KNOWLEDGE ACQUISITION IN INTERNATIONAL STRATEGIC ALLIANCES AMONG MALAYSIAN MANUFACTURING FIRMS

FARIZA HASHIM

Doctor of Philosophy

ASTON UNIVERSITY

April 2004

ASTON UNIVERSITY

KNOWLEDGE ACQUISITION IN INTERNATIONAL STRATEGIC ALLIANCES AMONG MALAYSIAN MANUFACTURING FIRMS

Fariza Hashim
Doctor of Philosophy
2004

Thesis Summary

This thesis examines the process of knowledge acquisition by Malaysian manufacturing firms through their involvement in international strategic alliances. The strategic alliances can be with or without equity involvement. Firms involved with a foreign partner with equity involvement are joint venture firms while non-equity involvement are firms that engaged in contractual agreements. Using empirical evidence from 65 international alliances gathered through a survey conducted in high-technology manufacturing sectors, several factors that influence the process of knowledge acquisition are examined. The factors are; learning capacity, experience, goals, active involvement and accessibility to the foreign knowledge. Censored regression analysis and ordered probit analysis are used to analyse the effects of these factors on knowledge acquisition and its determinant parts, and the effects of knowledge acquisition and its determinants on the performance of the alliances. A second questionnaire gathered evidence relating to the factors, which encouraged tacit knowledge transfer between the foreign and Malaysian partners in international alliances.

The key findings of the study are: knowledge acquisition in international strategic alliances is influenced by five determining factors; learning capacity, experience, articulated goals, active involvement and accessibility; new technological knowledge, product development knowledge and manufacturing process knowledge are influenced differently by the determining factors; knowledge acquisition and its determinant factors have a significant impact on the firm's performance; cultural differences tend to moderate the effect on the firm's performance; acquiring tacit knowledge is not only influenced by the five determinant factors but also by other factors, such as dependency, accessibility, trust, manufacturing control, learning methods and organizational systems; Malaysian firms involved in joint ventures tend to acquire more knowledge than those involved in contractual agreements, but joint ventures also exhibit higher degrees of dependency than contractual agreements ; and the presence of R&D activity in the Malaysian partner encourages knowledge acquisition, but the amount of R&D expenditure has no effect on knowledge acquisition.

KEYWORDS : Knowledge Acquisition, Tacit Knowledge, International Strategic Alliances, Learning, Performance

DEDICATION

This thesis is dedicated with affection to my husband, Abdul Rahim Abu Bakar, and four lovely daughters; Farzanah, Fathini, Faatihah and Fariheen, whose good humour and patience have been an inspiration to me.

ACKNOWLEDGEMENT

First and foremost, I am indebted to Professor Jim Love whose insights, guidance, expertise and actions have been instrumental in helping me complete this thesis as well as providing me with a strong foundation for my career. He has been a primary source of considerable inspiration and intellectual motivation, without which I would not have finished this thesis.

I am grateful to Universiti Utara Malaysia (UUM) for awarding me the doctoral scholarship and partly financing my data collection. For its financial help, I am deeply indebted. I would also like to thank the various agencies such as MIDA, MATRADE, FMM, and others for assistance during my data collection.

I also wish to thank my colleagues in Malaysia and in Aston University especially in the Academy of Research Management for their help and support in completing my research.

Most of all, special thanks go to my family especially my husband, Abdul Rahim Abu Bakar, and my four beautiful daughters; Farzanah, Fathini, Faatihah and Fariheen. I appreciated the unwavering support, endless patience and encouragement when it was most required.

LIST OF CONTENTS

Table of Contents

LIST OF TABLES AND FIGURES:

Figures :

CHAPTER ONE : INTRODUCTION

1.1 Background of International Strategic Alliances

The last two decades have witnessed a major transformation of the economy and business environment. The business environment is dealing with rapid change as a result of increasing complexities, uncertainties and discontinuities of technologies and products. Changing market conditions, increasingly intensified global competition and shorter product life cycles mean that firms need to constantly appraise their current strategies in doing business (Bartlett & Ghoshal, 1987; Ohmae, 1989). Therefore, firms cannot afford to continue with their conventional practices of doing business and sustain their competitiveness if changes have not been made in their strategies. These changes together with the globalisation of markets and technologies, have brought an importance to strategic alliances as a means of doing business particularly across national boundaries.

