether the company might have improved its performance still further with some form of official backing. In my judgement, Company M might be ignoring the fact that other aspects of its high technology operations need to be given attention if the company is to maintain its growth and competitive edge. These factors include innovation, exporting and R&D. Despite rapid growth, the company has not made progress in these three areas because of its inability to pay the market rate for skilled personnel. A number of schemes discussed in Chapter Two could help to remedy this shortfall, for example ITAF 2 and ITAF 4 (Appendix 2-4).

A number of firms had applied for Government assistance but had not been successful. Some of interviewees claimed that most of the advertised assistance for SMEs is purely political hype. In particular, some interviewees felt that only companies with strong political connections were granted assistance. Likewise, some non-Bumiputra interviewees were convinced that any application for Government assistance would be turned down solely on race grounds. In theory, the assistance is open to all entrepreneurs, irrespective of ethnic origin.
<table>
<thead>
<tr>
<th>Company</th>
<th>Growth Orientation</th>
<th>Assistance Currently Received</th>
<th>Unsuccessful/yet to be approved Application</th>
<th>Intend to Apply for Assistance in the Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>GO</td>
<td>None</td>
<td>N/A</td>
<td>None</td>
</tr>
<tr>
<td>B</td>
<td>GO</td>
<td>None</td>
<td>Technology Development Programme</td>
<td>None</td>
</tr>
<tr>
<td>C</td>
<td>FGO</td>
<td>Consultancy Service Scheme</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skill Development/ Upgrading</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Programme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>GO</td>
<td>ITAF 1 and ITAF 2</td>
<td>Credit Guarantee from PUNB</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bumiputra Development Fund</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vendor Development Programme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>GO</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>F</td>
<td>GO</td>
<td>Vendor Development Programme</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>G</td>
<td>GO</td>
<td>None</td>
<td>IRPA Funding MDC Funds</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>GO</td>
<td>None</td>
<td>IGS Fund</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>GO</td>
<td>None</td>
<td>None</td>
<td>Commercialisation of R&amp;D Fund Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Acquisition Fund</td>
</tr>
<tr>
<td>J</td>
<td>GO</td>
<td>Export Development Programme</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vendor Development Programme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>GO</td>
<td>None</td>
<td>ITAF 2</td>
<td>None</td>
</tr>
<tr>
<td>L</td>
<td>GO</td>
<td>None</td>
<td>None</td>
<td>Commercialisation of R&amp;D Fund Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Acquisition Fund</td>
</tr>
<tr>
<td>M</td>
<td>RGO</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>N</td>
<td>RGO</td>
<td>None</td>
<td>MSC</td>
<td>None</td>
</tr>
<tr>
<td>O</td>
<td>FGO</td>
<td>IGS</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On another tack, a number of companies claim that Government assistance is short-term in nature. According to the OM from Company D:

The focus of government assistance is on businesses offering short-term returns. This may reflect the fact that the culture of the Malaysian economy is focused on short-term investment.

If this accusation is true, such an approach is not compatible with the fact that high technology investment involves a long payback period. The statement above is based on Company D's experience with PUNB. Although a number of sample firms expressed the same opinion, it has to be acknowledged that a number of Government
Case Analysis

initiatives are long-term in nature. For example, Pioneer Status offers full tax exemption for high technology companies for a period of five years (see Appendix 3-1). Similarly, funding under the IGS is normally provided for three years, which is probably sufficient time for new products to be commercialised. Furthermore, the payback period for the IGS is 15 years, extremely long-term in nature (see Appendix 2-8).

Despite the misgivings expressed above, a number of firms are intending to apply for Government assistance in future - refer to Table 8-16.

For the purposes of this thesis, it is essential to gauge whether Government funds have been applied effectively. Government assistance in Malaysia comes in a variety of forms. The most direct form of assistance is a grant. Case study firms were asked whether such grants had contributed significantly to any major innovation or expansion projects and whether they would have proceeded with their projects if the grant had not been available - see Table 8-17.

Table 8-17 Contribution of Grants to Innovation/Investment Projects

<table>
<thead>
<tr>
<th>Company</th>
<th>Importance of Grant Currently Received towards Innovation/Expansion Projects</th>
<th>Would Proceed with Project even without Grant</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>B</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>C</td>
<td>Important</td>
<td>Yes</td>
</tr>
<tr>
<td>D</td>
<td>Important</td>
<td>Yes</td>
</tr>
<tr>
<td>E</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>F</td>
<td>Important</td>
<td>Yes</td>
</tr>
<tr>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>H</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>I</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>J</td>
<td>Important</td>
<td>Yes</td>
</tr>
<tr>
<td>K</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>L</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>M</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>N</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>O</td>
<td>Key Element</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note:
N/A: Not Applicable – Innovation activities in these companies are funded by the parent organisation or internal sources, and they have no plans to apply for Government assistance.
One interviewee (Company O) cited grants as a ‘key element’ of its financing package. IGS Funding played a big part in the ongoing developing its first product, although the Company accepts that any further investment hinges on a successful launch of that product. Despite these comments, Company O would have proceeded with its projects, irrespective of any official contribution, as the company has the support of its parent organisation, MTDC (ironically, another Government-backed institution).

Companies C, D, F and J categorise Government grants as important for growth, but intend to proceed with their expansion plans and/or innovation projects irrespective of whether they receive any official assistance. They may seek funding from other sources, such as funds from overseas, possibly an expensive alternative. The aim of Government assistance should be to provide additional finance to that available from the private sector - otherwise Government funding is ‘deadweight’. None of the case study firms were prepared to admit that the plethora of official incentives in Malaysia had affected their plans for growth! This important issue is explored in Chapter Nine.

Another, more indirect, form of assistance by the Malaysian Government to support HTSMEs is the establishment of a high technology infrastructure (see Section 4.5.3), notably Science Parks. According to Monck et al. (1988), governments need to direct additional resources towards such locations, because they enable scientific communities in general (and universities in particular) to forge successful partnerships with the commercial sector. Three companies (G, K, and M) are based on the Technology Park Malaysia (TPM), one (N) is located on the UPM-MTDC Incubation Centre and one (A) on the UTM Technovation Centre. The remaining companies operate from Industrial Estates throughout Peninsular Malaysia; these estates are often built by the Malaysian Government, but the sites are not restricted to HTSMEs.

The facilities available on the Industrial Estates were perceived to be disappointing and, more pertinently for this study, to be inappropriate for high technology companies. For example, Company H operates on a State Development Corporation Industrial Estate in Johor; it complained of constant disruption to the
water supply, vital to meet production needs and to ensure the cleanliness of its plant. Even when the water supply is functioning, the quality is questionable as it tends to be murky. Furthermore, there are no facilities for proper disposal of environmental waste. The local port facilities are also inadequate, forcing the company to despatch its products through Kuala Lumpur International Airport located about 300 kilometres away. In another example, Company J is located on a SME Industrial Estate in a rural area in Selangor. The company faces difficulty in transporting components to its anchor company because the nearest expressway is 30 miles away.

It should be noted, however, that those companies operating on science parks also face numerous problems. The most common complaint relates to the lack of cooperation with local universities, particularly for those companies on TPM. It is ironic that the TPM, a much-trumpeted initiative, has no formal links with any university. Such links are critical for the development of science parks in Malaysia; all science parks in the UK and US have been developed with formal support from the university sector (Monck, 1988). A separate issue is a perceived conflict of interest in respect of the management of TPM. The Park was initially set-up to assist HTSMEs, but its management adopted commercial principles when deciding to team up with a foreign company. The resulting partnership competes directly with some of the companies operating on TPM. Some interviewees expressed the opinion that TPM is not a 'true' science park, but just a property developer leasing out office space to companies. It is extraordinary that tenants on TPM are not permitted to utilise the Resource Centre created by (and for) the TPM management. Such action clearly goes against the basic ethos of a science park proposed by the UK Science Park Association, i.e., to actively engage in the transfer of technology and business skills to the organisations on site (Monck, 1988).

The two companies located on science parks associated with local universities also received little or no assistance from their academic neighbours. Company A is located next door to a university in the extreme South of Malaysia. In one incident, the Company was having difficulty in using newly-purchased computer software in its production process. The Engineering Faculty at the university refused to send in a technician to help. Likewise, Company N approached Universiti Putra Malaysia for
assistance in promoting its IT product, but received no response. In my opinion, it is easy to blame the individuals concerned in these examples for a lack of co-operation, but the fault probably lies in a failure to develop mechanisms for two-way communication and to establish, for example, the requisite financial and legal arrangements for ongoing collaboration.

The case analysis therefore raises many questions about the effectiveness of both direct and indirect forms of Government support. There is evidence that some direct grant sources are either under-utilised, or given to companies that had access to alternative funding options, and the infrastructure support is not universally praised.

8.3 SUMMARY
In-depth interviews, conducted with fifteen HTSMEs, aimed to provide sufficient qualitative data to test propositions on the four major growth constraints identified by the questionnaire survey. As far as possible, the propositions were tested and a summary of the results is shown in Table 8-18 - the labour constraint only was substantiated.

<table>
<thead>
<tr>
<th>Proposition</th>
<th>Constraint</th>
<th>Case Study Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Financing</td>
<td>Unsubstantiated</td>
</tr>
<tr>
<td>2</td>
<td>Labour</td>
<td>Substantiated</td>
</tr>
<tr>
<td>3</td>
<td>Innovation</td>
<td>Unsubstantiated</td>
</tr>
<tr>
<td>4</td>
<td>Demand</td>
<td>Unsubstantiated</td>
</tr>
</tbody>
</table>

Firms rely on both internal and external sources of financing, with the most common facilities being overdrafts and short-term loans offered by commercial banks. Market failure does seem to be present, as propositions were rejected for reasons other than perceived commercial viability. Although a lack of collateral was not mentioned explicitly as a problem, the increased risk stemming from a lack of security might be the ‘real’ reason for refusing to supply funds to certain firms. There was little evidence of a ‘credit crunch’.

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Labour shortages faced by case study companies were mainly due to insufficient skilled workers in the market and companies have been forced to bring in workers from neighbouring countries who are unskilled and untrained. The case studies suggested that larger HTSMEs are more likely to experience labour shortages than smaller ones.

Case study firms have not innovated, and/or will not innovate, for two principal reasons: they suffer from a shortage of skilled human resources; or, they are subcontracting firms. The issue of a lack of management time did not surface directly in the case studies. In addition, a ‘lack of information’ does not seem to present major problems to the case study participants, probably because they are generally more established organisations with a stronger network of contacts and good access to information sources. Most HTSMEs turn to the Internet and suppliers for information on product and process technology.

The evidence was not strong, but exporting HTSMEs seem to face fewer demand constraints. The issue is clouded, however, because the exporters discussed in this Chapter are mainly subcontracting firms whose markets have been guaranteed by the anchor company. Other interviewees had made plans to expand their market overseas.

The case analysis raised a number of questions about the effectiveness of both direct and indirect forms of Government support. There is evidence that some direct grant sources are either under-utilised, or given to companies that had access to alternative funding options, and the infrastructure support is weak.

Notes:

1 An LMW (Licensed Manufacturing Warehouses) can sell no more than 20 percent of its products locally.

2 Mirror Sites are established to dissipate Internet traffic and provide backup copies of Internet databases such as AltaVista and Yahoo (Notes, 1999).
CHAPTER 9

CONCLUSIONS AND RECOMMENDATIONS

9.0 INTRODUCTION

After an introductory chapter, Chapter Two summarised the policies towards, and initiatives introduced to support, SMEs engaged in high technology activity in Malaysia. It was essential to review the definitions of 'SMEs' and 'high technology' (firms and industries) because there are no universally-accepted definitions - this formed the crux of Chapter Three. I adopted a maximum of 250 employees as the cut-off point for defining SMEs. This definition enabled me to expand the number of companies available for study, particularly those involved in high technology activity. The operational definition of high technology industries used elsewhere (based on the proportion of scientists and engineers employed or R&D expenditure in relation to turnover) was impossible to apply in this study. Malaysia utilises a somewhat arbitrary definition of 'high technology' firms as those engaged in government-promoted activities or the production of promoted products (Appendix Two).

The next stage of the literature survey was to identify the factors affecting the growth of HTSMEs (Chapter Four). A theoretical framework was developed to explore the relationship between key factors or variables and the growth of HTSMEs, and thus to generate research hypotheses (Chapter Five). The framework also examines the constraints or barriers that hold back the ability of HTSMEs to grow.

The research methodology combined a questionnaire survey, in-depth interviews to build case studies, and interviews with key informants (Chapter Six). The questionnaire responses provided quantitative data, analysed using bivariate non-parametric analysis in Chapter Seven. Follow-up case studies provided qualitative data on how and why constraints occur, and gave some insights into the methods used to overcome those constraints (Chapter Eight).

Within the overall structure of the thesis, three major themes have been interlinked.
First, HTSMEs can play a vital role in economic and industrial development by creating new jobs, generating wealth and generating R&D spillover benefits. For these reasons, governments across the globe promote high technology activities, especially HTSMEs. To achieve its ambitions of becoming a fully-industrialised nation by 2020, it is imperative that HTSMEs in Malaysia are given every opportunity to grow. However, effective support should address the factors that contribute to the development and growth of HTSMEs.

Second, the pattern of growth in HTSMEs is by no means uniform, hence the usefulness of a number of models was examined. The widely-used 'staged' models imply that businesses pass through various stages as they grow, but it is now accepted that not all HTSMEs go through all the stages. Some firms remain in the same stage throughout their lifetime, while HTSMEs with leading edge technology progress rapidly through the various stages. To present a more comprehensive picture, this study proposed a composite framework of analysis that combines three components - the characteristics of the OM, the firm and the strategy adopted.

Third, the growth rate of HTSMEs can be hindered by a number of constraints or barriers. My study examines how and why such barriers exist, and assesses the effectiveness of some key initiatives by the Malaysian Government to assist HTSMEs to overcome these barriers.

With these three themes in mind, this final chapter summarises the key findings of the research programme conducted for this thesis. The implications of my results are explored for researchers, practitioners and policy makers involved with the high technology sector. The chapter concludes by acknowledging the possible limitations of the study and outlining avenues for future study.

9.1 CONCLUSIONS
The questionnaire survey focused on the factors that determine the growth of HTSMEs in Malaysia, with questions covering three broad areas - the characteristics of the OM and the firm, and the strategy adopted.
9.1.1 Characteristics of the OM

Tables 9-1 confirms that all hypotheses relating to the characteristics of entrepreneur, apart from age, were rejected (except for gender where the result was inconclusive).

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Rejected</td>
</tr>
<tr>
<td>Management experience</td>
<td>Rejected</td>
</tr>
<tr>
<td>Age</td>
<td>Substantiated</td>
</tr>
<tr>
<td>Career history</td>
<td>Rejected</td>
</tr>
<tr>
<td>Gender</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>Ethnic background</td>
<td>Rejected</td>
</tr>
</tbody>
</table>

The majority of questionnaire respondents were male and relatively young, and most had a technical background or education. As stated above, there was evidence of a negative relationship between the age of the OM and growth. The energy and enthusiasm of youth contributed to high growth. It was not unexpected, therefore, that the career history of the OM was negatively correlated to growth. While most OMs had previous experience in the high tech sector, ‘time-serving’ did not lead to higher growth companies. A more surprising outcome was the lack of a significant positive relationship between education and growth. It was probably the case that highly-qualified OMs were associated with larger, older companies – factors that tend to depress growth, as discussed in the next sub-section. It would certainly not be suggested here that MBAs and/or professional qualifications should be discouraged!

More than half of the questionnaire respondents were Bumiputeras, indicating that the New Economic Policy (NEP, Section 2.2.2) has been successful in increasing Bumiputera involvement in the industrial sector. The questionnaire findings revealed that the gap between the performance of Bumiputera/non-Bumiputera companies was narrow. The Chinese community in Malaysia has traditionally been superior in terms of business skills and culture, while the Bumiputeras have shown less interest in starting and developing commercial enterprises. (As argued in Chapter 7, it might have been anticipated that Bumiputera entrepreneurs should have done even better,
given the degree of preferential treatment from official sources). The implication of the ‘race’ finding for policymakers is incorporated in the recommendations below.