Lei and Slocum (1992) define alliances as co-alignment between two or more firms in which the partners hope to learn and acquire from each other the technologies, products, skills and knowledge that are not otherwise available to their competitors. Ohmae (1989) regards international strategic alliances as an important way to overcome potential difficulties and help firms to regain and maintain their competitive position in international markets. International strategic alliances, which derive from the same concept, involve a larger scope and are more complex as they align two or more firms from different nations and blend different cultures. Parkhe (1991) defines international strategic alliances as enduring interfirm cooperative arrangements which involve cross-border flows and linkages that utilize resources and governance structures, to accomplish joint goals that link to corporate mission. Various studies have indicated that interfirm collaboration becomes necessary for multinational corporations to compete effectively in globalizing markets because it becomes a vital means to manage environmental turbulence and interdependence (Astley, 1984, Bresser & Hall 1986). The collaborative alliance is now an essential mechanism for competitive positioning in the market.

The rapid growth of international alliances has been encouraged by several factors, some of which are: the internationalisation of markets; the speed, complexity, interrelation and uncertainty of technological development; increase in costs of Research & Development (R&D); and the necessity for large companies to monitor a spectrum of technologies (Contractor & Lorange, 1988). Hagedoorn (1993) claims that firms engage in alliances not only to increase complexity of new technologies and technological synergies, and to access to new market and opportunities; but also to involve in concrete innovation process, which includes capturing partners' knowledge of technology and shortening product life cycle by reducing the period between invention and market introduction. Hence, alliances aid firms to harness the capabilities and the dynamism of firms to do things that would be otherwise hard to do alone. Firms often find it too costly and cumbersome to develop on their own, all the knowledge and capabilities they need or want to have available.

The rate of formation of alliances has increased significantly over the last two decades and the motives for their establishment has shifted. Strategic alliances have become widespread in technology-intensive industries such as semi-conductors and computers, compared to other industries. Motives for the formation of these alliances include the need to spread the costs, risks of innovation and rapid penetration of foreign markets which is easily achieved through alliance. Other motives include coordinating and formulating technical standards and 'dominant design' particularly collaboration between users and suppliers of new products (Grindley, 1995). Alliances also play a role in facilitating coordination among competitors to increase market power (Porter & Fuller, 1986; Hagedoorn, 1993).

One of the most widely cited motives for collaboration, linked to many of those just described, is the acquisition of new technical skills or technological capabilities from partner firms (Mariti & Smiley, 1983; Hamel et al., 1989; Shan,1990; Hamel,1991; Powell & Brantley, 1992; Moody, 1993; Khanna, 1996). Alliances also create knowledge links and give firms access to the skills and capabilities of other organizations and sometimes enable them to create new capabilities. Alliances have advantages over conventional contracts or markets for this task because firm-specific technological capabilities frequently are based on tacit knowledge and are subject to considerable uncertainty concerning their characteristics and performance. By combining some of the incentive structures of markets with the monitoring capabilities and administrative controls associated with hierarchy, alliances can provide a superior means to gain access to technological and other complex capabilities. In fact, alliances range from fairly simple unilateral contracts, such as licensing, through more complex contractually based arrangements, such as technology sharing and joint development agreements, to pure equity joint venture, where ownership in a separately incorporated entity is shared by the partner firms. Figure 1.1 shows the variety of alliance form that are conducted by firms.

Figure 1.1: Variety in Alliance Forms

Source: CATI Database*

*CATI – Cooperative Agreements and Technology Indicators (CATI) database, a comprehensive data set that contains information on over 9000 alliances involving some 5000 firms in many industries and countries (Hagedoorn & Schakenraad, 1990)

1.2 International Strategic Alliances in Malaysia

The emergence of international strategic alliances is widely spread not only in developed countries but also in developing countries. Indeed, international strategic alliances create an avenue for developing countries to cope with the changes that take place in the competitive environment. Developing countries particularly in the Far East region are focusing their efforts to build up their competitive strength through international strategic alliances. Countries like Malaysia, Indonesia, Thailand, Vietnam, Cambodia and China are very keen to engage in strategic alliances with foreign partners especially from the developed nations like United States, Japan, Germany, United Kingdom, France and other countries that are considered as possessing technological knowledge or know-how.