### 9.1.2 Characteristics of the Firm

Table 9-2 summarises the empirical results on the characteristics of the firm.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of the firm</td>
<td>Substantiated</td>
</tr>
<tr>
<td>Size of the firm</td>
<td>Substantiated</td>
</tr>
<tr>
<td>Industrial Sectors</td>
<td>Rejected</td>
</tr>
<tr>
<td>Company structure</td>
<td>Rejected</td>
</tr>
<tr>
<td>Location</td>
<td>Rejected</td>
</tr>
</tbody>
</table>

The age of the firm is negatively correlated to growth, confirming that younger firms grow rapidly but slow down in the later stages once the Minimum Efficient Scale has been achieved. Likewise, smaller firms grow more rapidly than their larger counterparts. Apart from seeking to achieve the MES, small firms may be more flexible than larger firms and able to react quickly to changes in the market (Section 4.4.2.3, Chapter Four).

Turning to the rejected hypotheses, there was no significant relationship between company structure and growth. The most probable explanation (put forward in Chapter 7) is that the PLCs in my sample are older and larger than firms of other legal forms. The questionnaire findings did not offer any evidence of significant differences between the electronics and non-electronics sectors in terms of growth.

The location of a business was also not a factor influencing the growth of HTSMEs. This result is one of the most important in the whole thesis, and it was confirmed by the case study analysis. Firms operating on a science park, for example, did not outperform firms located elsewhere. Why? Some companies operating on the Technology Park are relatively new, and the benefits of R&D have not yet come through. Others are IT-based, with IT being an industry still to be fully developed in Malaysia. However, my research programme has enabled me to formulate a number
of recommendations to improve the performance of firms on science parks – see below.

9.1.3 Business Strategy

The final area explored in the questionnaire survey is the relationship between the strategy adopted by HTSMEs in pursuing their goals and growth – refer to Table 9-3.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>External equity</td>
<td>Rejected</td>
</tr>
<tr>
<td>Product innovation</td>
<td>Rejected</td>
</tr>
<tr>
<td>Process innovation</td>
<td>Substantiated</td>
</tr>
<tr>
<td>Market research</td>
<td>Rejected</td>
</tr>
<tr>
<td>Marketing orientation</td>
<td>Rejected</td>
</tr>
<tr>
<td>Government Support</td>
<td>Rejected</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Substantiated</td>
</tr>
</tbody>
</table>

Process innovation was described in Chapter 7 as the driving force behind product innovation (Pisano and Wheelwright, 1995), and the hypothesis relating process innovation to growth was accepted. However, there was no evidence to link product innovation with growth. The sample companies include a considerable number of subcontracting firms that achieve high sales turnover but rely on their anchor company for product innovation. (This finding was confirmed in the case studies). R&D is positively related to growth, although the relationship is not strong.

The other hypotheses relating to strategy were rejected, although my findings did offer some interesting insights to OMs and policy makers. The influence of subcontracting firms seems to have played a part in the rejection of a number of hypotheses, the impact of venture capital is currently only marginal, and firms in receipt of Government support did not appear to achieve high growth. Some of these issues are taken up in the discussion of the case studies below and/or in the recommendations later in this chapter.
9.1.4 Constraints

The questionnaire responses suggested that HTSMEs face constraints across a number of areas: lack of finance for expansion; poor quality and/or shortages of labour; lack of management time to develop new products and markets; inadequate information on new products or developments in process technology; and, a lack of demand. As a consequence, four propositions were formulated for assessment in the case studies.

The questionnaire responses revealed that younger companies, including start-ups, are most affected by a lack of finance. High technology companies invest heavily in R&D, particularly in developing the first product, thus they are exposed to maximum financial stress (Figure 4-2, Chapter Four). The case studies comprise more mature companies, but such firms encounter many of the financial pressures faced by the questionnaire respondents as, for example, they develop new products. The interviews confirmed that the 15 firms utilise both internal and external sources of funding. Bank finance is prevalent, with the most common facilities offered by commercial banks being overdrafts and short-term loans. Parent company support is also available. However, market failure did seem to be present in the financial market, as participants were refused finance for reasons other than perceived commercial viability – as discussed in Chapter 8. Although a lack of collateral was not mentioned explicitly as a problem, the increased risk stemming from a lack of security might be the ‘real’ reason for firms being denied access to finance. The evidence from the questionnaires indicated a definite lack of finance for HTSMEs in Malaysia, yet the case studies did not substantiate such claims. Individual members of financial institutions might be ill-informed on occasions, but there was no evidence of a widespread lack of funds within the financial system as a whole.

The case studies confirmed that venture capital (VC) is not a major player in providing finance to HTSMEs. Government sources of VC do not appear to function as ‘true’ VCCs. The role of private sector VCCs has not taken off as anticipated, despite operating in Malaysia for over a decade (see recommendations below). The case analysis did highlight the importance of Islamic financing, a form of finance that has some features of venture capital, notably the absence of interest and repayments.
linked to profit sharing. Islamic finance may become a major source of financing for Bumiputera HTSMEs in future.

The second most important concern for questionnaire respondents was shortages, or poor quality, of labour. Owing to rapid industrial growth over recent years, Malaysia has been experiencing severe labour shortages. Workers from neighbouring countries have provided a good source of cheap labour, but the level of skills and training are questionable. While there are sufficient unskilled workers to meet employers' demands, the key problem for the country (and for this study of HTSMEs) relates to the lack of skilled manpower. From the questionnaire responses, Advanced Electronics, Biotechnology and Optoelectronics are the sectors most affected (Figure 7-15). My case studies confirmed that skilled manpower is needed to support high technology activities – those firms that brought in workers from (say) Indonesia and the Philippines complained that these employees lack basic skills and require time for training. Thus, the proposition that labour constraints among HTSMEs stem from a shortage of skilled workers in the labour market was substantiated. This is an obvious area for the authorities to address – see recommendations.

The third constraint was concerned with problems relating to product and process innovation. The questionnaire responses suggested that a lack of management time, coupled with inadequate information on new product and process technology, were problematic. This led to the formulation of Proposition Three. However, the interviews conducted for the case studies suggested that companies fail to innovate for other reasons, principally a lack of skilled human capital to conduct R&D, or a reliance on their parent company for new products/processes. None of the participants cited a lack of management time as a reason for the failure to innovate. To counter a lack of information, the Internet and suppliers were the most common solutions. The case study firms had also utilised other sources, including: technology transfer; strategic alliances with other companies; local and foreign universities; and, business and academic journals.
Once again, there was a difference of opinion between questionnaire respondents and the case study interviewees – there was little evidence to substantiate Proposition Three. The recommendations put forward on R&D (see below) are mainly drawn from the experience of the case study firms.

The final constraint faced by HTSMEs responding to the questionnaire was a lack of demand. Proposition Four implied that this might have resulted from a failure by HTSMEs to export their products. The evidence from the case analysis was not strong, but it did support the contention that exporting HTSMEs face fewer demand constraints. The issue was clouded, however, because a number of the case study firms are subcontracting firms whose markets have been guaranteed by the anchor company, hence they were in a better position to weather the storm of the Asian Financial Crisis (that was affecting firms at the time of my research programme). On balance, it was not possible to substantiate Proposition Four.

A crucial concern of this thesis is how the performance of the high technology sector might be enhanced by Government assistance. There is a high level of awareness of initiatives offered by the Malaysian Government, yet the number of HTSMEs utilising that support is much lower. A number of case study firms had applied for Government assistance but had not been successful. Some interviewees claimed that most of the advertised assistance for HTSMEs is purely political hype, or that help is channelled to companies with strong political connections. On the same tack, a number of non-Bumiputra interviewees were convinced that applications for Government assistance were decided solely on race grounds. The evidence in support of such claims is largely anecdotal. However, I did attempt to establish the level of 'deadweight' in the allocation of Government funds. Case study firms were asked whether official funding had been a deciding factor in their investment plans. A number of them categorised Government grants as 'important', but all recipients would have undertaken their expansion plans and/or innovation projects irrespective of the availability of official assistance. This important finding is explored further in the next section.
9.2 RECOMMENDATIONS

On completion of my research programme, and drawing upon the literature in this field, I am convinced that implementing the recommendations set out below could enhance the growth of HTSMEs in Malaysia.

9.2.1 Redefinition of 'High Technology'

The classification of high technology industries in Malaysia was discussed in Chapter 3. The Promotion of Investment Act (PIA) 1986 identified eleven areas of new or emerging technologies, and MITI offers incentives to all companies operating within those industries provided they achieve minimum (and minimal) standards for local R&D expenditure, and the employment of science and technical graduates (Appendix 3-1). There is no reason why Malaysia should follow the standard global criteria for establishing high technology industries – developing countries should always have the opportunity to set priorities in accordance with local needs. However, it is evident that some of the MITI priority products (Appendix 2-2) would not be classified as high technology elsewhere.

I would urge the authorities that it is time for Malaysia to review the industries classed as high technology. It makes sense to target assistance at specific industries; this would reduce inconsistencies and anomalies when deciding which firms qualify for government assistance. However, relevant government agencies do need to formulate a standardised and working definition of high technology industries – a good starting point would be the measures applied elsewhere (the proportion of scientists and engineers, PSEE, and the ratio of R&D expenditure to turnover, RRDET). This would require the collection of more accurate data on a national basis, but such information should be available in the third millennium! The key point is to review and prioritise high technology support. This approach to classifying high technology industries does not, of course, preclude the authorities from assisting other firms to implement new processes or introduce new products if there are economic benefits – the issue of targeting is taken up below.

9.2.2 Improve The Performance of Science/Technology Parks

A clear message from my programme of research is that science or technology parks (including the flagship Technology Park Malaysia - TPM) are not providing an
appropriate level of support to their tenant companies. (The shorthand ‘science park’ is used here to cover all types of technology-based parks). Substantial public funds have been committed to the physical development of such parks in Malaysia, but the on-site management needs to be much more proactive if greater economic and industrial benefits are to be realised. There was evidence of a conflict of interest between ‘landlord’ and tenants (Chapter 8), and many supposed ‘science’ parks are viewed as simply property-based initiatives. Moreover, there is minimal interaction between academia and firms on science parks located near to universities. The potential benefits of interaction between universities and neighbouring companies are perhaps overstated (Oakey, 1996), but the links could surely be strengthened. Overall, the current image of science parks in Malaysia is not prestigious.

Against this background, I would put forward the following recommendations:

i) To improve the image of science parks, from a property-based initiative to a channel by which R&D may be linked to commercial activities, the provision of on-site resources and services should be enhanced. These facilities would include basic business services (IT facilities, some common laboratory space, meeting rooms, etc) and practical assistance on (say) joint ventures, exporting and business development. Such advice could be provided direct, or facilitated by encouraging closer contact between the park tenants and local universities – see point (b) below.

ii) The local universities have a role to play in encouraging the supply of entrepreneurs by establishing Departments of Entrepreneurship or Innovation. The questionnaire survey revealed that most of the OMs (Chapter Seven) were young graduates, technically trained in the field of science and engineering. These individuals may lack key skills such as management, marketing and finance know-how on completion of their university education. The literature review stressed that the OMs’ ability to combine technical and business/entrepreneurial skills is an important factor in the success of HTSMEs. Based on my experience in a Technological University, an Entrepreneurship or Innovation Department could teach the basic entrepreneurial skills at tertiary level, which would assist the OMs to create
Conclusions

and manage growing entrepreneurial ventures. The case studies confirmed that universities in Malaysia have already taken initiatives to promote entrepreneurship among their academic staff by setting up spin-off companies (Companies A and O) and Incubation Centres. The effort could be expanded to include students by introducing modules on, say, new venture development.

The case studies also highlighted the lack of interaction between companies operating on science parks and universities. The Entrepreneurship or Innovation Department could act as an interface to facilitate R&D, technology transfer and the dissemination of new knowledge – from university to industry and vice versa.

iii) The park managements should increase the frequency of contact with their tenants, to gain feedback on what is required. Science park tenant companies are not homogenous and they have a variety of needs. The aim should be for science parks to offer (with Government assistance) an integrated package of support. Apart from the measures outlined above, my research programme suggests that HTSMEs feel constrained by a lack of finance, an inability to conduct R&D, and weaknesses in sales and marketing. The direct or indirect link to a lack of funding is evident. Science parks need to be able to offer appropriate sources of funding 'in-house', or to direct client firms to financial institutions. Proposals to increase the supply of venture capital are given later in this chapter.

iv) The selection policy for science parks has to be clarified – the focus has to be on technology-oriented, growth companies. The questionnaire survey revealed that not all firms currently operating on the science parks are technology-based. The managers of science parks should allow only HTSMEs engaging in R&D to operate within their park. The exception would be if the 'science' park had other objectives, such as encouraging social inclusion (women or ethnic minorities) or developing local communities.
v) The case study interviews highlighted the importance of informal relationships in encouraging and facilitating innovation – steps should be taken to facilitate interaction between tenant companies and to enhance informal social networks. The evidence from my research is that these intangible benefits are not being fully captured.

vi) Steps should be introduced to share good practice between science parks – the level of support given at present is patchy at best! For example, from the case studies, it was found that tenants are not given access to the well-equipped Resource Centre on the TPM! A system of sharing information and/or benchmarking of park management should raise standards. This should, hopefully, create clusters of excellence and broaden the industrial base of regions.

9.2.3 Increase the Output and Quality of Skilled Manpower

The specialised demand for labour of HTSMEs has direct implications for training and human resources development in Malaysia. There are two elements to my recommendations for human resources development, the first relates to the supply of skilled labour available to HTSMEs, and the second deals with the development of entrepreneurial talent.

Malaysia has moved from a labour-intensive, agriculture-based economy to its present state of development. In the 1960s/70s, the attraction of Malaysia was as a low-cost manufacturer of simple consumer electronics under joint-venture or subcontracting arrangements. A key reason for FDI was the assembly and/or testing of semiconductors. Over the years, there has been a gradual upgrade in production processes and efforts to improve the speed and quality of manufacturing (as highlighted by the ‘Manufacturing ++’ Initiative described in Chapter 2). These moves to enhance quality and add value require additional technical know-how and skills to meet the complex demands of a global market. However, this study raises doubts as to the readiness of Malaysia to meet this challenge.
The principal measure of a high technology industry, as stated above, is the proportion of scientists and engineers in the workforce (PSEE). There are some pockets of activity where Malaysia meets international standards; for example, further analysis of the questionnaire data (not shown in the thesis) indicates that both the Aerospace and Software Engineering sectors have PSEE ratios in excess of 40 percent. The ongoing development of the Multimedia Super Corridor (MSC) calls for 17,000 knowledge workers, many of whom will be engineers or IT specialists. The acute shortage of technical skills within the workforce will surely slow down the progress of MSC and constrain the growth of HTSMEs. The situation can only be resolved by a long-term programme whereby schools and colleges encourage students to pursue science-based subjects within the curriculum. Local universities should also increase their intake of science and engineering students. This investment in education will require high investment, but the long-term benefits should more than compensate. In the short-term, Malaysia will obviously have to operate a flexible immigration policy to encourage skilled-workers to migrate to the country to plug the existing gaps in the labour market.

The other recommendation in the field of ‘education’ is for the Government to ensure that the entrepreneurial base is strong enough to lead industrialisation (and high technology activity within that overall aim).