This study will focus on Malaysia as one of the developing nations in South East Asia. Malaysia is selected because it is one of the countries that is rapidly developing in the region since 1990. The source of economic strength in Malaysia lies in its manufacturing sector, which is strongly supported by the foreign firms through their engagement in international strategic alliances (ISAs) with local firms. This phenomenon has become the push factor for an enormous growth of international strategic alliances in Malaysia. The growth of international strategic alliances in Malaysia has been very rapid and it does not only involve private firms, but also the Malaysian government-owned firms.

Despite the high growth of the ISAs in the country, not much is known about the international strategic alliances in Malaysia. Although the ISAs tend to focus at the manufacturing sector, the understanding of the relationship between the local and foreign firms in this sector is very limited. Though the number of international strategic alliances involving Malaysian firms has reached four digits according to Malaysian government agency, MIDA, the exact number is not possible to be provided as there is no authoritative body that monitor the ISAs progress and development. There is a risk of failure when the local firms involved in ISAs with foreign firms. Some of the established ISAs might continue to grow over time while some of them might not able to progress well while others might totally fail. Due to these risks that ISAs have to deal with, it is difficult for MIDA, the government agency to monitor ISAs progress and development over the time. Thus, MIDA only provides databases of the local firms based on approved application of strategic alliance projects. As a result, the number of existing alliances cannot be accurately presented.

Another reason for choosing Malaysia as a focus of the study is because the researcher is a Malaysian national and is used to the cultural environment in the country. This has contributed to facilitate the data gathering process particularly in getting the interviews.

The rapid development has been in place for several years since Malaysia embarked on its industrialisation and foreign direct investment policy in late 1980s. Many foreign firms are included in both the government and private firms development project until today. Hence, this indicates the vital role that foreign firms play in the development of the country in the last few decades. Further discussion on the contribution of foreign firms to the Malaysian economy is in section 1.7. Nonetheless, despite the rapid growth of international strategic alliances and the significant involvement of foreign firms in the manufacturing sector in Malaysia, little is known about an achievement or progress in these relationships. This has triggered this study to investigate the improvement that take place in international strategic alliances among Malaysian firms especially in high technological industries such as electronic and electrical sector.

1.3 Classification of Strategic Alliances

Generally, strategic alliances can be divided in two categories, equity sharing and non-equity sharing (Hagedoorn & Narula, 1995). Equity sharing includes firms that have equity involvement in the alliances and have a governance structure with a new administration. Modes for equity sharing alliances are like joint ventures and jointly-owned research corporations. Killing (1983) identified two types of joint venture; majority holding or dominant partner, and equal participation. Majority holding refers to a firm that has more than 70% equity or has dominant control over the new structure while equal participation refers to a firm that has equal amount of equity namely 50-50 participation.

In contrast, non-equity alliances involve firms that have agreements and have no equity sharing. Non-equity alliances are also known as contractual agreements and the types of modes include joint development agreements, joint research pacts, cross-licensing, second-sourcing agreements, mutual second sourcing and R&D contracts

(Hagedoorn & Narula, 1995). Contractual alliances can be further classified as unilateral-based and bilateral based. Unilateral based includes modes like one-directional technology flow, second sourcing and licensing while bilateral-based alliances include modes like technology exchange agreements, technology sharing, cross-licensing, mutual second-sourcing, joint R&D.

Hagedoorn (1990) classified all the modes in alliances in a spectrum form to show the organizational interdependence between the firms (Figure 1.2).

Figure 1. 2 : Alliances Based on Organizational Interdependence.

Mode of cooperation	Organizational interdependence
Joint ventures and research corporations	Large
Joint R&D, such as research pacts and joint development agreements	
Technology exchange agreements (mutual), technology sharing, cross-licensing, mutual second-sourcing	Medium
Direct investment, minority and cross-holding	
Customer-supplier relations, R&D contract, co-production, co-makership	
One-directional technology flow, second sourcing, licensing	Small

1.4 Link between Strategic Alliances and Knowledge Acquisition

As many firms have now realized that self-sufficiency is becoming increasingly difficult in a business environment that demands strategic focus, flexibility and innovation (Drucker, 1995), the importance of international strategic alliances has grown significantly and adapted. International strategic alliances provide the local firms with opportunities to pull their strengths with the help of foreign partners and create potential for firms to acquire knowledge associated with partner skills and capabilities (Inkpen, 1996). This knowledge can then be assimilated into the local firm's systems and structures. Without an alliance, access to the foreign partner's skills would probably be restricted, thus limiting opportunities for learning. The formation of alliances represent strategic initiatives that create potential for creating experiences, actions, and strategic choices that provide the basis for learning. However, the formation of the alliance cannot ensure that its learning potential will be realized. Firms must take explicit steps to capitalize on the alliance knowledge potential.