In the new millennium, HTSMEs need entrepreneurial skills to exploit foreign technology and markets to their advantage. The situation in Malaysia is similar to that prevailing in other developing countries; having been a major manufacturer, Malaysia now needs to become more entrepreneurial (especially in the Bumiputera community). The prevalence of FDI has created firms with mature, standardised manufacturing processes, yet the focus for HTSMEs is product/process interfacing and product design and development. There is a role for Government support to provide training programmes in a flexible, convenient form for OMs. If managerial competencies (marketing, finance, etc) are improved within HTSMEs, this frees up time for the important drivers of innovation, notably R&D.
9.2.4 Reviewing Support to HTSMEs

Any government has limited resources for influencing technological progress, and it is important to allocate those resources in a way that maximises the potential economic benefits. The ideal scenario in Malaysia would be for the Government to identify those sectors that are most likely to have a high pay-off in terms of stimulating and sustaining high quality economic growth. (This suggestion would link with the review of the definition of high technology industries). At present, the Government tends to adopt a 'scattergun' approach and my research programme presents evidence of 'deadweight' in the allocation of funds.

The problems involved in trying to 'pick winners' for government assistance are acknowledged, although the profile of high growth companies developed in Chapter 7 might help in this respect. More specifically, the authorities in Malaysia need to review existing support programmes to ensure that the growth of HTSMEs is maximised. Whatever the form of Government assistance, it should be promoted to all HTSMEs, irrespective of ethnic background.

Government schemes tend to become entrenched and 'politically difficult' to withdraw, but I would suggest that there is a need for Malaysia to formulate a coherent overall strategy for R&D support. This programme of research has confirmed that HTSMEs are not all the same. The conditions and mechanisms for supporting added value R&D need to be strengthened. Within this overall framework, I would recommend that the following areas are in need of review: financial assistance for HTSMEs; and, the Vendor Development Programme (VDP).

i) Reviewing Financial Support

I propose that the funding of R&D is in need of urgent review. The principal feature of HTSMEs that sets them apart from 'conventional' firms is the large sums of money spent on R&D. The questionnaire responses suggested that public and private sector funding organisations are reluctant to offer assistance to HTSMEs. The interviews conducted for the case studies did not reveal widespread shortages of finance (possibly because many of the case studies could rely upon parent company support), but there was evidence of some deficiencies in the funding market serving HTSMEs. Some interviewees
claimed that financial institutions lack technical expertise and adopt a 'wait and see' attitude to R&D ventures. For example, Company D sought funding to develop its spiral wound gasket. Its funding agency (the Government-owned PUNB) withdrew funding after a year of product development, only to offer financial assistance when sales started to take off.

The literature review suggested (and this programme of research has confirmed) that the age of HTSMEs is inversely related to growth. Although younger firms grow more rapidly than older HTSMEs, they are more exposed to financial stress (Figure 4-2, Chapter Four) especially before the launching of the first product. At this point R&D costs have been incurred and marketing activity has to be funded, but no sales have been achieved. Therefore, I propose that the Government reviews its financial assistance towards younger and/or smaller HTSMEs. It is evident, for example, that grants awarded to SMEs for product development under ITAF 2 (see Appendix 4) have not been taken up. This Scheme involves matched funding, with the Government contribution being made only after the SME has found cash from its own resources. Such a system increases the financial burden on HTSMEs during the early stages of their existence. One alternative might be to offer a full Government grant, with repayment to come from a royalty on sales.

Although my study did not show any significant relationship between marketing orientation/research and growth, I did discover that many HTSMEs devote limited funds to marketing purposes and that very few conduct market research. Some case study firms (and questionnaire respondents) are subcontractors, and the anchor company performs most marketing activity. However, others spend too much of their limited capital on R&D leaving very little cash for marketing when the product is ready. The Government currently offers little assistance for funding marketing activity or market research (ITAF 2 focuses only on breaking into export markets). I therefore propose that the Government, through its agencies, offers funding to assist HTSMEs in conducting market research and marketing their products.
To underpin all the above proposals, I would support the view of Oakey and Mukhtar (1999) that the way forward is to establish a joint public-private long-term funding body for HTSMEs. Many companies in the US have successfully tapped such sources - fledgling companies are often given capital and backing 'on the strength of an idea' (Jackson, 1999). Alternatively, a scheme that links public support to private finance, on the lines of the UK SMART Scheme (Chapter 3) might be introduced.

Another approach put forward by Oakey and Mukhtar (1999) is a taxation system that is more sensitive to the high front-end R&D costs of HTSMEs. The implementation would be complex, but it should be possible to offer tax relief on R&D over the complete product life cycle (including sales), rather than just the period in which R&D is performed.

Venture capital is another source of funding that is yet to be fully capitalised. The case study analysis confirmed that venture capital funds in Malaysia play a very limited role in financing the growth of HTSMEs. The formal venture capital sector has not developed to any great extent and most SMEs are not aware of the benefits that venture capital can offer. Venture capitalists across the globe (and Malaysia is certainly no exception) are reluctant to invest small sums in start-up or early-stage companies. The Government has entered this arena through government-backed venture funds, for example those administered by MTDC. Other Government bodies (such as PUNB) claim to offer venture capital, but the provision of risk finance is essentially a private sector pursuit. It would be possible to increase the amount allocated to Government-backed venture funds, but the problem would be to support this move with the requisite expertise in fund management. The way forward, in my judgement, is to build private-public sector venture funds, with the private sector providing the fund managers. These individuals have to be able to invest wisely, and then deliver assistance across a range of areas (finance, marketing, technology transfer, and so on) to investee companies.

Any attempts to tackle the funding of HTSMEs have to be underpinned by a consistent definition of R&D within the review of the definition of 'high
technology' firms suggested above. The case studies revealed that subcontracting firms measured R&D in terms of research on processes, while independent HTSMEs focused R&D on product development. I would prefer the definition of R&D to include product and process development right up to the point where the first sales are made (Figure 4-2, Chapter Four). This would also include the cost of marketing new products.

ii) The Vendor Development Programme (VDP)
The VDP started with the implementation of the Proton Car Component Scheme and has been extended to other areas, mainly in low technology sectors, except for the electronics industry. The VDP should now be extended to other high-technology sectors, such as biotechnology and aerospace.

IMP2, instituted in 1996, stressed the importance of using the VDP to promote R&D in product development and process innovation. The Government stated its intention to create the necessary environment and support programmes to promote R&D in SMEs, and the VDP was to be a key part of achieving that aim. However, the case studies reveal that vendor companies rely heavily on their anchor company for both R&D and product/process development.

There are clearly issues of commercial sensitivity in transferring leading edge technology to local subsidiaries, but the maximum gains on FDI and joint ventures will only be achieved if local firms have access to the latest technology. It would be unwise to put strict conditions on FDI. However, incentives could be offered to anchor companies that encourage vendor companies to conduct R&D and innovate. Conducting joint R&D between the anchor and vendor companies could facilitate the growth of local innovation. Alternatively, the anchor company could offer modest funding to local enterprises that show a strong interest in carrying out R&D, with the benefits to be shared by the two parties. Support for foreign-based anchor companies would have to be indirect, as it would be inappropriate to use taxpayers' money to support such companies directly. The anchor companies might be offered, for example, some exemption from import or excise duties.
9.3 LIMITATIONS OF THE STUDY

This study has provided important insights into the factors affecting, and barriers to growth of, HTSMEs. However, the study has a number of limitations, discussed below.

My study involves three research strategies: a mail questionnaire survey; case studies formulated from in-depth interviews; and, interviews with key informants. The biggest drawback with questionnaires is the risk that the questionnaire is delegated to someone not involved in decision making. Therefore, the researcher has to accept the completed questionnaires on faith (Shariff, 2000; Wahab, 1996). It is also possible that respondents give the answers they think the questioner wants to hear.

Furthermore, the survey was conducted at a time when Malaysia was experiencing a serious economic recession. The perceptions of the respondents towards the economy as a whole, and the progress of their firm in particular, would have been influenced by the economic situation. This could have distorted their views on the determinants of, and constraints on, growth. To minimise potential biases, I asked respondents to focus on the situation before the onset of the recession, i.e., from 1994 to 1996. This raises the possibility that memories are subjective and the interpretation of past events might not be entirely accurate.

Turning to the interviews that form the basis of the case studies, it is crucial that an interviewee is prepared to accept the presence of the researcher in the organisation and to relay the relevant information. It proved difficult to obtain full cooperation from certain OMs; Malaysia is a multi-racial, multi-lingual society and there is particular sensitivity in some communities about questions concerned with profit, turnover and the funding of the business. Almost all of the interviewees refused to allow the researcher to tape-record the interview. The researcher thus had to rely on memory and written notes when analysing the information.

As stated on a number of occasions throughout this thesis, the conclusions from the case studies tended to conflict with the questionnaire findings. The researcher had limited access to HTSMEs and there was a preponderance of mature and/or subsidiary firms. The researcher has attempted to explain any anomalies!
In both questionnaires and case studies, some potentially valuable factors were omitted because the researcher was not satisfied that a suitable proxy could be ascertained – ‘motivation’ is a case in point. However, it is acknowledged that some of the factors that remain are subjective; if a respondent suggests that process innovation has taken place, for example, it is difficult to verify whether this is a minor change to existing practice or a genuine innovation. Likewise, some products claimed to be innovative would not turn out (with hindsight) to be commercial successes! In the case studies, the researcher took the opportunity, wherever possible, to ensure that the information given was objectively verified.

Still on the theme of data collection, interviews were conducted with key informants from Government bodies including MTDC, MITI, SIRIM and SMIDEC. The discussions covered a number of sensitive areas, such as the amount of funding allocated to HTSMEs for R&D purposes, and details of companies receiving ITAF grants. However, these organisations are very sensitive to any possible criticism, and it was difficult to obtain co-operation from some individuals. Even where they did agree to be interviewed, they were reluctant to disclose information deemed to be sensitive.

In analysing the data, there is an underlying assumption that high technology companies (and sectors) can be treated the same. Large-scale electronics manufacturing sites carry the same weight in the questionnaire responses as, for example, small, design-intensive producers of intelligent buildings – see following section for further research suggestion.

In testing the hypotheses, nonparametric techniques were used because of the presence of outliers and qualitative variables. In utilising this approach, the outlying cases do not exert undue influence on my results. However, the nonparametric approach does not yield results that are as robust as those obtained from parametric tests. Nonparametric techniques ignore some of the available information, because data values are replaced by ranks.
9.4 FUTURE RESEARCH DIRECTIONS

Building on the present research, there are opportunities for further work, especially on the key issue of profiling the growth of HTSMEs.

A number of variables concerned with business strategy, and the characteristics of the OM and the firm, did not show any significant relationship to growth. However, this study should not be viewed as constituting a total rejection of such variables in explaining the growth of HTSMEs. The present research could serve as a starting point for a more detailed study involving a larger sample of HTSMEs. This might yield a more accurate and comprehensive profile of high growth companies in the underlying population of HTSMEs in Malaysia. The ultimate aim is to enable the Government (and/or the private sector) to channel support to firms that have the potential to succeed, and bring the benefits associated with the high technology sector.

There is also a need for more focused research on certain sectors and issues. The impact of property-based science parks, for example, can only be judged by comparing the performance of science park firms with comparable firms that have not selected a science park environment. More generally, it would be useful to compare the experiences of high tech firms in certain sectors with those operating in others. Likewise, it would be helpful to compare the experiences of subsidiary firms and/or subcontractors with the experiences of independent firms having to develop their own products and markets.

This study has focused on the Malaysian definition of high technology. It would be interesting to assess the growth of high technology firms based on the definition used in developed countries. A study on high technology industry based on the RRDET and PSEE criteria could add significantly to the body of knowledge and provide important information for policy makers in Malaysia.

My analysis of the constraints that impede the growth of HTSMEs is very much at an exploratory level because of the relatively modest number of firms involved in this study. For example, my sample did not include companies that are
receiving assistance under ITAF 2, a product development scheme managed by SIRIM. This scheme is aimed at innovative HTSMEs, yet representatives of SIRIM were reluctant to allow these firms to be contacted. I hope that SIRIM (and other bodies such as SMIDEC) will adopt a more open and transparent approach towards research opportunities in future.

The previous section has highlighted deficiencies in the provision of Government support for HTSMEs. The authorities should commission research to establish the extent to which its support is truly additional, rather than simply giving assistance to firms that would have invested or expanded anyway. If under-utilised schemes are found to be effective, they should be promoted more strongly; if schemes are judged to be ineffective, they should be scrapped. Even a 'rough and ready' research programme should enable the Government to rationalise its initiatives significantly and present a more coherent portfolio of support to HTSMEs.

Finally, as acknowledged at the outset in Chapter 1, the impact of each of the factors in this study on growth is studied independently. According to Storey (1994b), if all elements could be simultaneously included in a single study, a more accurate picture would emerge of the relative impact of these elements on growth. A real challenge for a future PhD student is to tackle such an assignment, using multivariate statistical analysis.
References


Asian Development Bank (1990), Study on Small and Medium Enterprise with Special Reference to Technology Development, Programs Department (East), Asian Development Bank, unpublished working paper.


References


Brown, F. (1991), *High Technology Firms, Higher Education Institutions, and Science Parks in the United Kingdom*, Centre for Regional Economic and Social Research, Sheffield Hallam University, Sheffield.


Cringely, R. X. (July 1997), High-tech Wealth, Forbes, pp. 296-308.


References

Donath, B. (1997), Marketers of Technology make Promises They Can't Keep, Marketing News, Vol. 31, No. 21, p. 5.


Einhorn, B. (1999), The Casualties Lying Along the Super Corridor, Business Week, 26 March, p. 86.


Freeman, C. (1984), The Role of Technical Change in National Economic Development, Paper presented, Workshop on Regional Perspective on Technological Change, Small Firms and Employment, University of Newcastle Upon Tyne, Centre for Urban and Regional Development Studies.


References


References


Kinsella, R. P., Clarke, W., Coyne, D., Mulvenna, D. and Storey, D. J. (1993), Fast Growth Firms and Selectivity, Irish Management Institute, Dublin.


Kulicke, M. (1986), New Technology Based Firms, in New Technology Based Firms in Britain and Germany, Anglo German Foundation.


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Malaysia (1986), The Industrial Master Plan, Malaysian Industrial Development Authority (MIDA), Kuala Lumpur.


Malaysia (1996b), Seventh Malaysia Plan 1996-2000, Economic Planning Unit, Prime Minister’s Department, Kuala Lumpur.


Malaysia (1996d), Shaping the National Competency in High Technology Through Partnership, MIGHT, Prime Minister Department, Kuala Lumpur.


Morse, J. M. (1991), Approaches to Qualitative-Quantitative Methodological Triangulation, Nursing Research, Vol. 40, No. 1, pp. 120-123.


Neuman, W. L. (1997), *Qualitative and Quantitative Approaches*, Allyn and Bacon, Boston.


References


References


References


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Appendix 2-1

The Industrial Co-ordination Act 1975
The objective of the Industrial Co-ordination Act 1975 (ICA) is to ensure orderly development and growth in the manufacturing sector. The ICA requires person(s) engaging in any manufacturing activity to obtain a licence from the Licensing Officer in respect of such manufacturing activity. Only manufacturing companies with shareholders’ funds of RM2.5 million and above or engaging 75 or more full-time employees need to apply for a licence under the ICA.

All applications for manufacturing licences should be made in the prescribed form to the Director-General of the Malaysian Industrial Development Authority (MIDA) in Kuala Lumpur, Malaysia. MIDA, is the Government’s principal agency for the promotion and coordination of industrial development in Malaysia.

The relevant definitions in the ICA are as follows:

The “Licensing Officer” is the Secretary-General of the Ministry of International Trade and Industry (MITI).

“Manufacturing activity” means the making, altering, blending, ornamenting, finishing or otherwise treating or adapting any article or substance with a view to its use, sale, transport, delivery or disposal and includes the assembly of parts and ship repairing but shall not include any activity normally associated with retail or wholesale trade.

“Shareholders’ funds” means the aggregate amount of a company’s paid-up capital (in respect of preference shares and ordinary shares and not including any amount in respect of bonus shares to the extent they were issued out of capital reserve created by revaluation of fixed assets), reserves (other than any capital reserve which was created by revaluation of fixed assets and provisions for depreciation, renewals or
replacements and diminution in value of assets), balance of share premium account (not including any amount credited therein at the instance of issuing bonus shares at premium out of capital reserve by revaluation of fixed assets) and balance of profit and loss appropriation account.

“Full-time paid employees” means all persons normally working in the establishment for at least six hours a day and at least 20 days a month for 12 months during the year and who receive a salary. Persons such as travelling sales, engineering, maintenance and repair personnel, or who are paid by and are under the control of the establishment, are also included. Full-time paid employees also include directors of incorporated enterprises except those paid solely for the attendance at Board of Directors meetings. Family workers who receive regular salaries or allowances and who contribute to the Employees Provident Fund (EPF) or other superannuation funds are also included in the definition.
Appendix 2-2

List of Promoted Activities and Products for High Technology Companies
List of Promoted Activities and Products for High Technology Companies under the Promotion of Investments Act 1986

This list of promoted activities and products is gazetted under the Gazette Notification No. P.U. (A)32 dated 4 January, 1995

I. Advanced electronics

1) Design, development and manufacture of:
   a) computer or peripherals
   b) microprocessor application

2) Development and production of communication equipment

3) Design and production of integrated circuits (IC)

II. Equipment/Instrumentation

1) Design, development and manufacture of:
   a) medical equipment
   b) medical implant or devices
   c) scientific equipment

2) Development and production of high pressure water cutting equipment

III. Biotechnology

1) Development, testing and production of:
   a) pharmaceuticals
   b) fine chemicals
   c) food or food ingredients
   d) feed or feed supplements
   e) biodiagnostics

2) Development and production of:
   a) cell cultures
   b) biopolymers
   c) biomaterials

3) Development and production of biotechnology processes for waste treatment
IV. Automation and flexible manufacturing systems

1) Development and production of:
   a) computer process control systems/equipment
   b) process instrumentation
   c) robotic equipment
   d) computer numerical control (CNC) machine tools

V. Electro-optics and non-linear optics

1) Development and production of:
   a) optical lenses
   b) laser application equipment
   c) fibre-optic communication equipment

VI. Advanced materials

1) Application or production of:
   a) polymers or biopolymers
   b) superconductors
   c) fine ceramics or advanced ceramics
   d) High strength composites

VII. Optoelectronics

1) Development and production of:
   a) optoelectronics systems components
   b) optical systems components
   c) photo-couplers
   d) semiconductors lasers
VIII. Software engineering
1) Development and production of:
   a) neural networks
   b) pattern recognition systems
   c) machine vision
   d) fuzzy logic systems

IX. Alternative energy sources
1) Development and production of:
   a) fuel cells
   b) polymer batteries
   c) solar cells
   d) renewable energy

X. Aerospace
1) Manufacture and assembly of aircraft
2) Manufacture of aircraft equipment, components, accessories or parts thereof
3) Modification and conversion of aircraft
4) Refurbishment or re-manufacture of aircraft equipment, components, accessories or parts thereof

XI. Food production and food processing
1) Food production using emerging technologies and advanced farming systems.
2) Development, testing and manufacturing of food products using emerging technologies and advanced manufacturing systems.
Appendix 2-3

Malaysia’s Tax Incentives
MALAYSIA’S TAX INCENTIVES

A. Introduction

The tax incentives are found mainly in the following legislation:

- the Promotion of Investment Act 1986; and

There are broadly five major forms of incentives under the Investment Act, namely:

(i) Pioneer Status;
(ii) Investment Tax Allowance;
(iii) Abatement of Adjusted Income;
(iv) Export Allowance; and
(v) Double Deduction for Promoting Exports.

B. Pioneer Status

A company which has been granted pioneer status under the Promotion of Investment Act is given a total tax exemption on the adjusted income derived from the promoted activity or promoted product for a period of five years commencing on its production day.

The activities or products which qualify as promoted activities or promoted products are determined by the Minister of Finance and are published in the Government Gazette.

Exempt income which is distributed to shareholders of the company as dividends are tax exempt. Redistribution by shareholders of such exempt dividends is also exempted from tax.

The tax relief period may be extended by another five years if after initial five-year period:

- the company's fixed assets (excluding land) reaches at least M$25,000,000;
- the company employs not less than 500 full time Malaysian workers; or
- the company, in the opinion of the Minister, contributes to the economic and technological development of the country.

Net pioneer losses incurred during tax relief period may be carried forward or set-off against post-pioneer profits.
C. Investment Tax Allowance

This is an alternative to pioneer status and not complementary or supplementary to pioneer status. This incentive is given in the form of capital allowance (which varies from 15% to 100% depending on a variety of circumstances) on qualifying capital expenditure incurred by companies producing promoted products or are participating in promoted activities within five years from the date of approval. This allowance is in addition to the normal capital allowance given under the Income Tax Act 1967.

The investment tax allowance is set-off against adjusted income and may be carried forward to subsequent years of assessments. The amount of tax allowance utilized in a basis year may be transferred to an exempt income account and distributed to shareholders as tax exempt dividends. Redistribution by shareholders of such income is also exempted from tax.

D. Abatement of Adjusted Income

There are four such abatement of adjusted income, and they are for:

(i) location in a promoted industrial area;
(ii) small scale companies;
(iii) export; and
(iv) compliance with government policy on capital participation or employment.

The portion of the adjusted income equal to the amount of the abatement may be transferred to an exempt income account and be distributed to shareholders as tax exempt dividends. Redistribution of such income by shareholders is also exempted from tax.

1. Location

Certain industrial areas are designated by the government of Malaysia as promoted areas, and resident manufacturing companies which operate factories and derive income from the manufacturing of products in such designated areas can claim an abatement of 5% of the adjusted income of the company for each year of assessment in which the factory is in operation in the promoted industrial area. The abatement will be granted for a minimum period of five years even if the declaration of the promoted industrial area is subsequently revoked.

2. Small Scale Companies

To be eligible for the 5% abatement of adjusted income for a maximum of five years, a company must have commenced business on or after January 1, 1986 and its shareholders' funds at the first day of a basis period for a year of assessment must not exceed M$500,000.
3. Export

A resident manufacturing company exporting products which are manufactured in Malaysia are given an abatement of:

- 50% of export sales as bears to the total sales; and
- 5% of the value of indigenous Malaysian materials which are incorporated in the manufacture of the products exported.

Export includes the sale of locally manufactured products to companies in designated Free Trade Zones and to Licensed Manufacturing Warehouses.

4. Compliance with Government Policy

An abatement of 5% of the adjusted income is granted for five consecutive years of assessment to companies formed on or after January 1, 1986 or companies which have restructured on or after January 1, 1986 to comply with government policies as follows:

- on capital participation where at least 30% of equity was held by Bumiputera Malaysians throughout the year; or
- where the racial composition of the employees at all levels for that year reflects the multi-racial composition of the country, i.e., 59% Bumiputera, 32% Chinese, 8% Indian and 1% others.

E. Export Allowance

An export allowance of 5% based on the f.o.b. value of exports is granted to resident trading companies which export products manufactured in Malaysia. This amount is deductible from the gross income in ascertaining the adjusted income of the business of the company.

F. Deduction for Promotion of Exports

Certain expenses incurred by resident companies for the purpose of seeking opportunities for export of products manufactured in Malaysia are eligible for double deductions. The expenses that qualify are set out in the income tax legislation and, as a general rule, include certain expenses incurred in the promotion of exports and the supply of goods overseas.

The incentive is available to all resident companies, and in the case of a pioneer company, the deduction is accumulated and allowed against their post-pioneer income.
G. Reinvestment Allowance

This incentive is provided for by the Income Tax Act 1967 and is only applicable for capital expenditure incurred by a resident company on factory, plant, machinery or other apparatus to be used or used in an approved project in Malaysia incurred on or before December 31, 1995.

The reinvestment allowance is equivalent to 40% of the capital expenditure, but for a small scale company, such allowance is 50%.

Companies which are enjoying the pioneer status, investment tax allowance and abatement of adjusted income allowance are not eligible to apply for this allowance. Further, prior approval of the Ministry of International Trade and Industry has to be obtained to qualify for this allowance.

Approved project means a project for manufacturing or processing undertaken by a company in expanding its existing business, and if approval is required under the Industrial Coordination Act 1975, the approval being from the Minister of International Trade and Industry.

The portion of adjusted income equivalent to the reinvestment allowance may be transferred to an exempt income account and The portion of adjusted income equivalent to the reinvestment allowance may be transferred to an exempt income account and distributed to shareholders as exempt dividends. Redistribution by shareholders of such income is also tax exempt.

H. Industrial Building Allowance

A company is eligible to claim industrial building allowance in respect of buildings used as/for:

- warehouses and as bulk storage installations for storing goods for export;
- purposes of approved research; and
- purposes of approved industrial training.

The incentive consists of an initial allowance of 10% and an annual allowance of 2%.

I. Double Tax Deductions Incentives

The objective of these incentives is to encourage businesses to undertake certain specific activities by giving additional tax deduction for the expenses incurred on these activities.

Double tax deduction is granted for expenses incurred in the following cases:

- premises paid on export credit insurance where the risks are insured with a company approved by the Minister of Finance;
Appendix 2-3

- expenditure incurred by a manufacturing company on employee training programs approved by the Ministry of Labor. These programs must be designed to develop and upgrade skills to modernize manufacturing processes;
- all remuneration payable to a physically or mentally disabled employee;
- insurance premiums incurred in the importation of goods into Malaysia where the risks are insured with a company incorporated in Malaysia; and
- expenditure incurred for research approved by the Minister of Finance.

J. Operational Headquarters Companies

Income derived by an Operational Headquarters Company ("OHC") from the provision of the following services to its offices outside Malaysia or related companies outside Malaysia is taxed at 10%:

- general management and administration;
- business planning;
- procurement of raw materials and components;
- technical support;
- marketing control and sales promotion;
- training and personnel management;
- research and development work; and
- assistance in obtaining of credit facilities.

An OHC must be approved by the Minister of Finance and must be wholly owned by foreign companies or non-citizens.

This abated rate of tax applies for five years from the date of approval and may, subject to fulfillment of conditions prescribed by the Minister, be extended for a further five years.

Dividends received by an OHC from a related company outside Malaysia is tax exempt for ten years from the date of approval. Redistribution by shareholders of such exempt income is also exempted from tax.

K. Venture Capital Companies

Gains derived by a venture capital company from its disposal of shares in a venture company are tax exempt. A venture capital company is as a resident company which has been approved by the Minister of Finance and which holds shares in a venture company. A venture company is defined as a Malaysian resident company involved in any high risk venture or engaged in a new technology product or activity which, in the opinion of the Minister, would promote the economic or technical development in Malaysia.

Appendix 2-4

Industrial Technical Assistance Fund
Industrial Technical Assistance Fund

To assist SMEs in their development, SMIDEC has been entrusted to manage the Industrial Technical Assistance Fund (ITAF). Assistance is given in the form of a matching grant, subject to a maximum stipulated for each scheme. To qualify for any of the schemes, applicants must meet the following criteria:

1. Possess production facilities or have access to other facilities approved by the Government, (such as incubator schemes and technology parks).
2. The company must be involved in manufacturing or services or any related projects under the government franchise scheme.
3. Incorporated under the Companies Act 1965
4. The company has a shareholder's fund not exceeding RM2.5 million, with at least 70 percent of equity held by Malaysians and 51 percent owned by SMEs or individuals.

Assistance is given in the form of matching grant where 50% of the project cost is borne by the Government and remaining 50% is borne by the applicant company, subject to a maximum grant stipulated by each scheme.

Currently there are four ITAF schemes, namely:

1. **Industrial Technical Assistance Fund 1 (ITAF1) - Consultancy Service Scheme**

This scheme is currently managed by Bank Pembangunan Malaysia Berhad (BPMB) to assist SMEs to obtain consultancy and advisory services from eligible consultants for project expansion and/or diversification, modernisation and upgrading technical skills, and upgrading of product quality and productivity. Eligible expenses include consultancy fees; testing cost for
product or material; registration cost for the quality scheme; training expenses; and cost of purchasing computer softwares.

The grant will normally be made in two stages and disbursed directly to the consultant or appropriate party or the SME company on submission of a written statement of payments made by the company. The scheme is currently managed by Bank Pembangunan Malaysia (BPMB) with maximum grant of RM40,000 per project.

2. Industrial Technical Assistance Fund 2 (ITAF2) - Product Development and Design Scheme

This scheme is designed to help upgrade indigenous technology through the development of new products or processes or improvement of existing products or processes. To be eligible for the grant, the applicant company must also have the capacity to commercialise the results; possess marketing facilities; and the product must possess market potential. Assistance is given in the form of matching grant where 50% of the project cost is borne by the Government and remaining 50% is borne by the applicant company, subject to a maximum grant of RM 250,000. SMEs that have successfully developed a new product can forward a second application either for developing another new product or improving the existing product or processes. A new product qualifies for additional grant up to RM250,000 but an improvement on existing products or processes, qualifies for the balance of the grant.

Eligible expenses includes: costs of technical manpower directly involved in the development work; consultancy fee; costs of acquiring necessary technology and skills (subject to maximum of 30% of the total grant); service costs such as testing in laboratories, subcontracting, leasing, preparation of project proposals or documentation; costs of acquiring equipment for development and designing, testing, security, pollution prevention and equipment modification including acquiring software (Subject to a maximum of 30% of total grant); costs of materials used in designing and building prototypes; and incidental costs amounting to 10% of the total grant approved.
The scheme is currently managed by Standards and Industrial Research Institute of Malaysia (SIRIM) Berhad.

3. Industrial Technical Assistance Fund 3 (ITAF3) - Quality and Productivity Improvement Scheme

The scheme, managed by SIRIM Berhad, is meant to upgrade product quality, quality system and productivity. Applicant must show commitment towards quality and the proposed project must show potential for improving existing production systems and should conformed to development and design practice.

Assistance is given in the form of a matching grant where 50% of the project costs is borne by the Government, the remainder borne by the applicant. The maximum grant under this scheme is RM 250,000. A company that has successfully implemented a quality or productivity improvement scheme may also apply for another quality/productivity upgrading grant. However, the grant allowed for the second application may not exceed the balance of the grant approved for the first application.

Eligible expenses includes: costs of technical manpower directly involved in the development work; consultancy fee; costs of acquiring necessary technology and skills (subject to maximum of 30% of the total grant); service costs such as testing in laboratories, subcontracting, leasing, preparation of project proposals or documentation; costs of acquiring equipment for development and designing, testing, security, pollution prevention and equipment modification including acquiring software (subject to a maximum of 30% of total grant); costs of materials used in designing and building prototypes; and incidental costs amounting to 10% of the total grant approved. However the scheme exclude materials and equipment cost for production.
4. Industrial Technical Assistance Fund 4 (ITAF4) - Market Development Scheme

The scheme, managed by Malaysian External Trade Development Corporation (MATRADE), is designed to develop export market for SMEs. Applicants must be exporters of Malaysian manufactured products. Assistance is given in the form of matching grant where 50% of the project costs is borne by the Government, and the remaining 50% is borne by the applicant. The maximum grant under this scheme is RM 40,000.

Eligible expenses includes: cost of producing promotional materials for overseas publicity; cost of participation in overseas trade missions & trade fairs including cost of preparing samples; consultancy fees in assisting SMEs to apply for overseas 'Certificate of Recognition'.

Source: SMIDEC
Appendix 2-5

Promotion of Investments Act 1986
Promotion of Investments Act 1986 (PIA)

PIA provides incentives for the following sectors:

- Manufacturing
- Agriculture
- Tourism
- Research and Development
- Technical or Vocational Training

Companies intending to undertake activities in those sectors are eligible for the following tax incentives:

**Pioneer Status**

A company granted Pioneer Status will enjoy partial exemption from the payment of income tax. It will only have to pay tax on 30% of its statutory income. The period of tax exemption is five years, commencing from the Production Day as determined by the Minister of International Trade and Industry.