In the context of this study, the collaboration between the local firms and foreign firms, namely MNCs, who are assumed to possess the desired knowledge, will direct the local or recipient firms to the processes of learning and knowledge transfer. Foreign firms are normally firms that possess advanced knowledge in certain technology or products and they are expected to provide that knowledge to the local partners through the strategic alliance modes. As learning and knowledge transfer processes would be involved in this inter-organizational relationship, spill-over benefits are expected to be gained through organizational learning and technology transfer. These two processes and tangible benefits as well as intangible benefits would be the knowledge that is acquired by the local firms. The recipient firms expect to learn as much as possible within the limited period of the relationship.

As acquiring new knowledge or technological capabilities is the most significant motive for collaboration, strategic alliances become a strategic learning channel for firms to accomplish such a motive. Strategic alliances provide opportunities for exploring and learning new knowledge, which is becoming a managerial priority as it provides the basis for organizational renewal and sustainable competitive advantage. Strategic management researchers have begun to recognize knowledge as the most important resource that managers need to value and understand if they are to create sustainable competitive advantages (Epple, Argote & Devadas, 1991; Doz, 1996; Barkema, Bell & Pennings, 1996).

In order to understand knowledge, firms have to value the complexities of acquiring, transferring, and integrating knowledge in a learning environment. The complexities in acquiring, transferring and integrating knowledge are more intense when it involves firms from different countries. The complexities are greater as firms have to deal with cross-border issues like skills and cultural differences, and the challenge of adapting the organizational skills in diverse settings. International strategic alliances create learning prospects for the partner firms as it brings together firms with different skills and knowledge bases. The primary interest in the strategic alliances is to gain access to the skills and knowledge of their partners. This access can be a powerful source of new knowledge that would not be possible without the formal structure of an alliance (Inkpen, 1998).

Certain challenges arise, which have to be properly managed in order to minimise the negative impact on the results of learning. Learning and acquiring new knowledge might not occur when those challenges dominate the alliances and the collaboration might end up with termination. Hence, firms should bear in mind that learning and acquiring knowledge is not a straightforward process, indeed it is a complicated process that requires appropriate planning and implementation. In addition, learning is not the only objective for firms to engage in strategic alliances, firms may engage in alliances to reduce transaction costs or maximize profits. Therefore, it remains unclear whether strategic alliances enable firms to learn from their partners. Grant and Baden-Fuller (1995) argue that firms form alliances not only to learn, but to use external resources so that they can concentrate on developing their existing capabilities. This argument is particularly true when it involves partners from developed and developing countries. Partners from developed countries are more likely to utilise the external resources for their existing capabilities while the local partners are more likely to focus on developing new capabilities. Different knowledge skills and experience among the partners from developed and developing countries would create a knowledge gap between them, which would create more obstacles for the learning process. Though learning through strategic alliances can occur successfully, it is still a difficult, disappointing and often misunderstood process. The primary obstacle to success is a failure to access, assimilate and disseminate the desired knowledge (Inkpen, 1996). Exploiting learning opportunities and internalising knowledge within the firm are the most difficult parts in acquiring knowledge from the partners. Hence, this study attempts to explore the barriers or factors that surround the knowledge acquisition process in international strategic alliances.

1.5 Research Problem

1.5.1 Research Problem on Knowledge Acquisition

A number of scholars have discussed the use of alliances by firms to acquire technology-based capabilities from alliance partners and their participants that facilitate the flow of technology-based capabilities and other knowledge among partners (Kogut, 1988; Hamel, Doz & Prahalad, 1989: Cohen & Levinthal, 1990; Hamel, 1991). Indeed, they also suggest that firms use interfirm collaborations to gain access to other firms' capabilities and exploit intensively on existing capabilities within each firm (Grant & Baden-Fuller, 1995; Nakamura, Shaver & Yeung, 1996).