As an added incentive, companies located in the States of Sabah, Sarawak, the Federal Territory of Labuan* and the designated “Eastern Corridor”** of Peninsular Malaysia, will only have to pay tax on 15% of their statutory income during the tax exemption period of five years.

* Only applicable to the hotel and tourist industry

** The Eastern Corridor of Peninsular Malaysia covers Kelantan, Terengganu, Pahang and the district of Mersing in Johor.

**Investment Tax Allowance (ITA)**

As an alternative to Pioneer Status, a company may apply for Investment Tax Allowance. A company granted Investment Tax Allowance will be given an allowance of 60% in respect of qualifying capital expenditure incurred within five years from the date on which the first qualifying capital expenditure is incurred. The allowance can be utilised to offset against 70% of the statutory income in the year of assessment. Any unutilised allowance can be carried forward to subsequent years until the whole amount has been used up. The balance i.e. 30% of the statutory income will be taxed at the prevailing company tax rate.
As an added incentive, companies located in the States of Sabah, Sarawak, the Federal Territory of Labuan* and the designated "Eastern Corridor"** of Peninsular Malaysia will be granted an allowance of 80% in respect of the qualifying capital expenditure incurred. The allowance can be utilised to offset against 85% of the statutory income in the year of assessment.

**Double Deduction for Promotion of Exports**

Certain expenses incurred by resident companies for the purpose of seeking opportunities for export of products manufactured in Malaysia are eligible for double deduction. The expenses that qualify are those incurred on:

- overseas advertising
- supply of free samples abroad
- export market research
- preparation of tenders for supply of goods overseas
- supply of technical information abroad
- exhibits and/or participation in trade or industrial exhibitions approved by the Ministry of International Trade and Industry (MITI)
- services rendered for public relations work connected with exports
- fares in respect of travel overseas by employees of companies for business
- accommodation and sustenance expenses incurred by representatives of the company who go overseas, up to RM200 per day
- cost of maintaining sales offices overseas for the promotion of exports.

**Infrastructure Allowance**

Companies which are engaged in the manufacturing, agricultural, hotel or tourism or other industrial/commercial activities in the States of Sabah and Sarawak and the designated "Eastern Corridor" of Peninsular Malaysia and which incur qualifying capital expenditure on infrastructure such as reconstruction, extension or improvement of any permanent structure including bridges, jetties, ports and roads, are eligible for an infrastructure allowance of 100%. The allowance can be utilised to set off against 85% of the statutory income in the year of assessment. The balance of that statutory income will be taxed at the prevailing company tax rate. Any unutilised allowance can be carried forward to the subsequent years until it is fully utilised.

*Source: MITI*
Appendix 2-6
Multimedia Super Corridor (MSC) Bill of Guarantees
Multimedia Super Corridor (MSC) 
Bill of Guarantees

The Malaysian Government commits the following to companies with MSC Status:

1. Provide a world-class physical and information infrastructure.

2. Allow unrestricted employment of local and foreign knowledge workers.

3. Ensure freedom of ownership by exempting companies with MSC Status from local ownership requirements.

4. Give the freedom to source capital globally for MSC infrastructure, and the right to borrow funds globally.

5. Provide competitive financial incentives.

6. Become a regional leader in intellectual property protection and cyberlaws.

7. Ensure no Internet censorship.

8. Provide globally competitive telecoms tariffs.

9. Tender key MSC infrastructure contracts to leading companies willing to use the MSC as their regional hub.

10. Provide a high-powered implementation agency to act as an effective one-stop super shop.

Source: Multimedia Development Corporation (MDC)
Appendix 2-7

Multimedia Super Corridor (MSC) Incentives
Multimedia Super Corridor (MSC) Incentives

Initiatives to assist MSC-status HTSMEs:

- launched the MSC R&D Grant Scheme (MGS) with the purpose of promoting R&D among MSC status SMEs (Xtremedia, 1999b). The MGS funds up to 50 percent of the total project cost (Fong, 1999).

- setting up the National Incubator Centre (NIC). Incubators in various universities will feed start-ups to the NIC which is based in the MSC. HTSMEs will be admitted to the NIC up to 2 years until their products or services would be ready for the market (Xtremedia, 1999c).

- establishment of MDC Advisory Consulting Centre for Entrepreneurs (MDC ACCESS). It is a centre within the MDC providing specialised consultation and support to local HTSMEs that intent to participate and grow within the MSC (Malaysian Enterprise, 1998).

The MSC financial incentives for SMEs are:

- Either Five-year exemption from paying federal income tax in Malaysia, commencing from the date when the company starts generating income or receive a 100 percent Investment Tax Allowance on new investments made in MSC. A company may apply to renew the income tax exemption for a second five-year term depending on it’s performance in transferring technology or knowledge to Malaysia.
• Duty free importation of multimedia equipment provided that the equipment is used by the company in the operation of its business.

• R&D grants for local SMEs. The 7MP has allocated 20 percent of the Plan's budget to the MDC for distribution as seed capital for MSC status companies that are at least 51 percent Malaysian owned.

MSC status companies will also entitled to the following non-financial incentives:

• Unrestricted employment of foreign knowledge workers who must have five years or more professional experience in the field of multimedia or IT business or in a field which uses multimedia heavily and a university degree of any discipline or a graduate diploma in multimedia or IT.

• Can be fully owned by foreign legal entities. However the company must be incorporated in Malaysia.

• Companies involved in developing MSC infrastructure are given the freedom to outsource their funds. Moreover MSC status companies are exempted from foreign exchange control requirements.1

Other MSC benefits include intellectual property protection, physical and IT infrastructure, global telecommunication services at a competitive tariff, no internet censorship, planned and high quality urban developments, good educational facilities and green environment.

1 Companies are free to execute transactions in any currency, borrow any amount from any institutions, hedge their foreign exchange exposure, remit globally for any purpose and open unlimited currency accounts in Malaysia or elsewhere. (MDC, 1996)
Appendix 2-8

The Industry R&D Grant Scheme (IGS)
INTRODUCTION

S&T is accorded high priority by the government. Building strong and innovative industrial technology capability across the important sectors of the economy is consequently one of the current national strategies for economic and social development. The Action Plan for Industrial Technology Development, launched in 1990, inter alia, recommended that Malaysia should target at least 2% of GDP on R&D expenditure by the year 2000 with private sector contribution of at least 60% of the total R&D expenditure. To date, two national R&D surveys have been completed by the Ministry of Science, Technology and the Environment. The first national R&D survey using base year 1992 showed total R&D expenditure of only 0.37% of the GDP with the private sector contributing 45%. The second survey using base year 1994 revealed that total R&D expenditure had declined to 0.34% and private sector contribution was 48%. This level of R&D expenditure is low especially when compared to developed economies like USA and Japan which, in 1993, for example; spent 2.8% of their GDP on R&D with the share of their respective private sectors exceeding 65%. The Government is concerned that whilst the economy has been growing steadily, R&D expenditures have fallen behind. The shortfalls are not only in respect of the targeted expenditures but also in terms of the expected role of the private sector. In the past, the government launched several incentive schemes to boost R&D activities, particularly to encourage the private sector. These schemes have been largely tax-based. Experience has, however, shown that while tax-based incentives have benefited some, they have not encouraged significant R&D ventures. Because of the high risk inherent in R&D investments, the private sector has regularly asked the Government for more direct, up-front grant support based on the concept of risk-sharing. The Government announced new policy measures for R&D in the 1997 Budget approved by Parliament and for this purpose the Industry R&D Grant Scheme (IGS) has been developed and approved for immediate implementation. This Brochure explains the details of the IGS. It is hoped that the IGS together with other existing incentives will lead to R&D investments as envisaged in national policies, particularly with regard to the role expected of the private sector.
OBJECTIVES OF THE IGS

The main objectives of this Scheme are:

- To encourage Malaysian companies to be more innovative in using and adapting existing technologies and creating new technologies, products and processes which will benefit the national economy.
- To strengthen national competitiveness in the global markets.
- To promote closer co-operation through joint ventures and institutional linkages between the private sector and public sector universities and research institutes; and
- To encourage strategic global and regional linkages in R&D to enhance indigenous technology development.

R&D DEFINITION

Project proposals submitted for grant support under the Scheme must meet the definition of R&D as defined in the Promotion of Investment Act, 1986 as follows:

"Any systematic or intensive study carried out in the field of science and technology with the object of using the results of the study for the promotion or improvement of materials, devices, products, produce or processes, but does not include-quality control or routine testing of materials, devices, products or produce; research in the social sciences or the humanities; routine data collections; efficiency surveys or management studies; and market research or sales promotion."

ELIGIBILITY

Only wholly owned Malaysian companies and Malaysian majority-held joint-venture companies are eligible to apply for support under this Scheme.

COLLABORATION WITH LOCAL R&D INSTITUTES AND UNIVERSITIES

Except for Applicants must show evidence of proposed collaboration with at least one or more local public research institute or university in the project submitted for support under the Scheme. Exemption from this condition may be given on a case to case basis.

PRIORITY TECHNOLOGY AREAS

Project proposals relating to Advanced Manufacturing, Advanced Materials, Electronics, Information Technology and Multimedia Technologies, Biotechnology, Energy, Aerospace as well as other key technologies supportive of the industrial clusters in the
new IMP or targeted technologies under the Seventh Malaysia Plan will receive priority consideration under the Scheme.

**SELECTION CRITERIA**

Selection of projects will take into consideration the extent to which projects:

- Meet the objectives and conditions of the Scheme
- Focus on key technology areas with prospects for early commercialisation.
- Have the potential to strengthen or extend existing areas of comparative advantage and contribute to the development of high value-added products, processes and services.

**R&D IN MALAYSIA**

As far as possible, approved R&D proposals under this Scheme must be undertaken in Malaysia.

**MAXIMUM GRANT SUPPORT**

The quantum of grant payable under this Scheme will be determined on the merits of each application. Cost sharing will be the norm. However, in exceptional circumstances, grant support not exceeding 70% of the approved cost, will be considered.

**REPAYMENT OF GRANT SUPPORT**

The Government has decided that a moderate formula for repayment will apply where a project funded under the Scheme is successfully commercialised. Funds collected from this source will be used to augment the pool of funds for the IGS. In the event, the project is commercialised, the IGS grant recipient will pay the Government royalties of between 0.5-3.0% of net sales. Where product or process is licensed out, the Grantee Company will pay the government royalties from 30%-50% of their licence fees agreed upon. Royalty payments will be for a period of 15 years from the date of commercialisation or until payment reaches twice the value of the grant, whichever, is achieved earlier.

**SCOPE OF FUNDING**

The Scheme will normally provide grants to meet direct project costs such as salary expenditure, contract expenditure, plant expenditure, prototype expenditure, pilot plant and materials consumed, administrative costs and travel related to the project. The grant applicant is expected to co-invest in the form of cash, personnel or equipment or a combination thereof.

Funding is normally provided for three years encourage early commercialisation.
Funds are disbursed on a reimbursable basis except for capital expenditure, which is eligible for advance payments. Disbursements are made on a quarterly basis upon receipt of the project progress report and certified statement of accounts.

GRANT APPROVAL

Project proposals will be considered by the IGS Inter-Agency Committee headed by the Ministry of Science, Technology and the Environment. All proposals submitted with complete information will be decided upon within 10 weeks of submission.

PROJECT MONITORING AND REPORTING

A Project Management Committee (PMC) will be established to monitor the technical and the commercial progress of every project under the IGS. The PMC will comprise representatives of all project partners. The Chairperson of the PMC will be the applicant of the project or his representative. The PMC will undertake to provide quarterly reports within one month of the completion of a milestone, or with one month from the date of which a milestone is to be achieved, whichever is the earlier. The PMC will undertake to provide a final completion report as well as on-going reports during the commercialisation phase.

INTELLECTUAL PROPERTY

A binding letter of understanding between project partners setting out existing and proposed ownership, disposition of intellectual property rights associated with the project, and exploitation of the project results must be lodged before funds are disbursed.

CONFIDENTIALITY

All information provided by the applicants will be treated as confidential.

AGREEMENT

The grant recipient will be required to sign an agreement relating to the project with the Government.

Source: MASTIC (1997)
Appendix 3-1

Incentives for High Technology Companies
Incentives for High Technology Companies

High technology companies are defined as companies engaged in promoted activities or in the production of promoted products in areas of new and emerging technologies. (Please refer to Appendix 2-2). High technology companies are eligible for the following incentives:

- Pioneer Status with full tax exemption at statutory income level for a period of five years; or
- Investment Tax Allowance of 60% on qualifying capital expenditure incurred within a period of five years. The allowance can be offset against the statutory income for each year of assessment without any restriction.

The high technology company must fulfil the following criteria:

- Local research and development (R&D) expenditure to gross sales should be at least 1% on an annual basis. However, companies are allowed a period of three years from the date of operation/ commencement of business to comply with this requirement.
- The percentage of science and technical staff having degrees or diplomas with a minimum of 5 years experience in related fields should be at least 7 % of total workforce.

Source: Malaysian Industrial Development Authority.
Appendix 3-2

Incentives for Software Development
Incentives for Software Development

In line with the Government's objective to encourage the development of computer software, companies which develop both original software and/or undertake major modifications of existing software other than those deemed established, are eligible to apply for Pioneer Status incentive for a period of five years subject to the following guidelines:

- The computer software must be for a general purpose and not for a specific customer.

- For companies undertaking modification of existing software packages, the cost of acquiring the existing packages must not exceed 25% of the modification expenditure which includes software tools, labour and equipment costs.
Appendix 3-3

Incentives for Research and Development (R & D)
Incentives for Research and Development (R & D)

The definition of R & D in the Promotion of Investments Act 1986 is as follows:—

"Research and development means any systematic or intensive study carried out in the field of science or technology with the objective of using the results of the study for the production or improvement of materials, devices, products, produce or processes but does not include:—

- quality control of products or routine testing of materials, devices, products or produce;
- research in the social sciences or humanities;
- routine data collection;
- efficiency surveys or management studies;
- market research or sales promotion."

To further strengthen the foundation for a more integrated R&D in the future, companies which carry out designing or protoyping as an independent activity are eligible for incentives.

Contract R & D Company

A contract R & D company (i.e., a company that provides R & D services in Malaysia to a company other than its related company) is eligible to apply for Pioneer Status with full income tax exemption at statutory income level for five years or an Investment Tax Allowance (ITA) of 100% on qualifying capital expenditure incurred within 10 years. The ITA can be utilised to offset against 70% of the statutory income in the year of assessment.

R & D Company

An R & D company (i.e. a company which provides R & D services in Malaysia to its related company or to any other company) is eligible to apply for an ITA of 100% on qualifying capital expenditure incurred within 10 years. The ITA can be utilised to offset against 70% of the statutory income in the year of assessment. The related companies concerned will not enjoy double deduction for payments made to the R & D company for the use of its services, unless the R & D company opts not to avail itself of the ITA.

Eligibility

Contract R & D and R & D companies are eligible to apply for the various incentives provided they fulfil the following criteria:

- research undertaken should be in accordance with the needs of the country and bring benefits to the Malaysian economy;
- at least 70% of the income of the company should be derived from research and development activities;
• for manufacturing-based R&D, at least 50% of the workforce of the company must be appropriately qualified personnel performing research and technical functions; and

• for agriculture-based R&D, at least 5% of the workforce of the company must be appropriately qualified personnel performing research and technical functions.

In-house Research

A company which carries out in-house research in Malaysia (i.e. R & D carried out within a company for the purpose of its own business) are eligible to apply for ITA of 50% on qualifying capital expenditure incurred within 10 years. The ITA can be utilised to offset against 70% of the statutory income in the year of assessment.

Applications relating to 7.1, 7.2 and 7.4 should be submitted to MIDA.

Double Deduction for Research & Development

- Double deduction is allowed on revenue (non-capital) expenditure incurred by a company on research directly undertaken, which is approved by the Minister of Finance.

- Double deduction is allowed on payment for the use of services of approved research institutes, R & D companies or contract R & D companies.

- Double deduction is also allowed on cash contributions made to approved research institutions.

Claims should be submitted to IRB.
Appendix 3-4

Incentives for the Use of Information Technology (IT)
Incentives for the Use of Information Technology (IT)

Special Capital Allowance

Computers and information technology assets are given an initial allowance of 20% and an annual allowance of 40%. Thus the full amount can be written off within a period of two years.

Other Incentives

Single Deduction is given to companies incurring the following expenditure:

(i) Operating expenditure including payments to consultants, related to the usage of IT in improving management and production processes in the manufacturing, agriculture and services sectors.

(ii) Purchases of new computers for employees.

(iii) Contributions in cash and kind for ICT acculturation projects at local community levels.

(ii) and (iii) are effective until the Year of Assessment 2003.
Appendix 6-1

The Questionnaire
Consultancy and Innovation Bureau
Universiti Teknologi Malaysia
Locked bag 791
80990 Johor Bahru
Telephone: 07-5541987/07-5505553
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GROWTH OF HIGH TECHNOLOGY SMALL AND MEDIUM SIZE ENTERPRISES (HTSMES) IN MALAYSIA

The objective of this study is to examine the growth, problems and constraints of HTSMEs in Malaysia.
Dear Sir/Madam,

It has been established that high technology small and medium sized enterprises (HTSMEs) make a major contribution to job and wealth creation, and economic and industrial growth.

The Malaysian Government provides support for HTSMEs, but such support is somewhat limited compared to many other countries. One of the difficulties in persuading the Government to improve the level of support is a lack of research on the problems and needs of HTSMEs. This survey will help to remedy that situation. Your cooperation will be extremely valuable.

May I ask you for a small amount of your time to complete the questionnaire enclosed with this letter. The utmost confidentiality will be observed in using the information provided; your name or the name of your organisation will not be used in reporting our research findings.

When the study has been completed, a copy of the report can be made available to you. If you would like a copy please tick the box at the end of the questionnaire and print your company name and address in the space provided.

If you should questions regarding this study please contact:

Associate Professor Abd. Aziz Mohd. Amin  
Biro Inovasi dan Perundingan  
Universiti Teknologi Malaysia  
Locked Bag 791  
80990 Johor Bahru  
Telephone: 07-5505547  
Fax: 07-5541990

Many thanks in anticipation of your assistance.

Yours sincerely,
Please tick (✓) or write your answer as appropriate.

Your answers are very important to the accuracy of our study. Please return the completed questionnaire at your earliest convenience.

Thank you for your cooperation.
1. **Age group:**

   - Under 30
   - 31 - 40
   - 41 - 54
   - 55 - 60
   - over 60

2. **Gender:**

   - Male
   - Female

3. **Highest educational qualification achieved:**

   - Primary Education
   - Secondary Education
   - Diploma or equivalent
   - Degree or equivalent - Science/Technical
   - Degree or equivalent - Business/Management
   - Professional Qualification
   - Others *(please specify)*: __________________________

4. **Were you employed prior to becoming full-time owner of the present business?**

   - Yes
   - No

   **If ‘Yes’ please specify:**

   - Nature of Employer’s Business: __________________________
   - Position: __________________________
Section B: Background of the Firm

5. What is the status of your company?
   - Bumi
   - Non-Bumi

6. Company registered as:
   - Sole proprietorship
   - Partnership
   - Private Limited Company
   - Other (please specify): ______________________

7. If the firm is a partnership: how many partners are there?
   ____________________ partners
   (please proceed to question 10)

8. If the firm is a limited company: what percentage of the firm’s shares do you own?
   ____________________

9. Company structure
   - Family owned
   - Subsidiary: part of a Malaysian
   - Subsidiary: part of an international group

10. Year business started (in Malaysia): ____________________
11. How many people are currently employed (full time) by your firm? (Including management and directors)

Less than 25
25 - 50
51 - 75
76 - 150
151 - 500
Greater than 500

12. If possible please distribute your company’s employees (full-time) among the categories below. Approximate figures are quite acceptable.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-skilled and unskilled manual</td>
<td></td>
</tr>
<tr>
<td>Skilled manual</td>
<td></td>
</tr>
<tr>
<td>Clerical and administrative</td>
<td></td>
</tr>
<tr>
<td>Marketing and sales staff</td>
<td></td>
</tr>
<tr>
<td>Technicians</td>
<td></td>
</tr>
<tr>
<td>Technologists, scientists and engineers</td>
<td></td>
</tr>
<tr>
<td>Management and professionals</td>
<td></td>
</tr>
</tbody>
</table>

13. Standard Industrial Classification (SIC), if known:

14. Briefly describe the nature your business.
(for example, manufacturing of office equipment etc.)
15. **Is your company involved in the design, development or manufacturing of .........? :**

*(you may tick more than one, if applicable)*

<table>
<thead>
<tr>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced electronics</td>
</tr>
<tr>
<td>Advanced materials</td>
</tr>
<tr>
<td>Equipment/instrumentation</td>
</tr>
<tr>
<td>Biotechnology</td>
</tr>
<tr>
<td>Optoelectronics</td>
</tr>
<tr>
<td>Electro-optics and non-linear optics</td>
</tr>
<tr>
<td>Software engineering</td>
</tr>
<tr>
<td>Alternative energy sources</td>
</tr>
<tr>
<td>Aerospace</td>
</tr>
<tr>
<td>Automation and flexible manufacturing</td>
</tr>
<tr>
<td>None of the above</td>
</tr>
</tbody>
</table>

16. **In which region is your firm located?**

- Western (K. Lumpur, Selangor & N. Sembilan)
- Eastern (Pahang, Kelantan & Terengganu)
- Northern (Perak, Penang, Kedah & Perlis)
- Southern (Malacca & Johor)

17. **Location of business:**

- State Development Corporation industrial estate
- Private industrial estate
- Specialised industrial estate (technology park)
- SMI industrial site
- Others *(please specify)*
18. What impact did each of the following attributes have on your company’s choice of location?

(Please tick the level of significance on a scale of 1 to 4)

<table>
<thead>
<tr>
<th>Key</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good transportation facilities for materials and products</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Good transportation for people</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Cost of property and construction</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Proximity to customers</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Proximity to raw materials and component supplies</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Community attitudes towards business</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Ample area for expansion</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Availability of energy supplies</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Proximity to a university system</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Availability of workers:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>skilled</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>unskilled</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>technical</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>professional</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Section C: Measurement of Growth

19. How many people did your firm employ full time at the following dates? (include management and directors)

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
</tr>
</tbody>
</table>

20. What was the turnover achieved by the business in the financial years below?

<table>
<thead>
<tr>
<th>Year</th>
<th>Turnover</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>RM</td>
</tr>
<tr>
<td>1995</td>
<td>RM</td>
</tr>
<tr>
<td>1996</td>
<td>RM</td>
</tr>
</tbody>
</table>

21. Over the period 1994 to 1996, how important to you was growth in ....?

(Please tick the level of importance on a scale of 1 to 4)

<table>
<thead>
<tr>
<th>Key</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnover</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Assets</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section D: Business Strategy

22. Have you ever taken any action to raise equity capital outside the company?

Yes

No

23. How important have the following factors been to the survival or growth of your business?

(Please tick the level of importance on a scale of 1 to 4)

<table>
<thead>
<tr>
<th>Key</th>
<th>1 not important at all</th>
<th>2 moderately important</th>
<th>3 important</th>
<th>4 very important</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product innovation</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Product diversification</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Process innovation</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Producing high quality product(s)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Low production cost</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Intensive marketing of product(s)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Low prices for your customers</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Other factors (please specify):</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

24. In the past three years how many new products have you introduced?

None

1 - 4

5 - 10

More than 10
25. To what extend have your production process improved, during the past three years? (you may tick more than one, if applicable)

- No improvement at all
- Slight improvement
- Moderate improvement
- Significant improvement

(If no improvement at all please go to question 27)

26. If there were some improvement in your production process, how have you done this?

- New machines
- Training of staff
- New staff
- Reorganisation of work patterns
- Other means (specify please):

27. In the past three years, have you engaged in research and development aimed at your improving product or process innovation?

- Yes
- No

If yes, what percentage (approximate) of turnover have you spent on R & D?

1994: ___________%
1995: ___________%
1996: ___________%
28. Do you actively seek customers?
   - Yes
   - No

   If yes, how is this done?

29. Do you use market research?
   - Yes
   - No

   If yes, approximately, what percentage of turnover have you spent on market research?

   1994 : _________ %
   1995 : _________ %
   1996 : _________ %
30. Government assistance is available from a number of institutions in Malaysia. Are you aware of the services provided by, and has your company utilised the facilities offered by, any of the following institutions?

(you may tick more than one, if applicable)

<table>
<thead>
<tr>
<th>Institution</th>
<th>Aware?</th>
<th>Used?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysian Industrial Development Authority (MIDA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysian Technology Development Corporation (MTDC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank Pembangunan (M) Bhd.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank Industri (M) Bhd.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard and Industrial Research Institute of Malaysia (SIRIM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small and Medium Industries Development Corporation (SMIDEC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysian Industry-Government Group for High Technology (MIGHT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysian Industrial Technology Information Centre (MITIC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perbadanan Usahawan Malaysia Berhad (PUNB)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (please specify):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

__________________________________________________________________

__________________________________________________________________
31. **Please indicate whether any of the factors below affected the growth of your company during the period 1994 to 1996.**

(Please indicate the level of importance on a scale of 1 to 4)

<table>
<thead>
<tr>
<th>Key:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>not important at all</td>
<td>moderately important</td>
<td>very important</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lack of demand for main products or declining markets</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortage of labour</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Poor quality of labour</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Lack of suitable finance for expansion</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Lack of suitable premises</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Lack of raw materials or supply deficiencies</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Equipment problems</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Inadequate information on markets home and abroad</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Inadequate information on finance</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Inadequate information on product technology</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Inadequate information on process technology</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Inadequate road or rail system</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Bad debt or late payments</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Difficulties in achieving quality standards</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Lack of management time to develop new products and markets</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Please use this space for any comments you wish to make.

Thank you for your cooperation. Your contribution to this study is highly appreciated.

Please return this questionnaire using the self-addressed envelope provided.

**Address for correspondence:**

Mohd. Hassan Mohd. Osman  
Bureau of Innovation and Consultancy  
Universiti Teknologi Malaysia  
Locked Bag 791  
80990 Johor Bahru

Please tick in the box if you wish to have a copy of the survey report, and print your company name and address in the space provided below:

Company Name:

Address:
Appendix 6-2

The Questionnaire - Malay Translation
BORANG SOAL SELIDIK

Biro Inovasi dan Perundingan
Universiti Teknologi Malaysia
Karung berkunci 791
80990 Johor Bahru
Telefon: 07-5541987/07-5505553
Faks: 07-5541990

PERTUMBUHAN SYARIKAT INDUSTRI KECIL DAN SEDERHANA BERTEKNOLOGI TINGGI (IKSBT) DI MALAYSIA

Matlamat kajian ini ialah untuk mengkaji pertumbuhan, masalah dan halangan yang dihadapi oleh syarikat kecil dan sederhana berteknologi tinggi (IKSBT) di Malaysia
Tarikh

Tuan/puan,

Syarikat industri kecil dan sederhana dalam sektor teknologi tinggi telah di kenalpasti sebagai penyumbang utama kepada pekerjaan dan kekayaan, serta pertumbuhan ekonomi dan industri.


Diharapkan tuan dapat meluangkan sedikit masa untuk mengisi borang soal selidik yang disertakan bersama surat ini. Segala maklumat yang tuan kemukakan akan dirahsiakan dan kami tidak akan mendedahkan samasekali nama tuan atau nama syarikat tuan semasa menyediakan laporan kajian ini.

Tuan boleh mendapatkan satu salinan laporan hasil kajian dengan menanda petak di muka surat akhir borang soal selidik dan menulis nama dan alamat syarikat di bawahnya.

Jika tuan mempunyai pertanyaan mengenai penyelidikan ini sila kemukakan kepada:

Profesor Madya Abd. Aziz Mohamed. Amin  
Biro Inovasi dan Perundingan  
Universiti Teknologi Malaysia  
Karung berkunci 791  
80990 Johor Bahru  
Telefon: 07-5505547  
Faks: 07-5541990

Sekian. Terima kasih

Yang benar,
Sila tandakan (✓) atau tuliskan jawapan di tempat yang sesuai.

Jawapan yang anda berikan sangat penting untuk penyelidikan ini. Sila kembalikan borang soal selidik yang telah dipenuhi secepat mungkin.

Terima kasih di atas kerjasama anda.
<table>
<thead>
<tr>
<th>1. Kumpulan umur:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bawah 30</td>
</tr>
<tr>
<td>31 - 40</td>
</tr>
<tr>
<td>41 - 50</td>
</tr>
<tr>
<td>51 - 60</td>
</tr>
<tr>
<td>Melebihi 60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Jantina:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lelaki</td>
</tr>
<tr>
<td>Perempuan</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Kelayakan akademik tertinggi yang dicapai:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sekolah Rendah</td>
</tr>
<tr>
<td>Sekolah Menengah</td>
</tr>
<tr>
<td>Diploma atau yang setaraf</td>
</tr>
<tr>
<td>Ijazah atau yang setaraf - Sains/Teknikal</td>
</tr>
<tr>
<td>Ijazah atau yang setaraf - Perniagaan/Pengurusan</td>
</tr>
<tr>
<td>Kelayakan Profesional</td>
</tr>
<tr>
<td>Lain-lain (sila nyatakan):</td>
</tr>
</tbody>
</table>


4. **Pernahkah anda bekerja sebelum mengusahakan perniagaan sekarang?**

- Pernah  
- Tidak Pernah  

**Jika ‘Pernah’ sila nyatakan:**

- Jenis Perniagaan Majikan:  
- Jawatan terakhir dipegang:  
- Tempoh bekerja:  
- Tempoh pengalaman dalam pengurusan:  

---

**Bahagian B: Latarbelakang Syarikat**

5. **Apakah status syarikat anda?**

- Bumiputra  
- Bukan Bumiputra  

6. **Syarikat didaftarkan sebagai:**

- Perseorangan  
- Perkongsian  
- Syarikat Sendirian Berhad  
- Lain-lain (*sila nyatakan*)  

---

7. **Jika syarikat perkongsian berapakah rakan kongsi?**

  ______________________ rakan kongsi  
  (Sila terus ke soalan 9)

8. **Jika syarikat terhad, berapa peratuskah saham anda di dalam syarikat?**

  _____

%
9. Struktur syarikat

Milik keluarga

Anak syarikat kumpulan Malaysia

Anak syarikat kumpulan antarabangsa

10. Tahun perniagaan dimulakan (di Malaysia):

11. Berapa ramaikah kakitangan (sepenuh masa) dalam syarikat anda pada masa sekarang? (termasuk pengurus dan pengarah)

Kurang dari 25
25 - 50
51 - 75
76 - 150
151 - 500

12. Sila anggarkan bilangan kakitangan (sepentili inasa) di syarikat anda mengikut kategori berikut:

<table>
<thead>
<tr>
<th>Kelas</th>
<th>Bilangan Kakitangan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separuh mahir dan tiada kemahiran</td>
<td></td>
</tr>
<tr>
<td>Berkemahiran</td>
<td></td>
</tr>
<tr>
<td>Perkeranian dan pentadbiran</td>
<td></td>
</tr>
<tr>
<td>Pemasaran dan jualan</td>
<td></td>
</tr>
<tr>
<td>Juruteknik</td>
<td></td>
</tr>
<tr>
<td>Ahli teknologi, saintis dan jurutera</td>
<td></td>
</tr>
<tr>
<td>Pengurusan dan profesional</td>
<td></td>
</tr>
</tbody>
</table>

13. 'Standard Industrial Classification' (SIC), jika di ketahui:
(misalan, pengeluaran peralatan pejabat dll.)