The role of alliances in knowledge acquisition has also been researched, with the focus nevertheless being on local knowledge acquisition rather than foreign knowledge acquisition. Beamish (1984,1988); Gomes-Casseres (1989,1990); Inkpen (1992) and Makino (1995) have focused on the role of alliances and, particularly, international joint ventures as a means of local knowledge acquisition. These researchers reveal that access to information about the local environment is the most important criterion in forming joint ventures with local firms. Indeed, the level of local knowledge is a significant factor influencing joint venture performance (Beamish 1984, 1988). The need becomes vital as MNCs operate in developing countries rather than developed countries. Despite these studies, little is known about foreign knowledge acquisition in alliance relationships. Lyles and Salk (1996) conducted a study on foreign knowledge acquisition through alliances in Eastern Europe, however, not much is known about foreign knowledge acquisition in South East Asia.

1.5.2 Research Problem on Alliances and Knowledge Acquisition

Even though it is known that firms use inter-firm collaboration to acquire new technologies and expand their product reach, most scholars have focused on the knowledge acquired through equity sharing modes like joint ventures, with few of them considering the knowledge acquired through non-equity sharing modes like joint development agreements. Osborn & Baughn (1990) who investigate the various forms of strategic alliances indicate that joint ventures rather than non-equity agreements are preferred to do collaborative research and development. Their study, however, is only focused on the preference of modes among alliances without referring to the knowledge acquired through those modes. The joint venture form is preferred because it allows greater integration where information flows are facilitated and day-to-day coordination is improved.

Kogut (1988) in his study did focus on knowledge transfer among firms, nevertheless, the modes studied tend to centre on international joint ventures which represent equity sharing mode. He stresses that the opportunity for interfirm transfer of capabilities is influenced by the structure chosen, and equity-based cooperation such as joint ventures is more effective for the transfer of tacit knowledge between the partners. Mowery, Oxley and Silverman (1996) conducted a study on alliances and looked into technology transfer and modes of alliances. They examined the transfer of technological capabilities within strategic alliances in both equity and non-equity alliances. Joint ventures represent equity while unilateral and bilateral represent non-equity. However, the study was conducted only on US firms that formed alliances with Japanese and European partners and, hence, the understanding of this knowledge transfer is limited to a developed countries. The understanding of knowledge transfer between developing countries and developed countries remains relatively unknown.

Based on the limited prior study and ambiguous understanding of knowledge acquisition through international alliances particularly in South East Asia, this study attempts to investigate the extent of knowledge acquisition by Malaysian firms from the foreign partner through two types of alliances: equity and non-equity sharing. Equity alliances will be considered in two modes: dominant and shared partnership;

while non-equity alliances will be examined in terms of unilateral and bilateral. This study will examine which types of alliances will contribute to a higher level of knowledge acquisition from the foreign partner.

1.6 Research Objectives

This study aims to focus on the knowledge acquired through the alliances and the learning process that occurs in both types of collaborations, equity and non-equity. Hence, the research objectives are:

1) To assess the extent of knowledge acquisition among Malaysian firms from the alliance relationship
2) To identify the factors that influence the knowledge acquisition in both equity and non-equity alliances.
3) To seek a link between knowledge acquisition and firms' performance from the alliances.
4) To provide recommendations for Malaysian firms in improving the alliance relationship

A construct on knowledge acquisition and performance will be developed and hypotheses of the relationship will be assessed. The knowledge acquired will be considered through the performance improvement that is experienced by the local firms. This study will examine in the context of collaborations between Malaysian firms and foreign MNCs and data will be collected from companies that are based in Malaysia.

1.7 Significance of the Research

Converging environmental forces have made knowledge and competencies essential for firms' global competitiveness and global competitiveness depends on the firms' receptivity, efficiency and absorptive capacity in organizational learning (Osland & Yaprak 1995; Cohen & Levinthal 1990). The new knowledge gained should be utilized by the learning firms, hence, they need to appropriate the value they create if they are to benefit from alliances and maintain or increase their bargaining power to the partner. The value created needs to be in the form of successful internalisation of new core competencies learnt from the partner (Hamel, 1991).

Prahalad & Hamel (1990) suggest that firms need to assimilate new sources of manufacturing technologies, tacit skills, and core competencies that will become the basis of future industry and technology initiatives. Hence, alliances create unique learning opportunities for the partner firms as it brings together firm with different skills and knowledge bases (Inkpen, 1998). Through alliances, firms could gain access to the skills and knowledge of their partners, which can be a powerful source of new knowledge to enhance their strategies and operations. All alliance mechanisms such as licensing, co-production, joint venture and consortia, will create direct and indirect opportunities for gaining knowledge and even strategic direction (Badaracco, 1991). Thus, strategic alliances either with competitors, customers, suppliers or governments, provide opportunities for firms to absorb new knowledge through cross-national collaborative arrangements.