15. Adakah syarikat anda terlibat dalam rekabentuk, pembangunan atau pengeluaran .......?  
(anda boleh tanda lebih dari satu jika berkaitan)

- Elektronik lanjutan
- Bahan lanjutan
- Peralatan/Instrumentasi
- Bio-teknologi
- Opto-elektronik
- Elekto-optik and optik tak linear
- Kejuruteraan perisian
- Sumber tenaga alternatif
- Aero angkasa
- Otomasi dan pengeluaran anjal
- Lain-lain (sila nyatakan): __________

16. Di kawasan manakah syarikat anda beroperasi?

- Barat (K. Lumpur, Selangor & N. Sembilan)
- Timur (Pahang, Kelantan & Terengganu)
- Utara (Perak, Penang, Kedah & Perlis)
- Selatan (Malacca & Johor)
17. **Lokasi perniagaan:**

- Kawasan Perindustrian Perbadanan Kemajuan Negeri
- Kawasan Perindustrian Persendirian
- Kawasan Perindustrian Khusus (taman teknologi)
- Tapak Perindustrian IKS
- Lain-lain (sila nyatakan): 

18. **Apakah kesait ciri-ciri berikut ke atas pentihan lokasi syarikat anda?**

(Sila tandakan tahap kepentingan pada skala 1 hingga 4)

<table>
<thead>
<tr>
<th>Kunci</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>tidak penting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sama sekali</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kurang penting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>penting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sangat penting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Pengangkutan yang baik untuk produk dan bahan
- Pengangkutan yang baik untuk kakitangan
- Kos hartanah dan pembinaan
- Kedudukan yang hampir dengan pelanggan
- Kedudukan yang hampir dengan bekalan bahan mentah dan komponen
- Sikap masyarakat terhadap perniagaan
- Ruang yang mencukupi untuk pembesaran
- Terdapatnya bekalan tenaga seperti air dan listrik
- Hampir dengan sistem universiti
- Terdapatnya pekerja:
  - mahir
  - tak mahir
  - teknikal
  - profesional
19. Berapa ramaikah kakitangan (sepenuh masa) dalam syarikat anda pada masa sekarang? (termasuk pengurusan dan pengarah)

Jumlah Kakitangan

<table>
<thead>
<tr>
<th>Tahun</th>
<th>Jumlah</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
</tr>
</tbody>
</table>

20. Berapakah perolehan jualan yang diperolehi oleh syarikat anda pada tahun kewangan berikut?

<table>
<thead>
<tr>
<th>Tahun</th>
<th>RM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
</tr>
</tbody>
</table>


(Sila tandemakan tahap kepentingan pada skala 1 hingga 4)

<table>
<thead>
<tr>
<th>Kunci</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>tidak penting</td>
<td>kurang penting</td>
<td>penting</td>
<td>sangat penting</td>
</tr>
<tr>
<td>sama sekali</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Perolehan jualan

Keuntungan

Pekerjaan

Jumlah aset
22. Adakah anda pernah mendapatkan modal ekuiti dari sumber lain?
   Pernah
   Tidak Pernah

23. Sejauhmanakah faktor-faktor berikut penting untuk pertumbuhan syarikat anda?

   (Sila tandakan tahap kepentingan pada skala 1 hingga 4)

<table>
<thead>
<tr>
<th>Kunci</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>tidak penting</td>
<td>kurang penting</td>
<td>penting</td>
<td>sangat penting</td>
</tr>
<tr>
<td>Inovasi produk</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Pelbagaian produk</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Inovasi proses</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Mengeluarkan produk berkualiti tinggi</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Kos pengeluaran rendah</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Pemasaran produk secara intensif</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Harga yang rendah untuk pelanggan</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Faktor-faktor lain (sila nyatakan):</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

24. Dalam tempoh tiga tahun yang lepas, berapakah produk baru yang dikeluarkan?
   Tiada
   1 - 4
   5 - 10
   Lebih dari 10
25. Apakah tahap peningkatan dalam proses pengeluaran syarikat anda dalam tempoh tiga tahun yang lepas?

   Tiada kemajuan sama sekali   
   Sedikit kemajuan 
   Kemajuan sederhana 
   Kemajuan besar

   (Jika tiada kemajuan sama sekali sila terus ke soalan 27)

26. Jika terdapat sebarang kemajuan dalam proses pengeluaran, dengan cara apakah anda mencapainya?

   Menggunakan mesin baru   
   Melatih kakitangan 
   melantik kakitangan baru 
   Menyusun semula corak pekerjaan 
   Lain-lain cara (sila nyatakan):

27. Dalam tempoh tiga tahun yang lepas, adakah syarikat anda menjalankan penyelidikan dan pembangunan untuk meningkatkan inovasi produk dan proses?

   Pernah   
   Tidak pernah

   Jika pernah, berapa peratus (anggaran) dari pusing ganti jualan yang dibelanjakan untuk penyelidikan dan pembangunan bagi tahun-tahun berikut?

   1994 : ____________ %
   1995 : ____________ %
   1996 : ____________ %
28. Adakah anda mendapatkan pelanggan baru secara aktif?

Ya [ ]

Tidak [ ]

Jika ya melalui cara apakah anda melakukannya?

29. Pernahkah anda menjalankan penyelidikan pemasaran?

Pernah [ ]

Tidak pernah [ ]

Jika pernah, berapa peratus (anggaran) dari pusing ganti jualan yang dibelanjakan untuk penyelidikan pemasaran bagi tahun-tahun berikut?

1994 : _________ %

1995 : _________ %

1996 : _________ %
30. Bantuan kerajaan boleh diperolehi melalui beberapa institusi di Malaysia. Adakah syarikat anda menyedari tentang wujudnya bantuan dan menggunakan kemudahan yang ditawarkan oleh institusi-institusi berikut?

*(anda boleh tanda lebih dari satu jika berkaitan)*

<table>
<thead>
<tr>
<th>Institusi</th>
<th>Menyedari?</th>
<th>Menggunakan?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysian Industrial Development Authority (MIDA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysian Technology Development Corporation (MTDC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank Pembangunan (M) Bhd.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank Industri (M) Bhd.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard and Industrial Research Institute of Malaysia (SIRIM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small and Medium Industries Development Corporation (SMIDEC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysian Industry-Government Group for High Technology (MIGHT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysian Industrial Technology Information Centre (MITIC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perbadanan Usahawan Malaysia Berhad (PUNB)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lain-lain <em>(sila nyatakan)</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Bahagian E: Halangan kepada Pertumbuhan


(Sila tandakan tahap kepentingan pada skala 1 hingga 4)

<table>
<thead>
<tr>
<th>Kunci</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>tidak penting sama sekali</td>
<td>kurang penting</td>
<td>penting</td>
<td>sangat penting</td>
</tr>
<tr>
<td>Kurang permintaan untuk produk utama atau kejatuhan pasaran</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kekurangan pekerja</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kualiti pekerja yang rendah</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kekurangan kewangan untuk pembesaran</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kekurangan premis yang sesuai</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kekurangan bahan mentah atau bekalan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masalah peralatan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tidak cukup maklumat tentang pasaran dalam dan luar negara</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tidak cukup maklumat tentang kewangan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tidak cukup maklumat tentang teknologi produk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tidak cukup maklumat tentang teknologi proses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sistem jalanraya dan keretapi yang tidak mencukupi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hutang lapuk atau bayaran lewat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kesukaran untuk mencapai piawaian yang tinggi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kurangnya masa pengurusan yang diperuntukkan untuk membangun produk dan pasaran baru.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Jika anda ingin memberi sebarang komen sila gunakan ruang dibawah.


Terima kasih di atas kerjasama anda. Sumbangan anda amat di hargai.

Sila kembalikan borang soal selidik ini menggunakan sampul yang disediakan.

**Alamat perhubungan**

Mohd. Hassan Mohd. Osman
Fakulti Pengurusan & Pembangunan Sumber Manusia
Universiti Teknologi Malaysia
Karung berkunci 791
80990 Johor Bahru

☐ Sila tandakan di dalam petak sebelah jika anda ingin satu salinan lapuran penyelidikan dihantar kepada anda. Tulis dengan huruf besar nama syarikat dan alamat di dalam ruang yang disediakan di bawah:

Nama syarikat: 

Alamat: 


Appendix 6-3

The Questionnaire - Mandarin Translation
请在适当的答案上画(√)或填上适合的答案。

您的回答对我们的研究的准确性是十分重要的。请您尽早填回已填好的调查表。
谢谢您的合作。
1. 年龄：

30以下 □
31-40 □
41-54 □
55-60 □
超过60 □

2. 性别：

男 □
女 □

3. 拥有的最高学历：

小学 □
中学 □
文凭或相关学位 □
理学士或相关理科学位 □
商学士或相关工商学位 □
专业人士 □
其他，请列出： ________________ □

4. 在您成为当今的雇主之前，您是否曾经在其他公司就业？

是 □（若是，请回答第5题）
否 □（若否，请回答第6题）
5. 请列出以往的工作:

雇主商业的性质: ___________________________

职位: ___________________________________

服务的期限: ____________________________ 年

管理的经验: ____________________________ 年

6. 贵公司属于:

土著公司 [ ]
非土著公司 [ ]

7. 贵公司注册为:

个人公司 [ ] (若是合伙公司，请回答第11题)
合伙公司 [ ] (若是个人公司，请回答第8题)
私人的有限公司 [ ] (若是个私人有限公司，请回答第9题)
其他（请列出） [ ] (请回答第10题)

8. 若贵公司注册为合伙公司，请问有多少位合伙人?

合伙人: ____________________________ (请回答第10题)

9. 若贵公司注册为私人有限公司，请问您有多少股份?

%
10. 公司结构:

家族的公司

个人的公司

子公司：属于马来西亚集团的

子公司：属于国际集团

11. 贵公司开始营业于（在马来西亚）________年

12. 请问贵公司当今聘请多少位全职员工（包括管理层及董事）?

少过25

25 - 50

51 - 75

76 - 150

151 - 500

超过500

13. 若可以，请把贵公司的员工归类在以下：

员工人数

半熟练, 不熟练手工

熟练手工

书记及行政人员

市场及销售人员

技术员

科技, 科学家及工程师

管理及专业人员

____________________
____________________
____________________
____________________
____________________
____________________
14. 工业标准的种类，若您知道：

15. 简要地描述贵公司的商业性质：
（例如，制造办公室设备等等）

16. 贵公司是属于设计、发展或生产______________的公司：
（若适合，您可选择超过一个答案）

先进的电子
先进的材料或原料
设备与使用仪器
生物工艺学
光学电子
光学电器和非线性的光学设备
软件工程
其他能量来源
航空
自动化生产
其他

17. 请问贵公司的地点属于哪个区域？

中部（吉隆坡，雪兰莪和森美兰）

东部（彭亨，吉兰丹和丁加奴）

北部（槟城，吉打和玻璃市）

南部（马六甲和柔佛）
18. 贵公司所在地：

州内工业发展区

私人的工业区

科技工业区

中小型工业区

其他（请列出）

19. 以下哪个因素将会影响贵公司在地点上的选择？请根据问题的严重性 1 至 4 等级来回答。

<table>
<thead>
<tr>
<th>指示</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>不严重</td>
<td>差不多严重</td>
<td>严重</td>
<td>非常严重</td>
<td></td>
</tr>
</tbody>
</table>

拥有良好的交通系统和产品

拥有良好的交通系统和公众

产业和建设的费用

靠近客户

靠近原料和组成部分供应商

社区对有关商业的态度

拥有宽大的扩充空间

拥有能力的供应

靠近大学系统

拥有的人力资源：

熟练

不熟练

技术人员

专业人员
20. 在以下的年份，请问贵公司拥有多少位全职员工？
（包括管理层及董事）

员工人数

<table>
<thead>
<tr>
<th>年份</th>
<th>数量</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
</tr>
</tbody>
</table>

21. 请问贵公司在以下年份时达到的营业额是多少？

营业额

<table>
<thead>
<tr>
<th>年份</th>
<th>营业额</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>RM</td>
</tr>
<tr>
<td>1995</td>
<td>RM</td>
</tr>
<tr>
<td>1996</td>
<td>RM</td>
</tr>
</tbody>
</table>

22. 在1994到1996的这段期间，以下的增长对您有多重要？

请根据问题的重要性从1至4等级来回答。

<table>
<thead>
<tr>
<th>指示</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>完全不重要</td>
<td>差不多重要</td>
<td>重要</td>
<td>非常重要</td>
</tr>
<tr>
<td>营业额</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>利润</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>就业机会</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>资产总额</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
23. 您是否曾经向外采取行动来提高贵公司的资本？

是  

否  

24. 以下因素将会对贵公司的生存和增长有多么重要？

请根据问题的重要性 1 至 4 等级来回答。

<table>
<thead>
<tr>
<th>指示</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>完全不重要</td>
<td>差不多重要</td>
<td>重要</td>
<td>非常重要</td>
</tr>
</tbody>
</table>

产品革新

产品多样化

革新过程

生产产品质高的产品

生产开销低廉

产品在市场上的销售量

销费的价格于顾客

其他因素（请列出）：

25. 在最近的三年里，您介绍了多少新产品？

没有  

1 - 4  

5 - 10  

超过 10
26. 在最近的三年里，对于扩展生产程序，你改进到什么程度？

（若适合，您可选择超过一个答案）

完全没有改进：[ ]
轻微改进：[ ]
适中改进：[ ]
很大的改进：[ ]

27. 若您在生产的程序上有所改进，你如何改进？

新的机器：[ ]
员工的训练：[ ]
新员工：[ ]
重整工作样式：[ ]
其他方法（请列出）: [ ]

28. 在最近的三年里，你有从事于志在改进或者革新产品的研究与发展吗？

有：[ ]
没有：[ ]

若有，您花费了营业额的多少百分比在研究与发展？

1994：[ ]
1995：[ ]
1996：[ ]
29. 您有积极地寻找客户吗？

有 □
没有 □

若有，您如何寻找客户？

__________________________________________________________________________

__________________________________________________________________________

30. 您有做市场调查吗？

有 □
没有 □

若有，您花费了营业额的上的多少百分比在市场调查？

1994 : _________ %
1995 : _________ %
1996 : _________ %
31. 一些政府机构有提供咨询或补贴计划于我国的中小型工业。您使用和利用了这些设备了吗？

（若适合，您可选择超过一个答案）

<table>
<thead>
<tr>
<th>机构</th>
<th>是</th>
<th>否</th>
<th>是</th>
<th>否</th>
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<tbody>
<tr>
<td>Malaysian Industrial Development Authority (MIDA)</td>
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<td>Malaysian Technology Development Corporation (MTDC)</td>
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<td>Bank Pembangunan (M) Bhd.</td>
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<td>Bank Industri (M) Bhd.</td>
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<td>Standard and Industrial Research Institute of Malaysia (SIRIM)</td>
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<td>Small and Medium Industries Development Corporation (SMIDEC)</td>
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<td>Malaysian Industry-Government Group for High Technology (MIGHT)</td>
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<td>Malaysian Industrial Technology Information Centre (MITIC)</td>
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<td>Perbadanan Usahawan Malaysia Berhad (PUNB)</td>
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<td>Malaysian Entrepreneurship Development Centre (MEDEC)</td>
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<td>其他（请列出）</td>
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________________________________________________________

________________________________________________________
32. 请指出以下在1994到1996期间影响贵公司增长的因素。

(请根据问题的重要性1至4等级来回答。)

<table>
<thead>
<tr>
<th>指示</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td></td>
<td>完全不重要</td>
<td>差不多重要</td>
<td>重要</td>
<td>非常重要</td>
</tr>
</tbody>
</table>

主要产品缺乏市场

人手短缺

员工素质差

缺乏适量的基金来扩充

缺乏适合的经营场地

缺乏原料或供应商

仪器问题

缺乏本过与外国的市场资讯

缺乏金融资讯

缺乏生产科技

缺乏工艺流程的资讯

缺乏道路或轨道系统

呆账或拖欠款项

难以符合品质标准

缺乏管理时间来开发新产品和市场
请利用这个空间来发表您的宝贵意见。


谢谢您的合作。万分感谢您对这研究的贡献。

请使用所提供的信封来寄回这份问卷。

寄至以下地址：

Mohd. Hassan Mohd. Osman
Faculty of Management and Human Resource Development
Universiti Teknologi Malaysia
Locked Bag 791
80990 Johor Bahru

若你希望得到这份问卷的报告，
请在格子里直接写上贵公司名称和地址。

公司名字：

地址：
Appendix 6-4

QQ Plot of Annual Turnover Growth
– Incidence of Outliers
Appendix 8-1

Summary of Case Studies
Summary of Case Studies

COMPANY A
Company A was established in 1995 by Universiti Teknologi Malaysia (UTM) as a teaching facility cum plastics technology training centre. Initially it was managed by the university's Bureau of Innovation and Consultancy (BIP). However, in 1998 it was officially established as a private limited company with Uni-Technologies, the commercial arm of UTM, as the majority shareholder (53 percent). Shachihata and Sadao (manufacturing companies from Japan) each hold 22 percent and 10 percent of equity respectively. Company A moved its operations from a small wooden building near the University to a much larger and conveniently located site on the University's incubation centre in 1998.

Company A produces and assembles plastic motor parts and components for Japanese MNCs such as JVC, Yokogose, Matsushita and B.M. Nagano. Currently the company is developing and testing a new plastic product to be designed and manufactured for industrial and agriculture use. Since Company A is an Licenced Manufacturers Warehouse (LMW)\(^1\), almost all of its products are exported. For the past three years the company has invested in new machines and worked with UTM to produce more own-brand products. Company A is also hoping to produce a Malaysian version of one of Shachihata's products under Company's A brand name.

Company A is mainly financed from internal sources. Since it is a teaching facility, financing for new machines is provided by UTM. UTM provides management and technical expertise from its pool of academic staff and Shachihata provides the market and marketing expertise.
COMPANY B
Company B started out in 1987 as a trading division of a Bumiputra company offering a range of scientific products and equipment. In 1992, owing to increasing sales, Company B was incorporated as a private limited company, under the control of two engineers and supporting staff. The company has since expanded to its present capacity, employing managers, engineers and technicians from various disciplines such as electronics, mechanical engineering and software development.

Today, Company B is engaged in a range of specialised services such as the design, supply and installation of integrated factory automation systems, building security and automation systems, and electrical services. The company is aiming to become one of the premier technology-based companies in Malaysia. Company B is moving into the design and manufacture of smart card and bio-identification media after its last product became obsolete. It is also exploring the idea of developing the Intelligent Building concept in Malaysia with Telekom Malaysia. In 1997, Company B formed a subsidiary to develop expertise in Intelligent Building Management Systems. This subsidiary company has been appointed as the consultant for various projects in the Klang Valley, including the Multi-Media University and the Multi-Media Super Corridor.

Company B has been financed by commercial banks, either in the form of a bank guarantee, 'al-mudarabah' (profit sharing scheme), or a letter of credit. For example, the Islamic Banking Section of Bank of Bumiputra provided a bank guarantee of RM4m. Finance company funding is also available but judged to be too expensive. Company B had applied for VC funding, but had been turned down. Likewise, the company sought funding from a development bank, but the application was rejected.

COMPANY C
Company C was incorporated in 1989 with authorised and paid-up capital of RM500,000. Company C concentrates the design and construction of scientific laboratories and the supply of scientific equipment. The company also provides 'end servicing' such as water, gas, mechanical and electrical installations. Its customers include research centres (such as the Atomic Research Centre and Institute for
Medical Research), universities, multi-national corporations (including Texas Instruments and ESSO), hospitals and schools. Currently, the company has 40 full-time employees.

Company C has been financed by commercial banks through letters of credit, bankers' acceptances or trust receipts. The company relies on banking facilities offered by the Islamic Bank of Malaysia (BIMB) or other commercial banks. For example, BIMB provides a bank guarantee of RM1.5m and Islamic leasing facilities (RM156,000), known as 'Al-Ijarah', for the purchase of machinery. However, an application for ITAF funding was declined, and the company did not accept the nominal amount offered.

COMPANY D
Company D, was incorporated in 1992 and has a paid-up capital of RM437,500. Since its inception, Company D has been a manufacturer of high precision tools and stamped metal components for the electronics and electro-technical industries. However, in 1993 it diversified into the manufacture of a spiral wound gasket used in sealing oil and gas pipelines. Its biggest breakthrough came in 1995, when the company was able to produce its first gasket for PETRONAS (the major national oil company in Malaysia).

SIRIM provided Company D with technical assistance and skills until the company was able to achieve ISO certification. Company D regularly sends its staff to SIRIM for skills upgrading. Recently, Company D was able to expand its gasket production capability when Technology Park Malaysia (TPM) leased some laser cutting machines at the TPM Robotic Centre in Bukit Jalil. In 1997, the Tenaga Nasional Berhad (the major power producer in Malaysia) appointed Company D as the sole manufacturer of spiral wound gaskets for its power plant in Peninsular Malaysia.

Company D's experience demonstrates PUNB’s short-term orientation. PUNB (a quasi-government organisation set up to assist Bumiputra start-ups) refused to provide further funding when Company D was not able to market its first product after a year of product development. However, when Company D was successful in
marketing its first product three years later, PUNB suddenly offered to finance Company D’s operations. Thus, Company D has been financed by PUNB and commercial banks. PUNB contributed 30 percent of the paid-up capital. Company D has secured local markets, but it sees a big potential to market its products in South Africa and the Middle East.

COMPANY E
Company E established its manufacturing and marketing organisation in 1976 and moved into its existing premises in Bangi in 1989. In 1995, Company E was acquired by a large Malaysian-owned chemical company, and it is now one of the leading suppliers of pharmaceutical products and services in Malaysia. It manufactures and markets a wide range of generic pharmaceuticals, health and food supplements for sale in Malaysia and in the ASEAN region. The core business is the manufacturing and marketing of over 350 pharmaceutical products, including antibiotics, antihistamines, expectorants, and anti-hypertensives. The company manufactures and markets over 100 health and food supplements, including vitamins and herbal products. Company E also manufactures pharmaceutical products under a contract for multinationals or leading pharmaceutical companies.

Over the years, Company E has invested significantly in improving and modernising its production facilities and this has resulted in the doubling of production capacity. In order to widen its network in neighbouring countries, the company has licenced manufacturers and distributors in Indonesia, Thailand, Hong Kong and Taiwan.

Company E does not require any external sources of financing. The parent company finances its expansion plans, while working capital requirements are met from cashflow.

COMPANY F
Company F, established in 1975, manufactures moulded rubber parts for the local (90 percent) and overseas (10 percent) market. The company uses synthetic and natural rubbers to supply the automotive and motorcycle industries, as well as other diverse
industrial applications. Its products include anti-vibration parts, sealing rings, gaskets, valves, bellows and insulators.

Since Company F is a subsidiary company, the bulk of its financing requirements are met by the parent company. Company F was offered modest financing facilities by its bank, but it has not used them.

COMPANY G

Company G was formed in 1991, with the objective of servicing organisations and individuals wishing to lead in the knowledge society. Company G is a subsidiary of Malaysia's largest telecommunications and information technology conglomerate. The aim was to exploit global convergence of computers and telecommunications. The company has over 100 experienced consultants involved in various IT projects in Malaysia and ASEAN countries.

Being part of a large telecommunications company, Company G has used its parent company's worldwide network to market its own products overseas. In 1993, the company launched the XD (Executive Desktop) and was able to penetrate the US market. However, owing to intense competition, the product was not widely accepted and only one major US company, KOMAG, adopted its product. By 1997, the product had become obsolete. Currently, Company G is working with established international IT companies, such as Microsoft and Hewlett Packard, to develop a new product.

Most of its financing comes from its parent company, a financially stable company. Although Company G is aware of external sources, such as the IRPA and MDC funds, it has not approached any of these sources.

COMPANY H

Company H, a wholly owned subsidiary of an American optoelectronics firm, was established in Johor in 1994. Company H manufactures OEM microelectronics and turnkey products, such as airport x-ray scanners and photo-optic sensors. It produces finished products and components for local and export markets. Since Company H is an LMW, no more than 20 percent of its products can be sold locally.
Company H relies upon its parent company for expansion finance. It also utilises the facilities offered by a commercial bank. Currently, it is exploring research funding with the IGS and intends to develop local technology jointly with UTM and Johor Corporation (a State Development Corporation).

COMPANY I
Company I is one of the leading chemical companies in Malaysia. The company was established in 1985 with a paid-up capital of RM1m. Since its inception, the Company has introduced 45 new chemical products, mostly in the agrochemical industry, with 12 more waiting for approval. Almost all of its products are exported to the US, ASEAN countries, Taiwan, Europe, Pakistan and Bangladesh. Company I is planning to set up a glyphosate ammination plant in Malaysia to compete with international companies such as Monsanto.

Company I has raised funds for expansion from commercial banks, finance companies, merchant banks and, recently, from a venture capital company. The VC funds have not yet been utilised. Company I has never been refused funding for expansion because it has an excellent track record and ample collateral.

COMPANY J
Company J manufactures and assembles printed circuit boards for audio, video and electrical products. It also provides manufacturing services to MNCs. Its main export markets are Germany, US and Brazil. It is 70 percent owned by Bumiputra and 30 percent non-Bumiputra shareholders.

Company J was established in 1994 under the VDP. Thus, its markets have been guaranteed by its anchor companies, including Yamaha and Phillips JVC. Over the past few years the company has won a number of awards such as the Excellent Entrepreneur Award and the Quality Achievement Award for a Vendor Company. Over the next three years, Company J will be focusing on OEM and R&D to develop its own products.

Company J has tapped a variety of external funding sources. Currently, it is using a loan of RM1m from MIDF, RM1m from an ASEAN Institution and RM1.5m
from the World Bank. PUNB provided loan stock of RM3m and RM500,000 in paid-up capital. In addition, RM2.25m was made available by a local commercial bank for the purchase of machines with another RM1.25m in the form of a bank guarantee.

**COMPANY K**
Company K was started by a group of enterprising mainframe engineers in January 1985. It is a Third Party Maintenance company. Today, the company has diversified its operations into the high technology sphere. Its specific concentration is on system solutions and the integration of IT in Local Area and Wide Area Network, Digital Broadcasting Integration, Internet Gateway Application Development, Wireless Power Application and Technology-Oriented Plastics Manufacturing.

Over the years, Company K has successfully handled the installation of products ranging from Mainframes, MINIs, UNIXs, NTs Servers to PCs. Its system consultancy has tackled Needs Assessment Studies, Fibre Optic and Copper Cabling, and Project Implementation. Company K is also involved in promoting solar electrical systems using the Photovoltaic method for wireless power application. This product utilises solar energy to deliver clean and economical electric power. As a synergistic move, Company K combines its established IT expertise with fully integrated disk-based systems for the Broadcasting industry. This covers recording, editing and on air playback, using digital solutions. The company also provides specialised maintenance support and services for IT hardware and peripherals.

Currently the company requires RM20m in order to expand its operations. Its major financing source is commercial banks, which provide RM17m (RM2m for working capital and RM15m for project financing). The remaining RM3m is internally generated. Company K was refused funding by PUNB, as that body was not convinced of the project's commercial viability.

**COMPANY L**
Company L is Malaysia first veterinary vaccine manufacturing company. It was established with a paid up capital of RM6m in 1992, as part of the Malaysian Government's privatisation programme. Company L took over the production of animal vaccines from the Veterinary Research Institute. The Company produces high
quality animal vaccines to meet the demands of the poultry and pig industries in Malaysia, as well as the international market.

Through a strategic partnership with Arthur Webster Pty of Australia, a wholly-owned subsidiary of American Cyanamid Company, and in collaboration with Universiti Putra Malaysia (UPM) and the Government’s Department of Veterinary Services, Company L set up a manufacturing plant to produce high quality animal health products. Presently, under the stewardship of Malaysian Technology Development Corporation (MTDC), Company L is poised to grow further to meet the demands of a competitive global market.

Its vaccine manufacturing facility, located at Puchong, was designed by Websters to meet International Standards of Good Manufacturing Practice. These manufacturing procedural codes are strictly adhered to at every stage of manufacture, from the receipt of raw materials through to the release of goods for sale. Managed by a team of qualified professionals in their respective fields, and supported by highly skilled and dedicated staff, Company L is positioned to exploit future opportunities in the animal vaccines and pharmaceuticals industries. Currently, 10 percent of its vaccines are exported to countries such as Indonesia, Thailand, Mozambique and Ghana.

Its major sources of financing are a loan from Bank Pembangunan (RM3m) and trade financing from its holding company, the MTDC.

**COMPANY M**

Company M was incorporated as a subsidiary to ABRAR Technologies in 1989, with paid up capital of RM3.5m. It is an IT company providing solutions based on network computing models, with the emphasis on UNIX and Java. Among the services offered by Company M are the design and installation of UNIX-based software, project management, business re-engineering, and systems design consultancy services, training and software customisation services.

Over the past few years the company has invested considerably in computer hardware and software, recruiting more knowledge-based personnel and training its
existing specialised workers. The Company planned to list on the Kuala Lumpur Stock Exchange Second Board. Owing to the Asian financial crisis, however, the plan has been postponed.

The company funds its investment plans mainly through Islamic financing. It has raised a total of RM28m linked to projects. It has also used services of a merchant bank to provide financial co-ordination and advice.

COMPANY N
Company N is an IT company focusing on managed services and NetMedia. Its operations are backed by the Skali Multimedia Applications Centre (SMAC), a first class data centre. These technological resources are easily accessible to users via the Internet and via affordable commercial packages. In providing the NetMedia and Managed Services, the company positions itself as a Content Aggregator, and it combines information, technology and services through worldwide partnerships with other Internet providers.

Company N commenced business in January 1997 with the signing of an AltaVista Affiliates Network agreement. The company was chosen by AltaVista Software Inc. to operate and manage the AltaVista search mirror site for the Asian region. Since then, the company continues to break new ground in Asia by introducing value-added service packages, establishing global partnerships and introducing competitive business models.

The company generates internal equity through profit retention and seeking additional funds from shareholders. The Company applied for the MSC grant, but has yet to receive approval from MDC. It also benefits from loan stock (RM10m) from PUNB Nomura, a VCC. An application for IGS Fund support was declined in rather controversial circumstances, as was a similar request to the Multimedia Development Corporation. However, the Company is facing cashflow problems. It has not been able to capture enough customers to break-even. Malaysian companies have yet to adopt e-business, or to advertise through the internet to any great extent. At the time of my interview, a number of IT executives had not been paid their salary for the past
month. The company plans to expand its market to the wider South East Asian market.

**COMPANY O**

Company O was established in 1997. It is a joint venture company between Uni-Tech, the commercial arm of UTM, and UniQuest, the commercial arm of the University of Queensland. It brings together strong research capabilities at the University of Queensland with the technology commercialisation and entrepreneurial skills of UniQuest, and blends these with the research capabilities and facilities at UTM. Company O combines Australian Science with Malaysian entrepreneurial skills to provide technology commercialisation, opportunities for collaborative university-industry R&D, consulting and R&D management services, training courses and opportunities to explore other technology-based business.

The company received a grant of RM2m under the IGS to develop a small, low cost, high performance flat antenna for the transmission and reception of satellite beams, suitable for local market. Company O will transfer the RLSA (Radio Line Slot Array) technology from the University of Queensland that has a provisional patent for the technology. The Company is in discussions with a local satellite antenna manufacturer, to develop the prototype, manufacture and distribute the product.

As stated above, Company O received a grant from the Ministry of Science under the IGS. The company is also considering applying for bank loans and approaching venture capital companies for further financing.

**Notes**

1 To encourage the manufacture of products mainly for export, the Government encourages the setting up of LMWs in areas where the establishment of a Free Industrial Zone (FIZ) is neither practical nor desirable.