1.8 Background of Malaysian Economy and Manufacturing Industry

Malaysia is one of the developing countries in South-east Asia with a population of twenty-four million in 2002 (Statistics Department of Malaysia, 2002) and surrounded by other developing nations like Thailand, Indonesia and Singapore. The country's GDP grew at 8.6% in 2000, slowing in 2001 to growth of 4%. The Malaysian economy rebounded from a sharp recession in 1998 when real GDP contracted by 7.4% in 1998. Despite the contraction, Malaysia managed to attract foreign direct investment of about US$3.7 billion in 1998 (UNCTAD, 2000). The foreign direct investment in Malaysia was spread across all sectors, and of the US$3.7 billion, the bulk US$3.4 billion was invested in the manufacturing sector. Malaysia possesses abundant resources and land, a well-educated work force, adequate infrastructure, and a relatively stable political environment.

The economy grew 6.1% in 1999 and a strong 8.3% in 2000, led by rapid growth in exports, particularly of electronics and electrical products. Due to the exports decline in late 2000, the Malaysian economy slowed dramatically. However, despite the decline in exports for the year 2000, Malaysia continued to receive increasing foreign investment in the manufacturing sector, MYR19.8 billion (USD5.23 billion) compared to MYR12.3 billion (USD3.2 billion) in 1999. The foreign investment maintained its importance in recent years though the amount invested slightly contracted following the global economic slowdown. MYR18.9 billion (USD4.98 billion) was invested in 2001 and the figure dropped further in 2002 to MYR11.5 billion (USD3.1 billion) (Malaysian Economic Report 2003). These figures show that the manufacturing sector in Malaysia relies heavily on foreign investors to boost the economy. Thus, the government is doing its best to attract foreign investors into the country by offering facilities and incentives to them. In fact, acknowledging the significance of the foreign-owned sector particularly in the manufacturing industries, government has expanded the current foreign investment policies in 1998. Apart from enjoying present incentives such as tax exemption (known as pioneer status), investment tax allowance, reinvestment allowance, infrastructure allowance, and incentives for export, foreign firms are also given other incentives such as liberalizing the equity policy, relaxation of export conditions and protection of foreign investment by having Investment Guarantee Agreements (MIDA, Feb. 2001).

Malaysia has developed successfully from a commodity-based economy to one focused on manufacturing. Today the Government of Malaysia seeks to make the leap to a knowledge-based economy. With independence in 1957, Malaysia inherited an economy dominated by two commodities - rubber and tin. The 1970s and 1980s witnessed some changes in the economy, with the government encouraging the growth of industries as a base for the economy and replacing commodities, as world commodity prices were very volatile at that time. Foreign companies started to enter the country from that period and some of them still remain in the country. In the past forty years, Malaysia's economic record had been one of Asia's best. From the early 1980s through the mid-1990s, the economy experienced a period of broad diversification and sustained rapid growth averaging almost 8% annually. New foreign and domestic investment played a significant role in the transformation of Malaysia's economy.

The manufacturing sector became more important in the economy and was the engine of growth of the Malaysian economy as it grew from 13.9% of GDP in 1970 to 33% in 2000. In contrast, agriculture and mining, which together had accounted for 42.7% of GDP in 1970, declined to 8.4% and 6.9%, respectively, in 1999. The exports of manufactured goods make up 85.2% of the country's total exports. These statistics reveal that manufacturing is becoming a dominant sector and a major contributor in the Malaysian economy. Hence, the understanding of this sector is increasingly vital to improve the country's economy.

Malaysia's rapid industrialisation was the result of the country opening itself early to foreign direct investment (FDI). The policy of encouraging FDI was believed to help the country to prosper. The role played by foreign investments or the foreign-owned sector are significant particularly in the manufacturing sector. The vital role played by the foreign firms in the manufacturing sector, particularly in high technology industries, has become a major source not only for production and exports, but also for employment. The significance of foreign firms is obvious as their investment to the country have generated a total of 738,000 jobs by 2000 and 894,000 and jobs by 2001 (refer Figure 1.3). The drop in foreign investment in 2002 has affected the employment rate and reduced the number of jobs to 647,000 (Malaysian Economic Report, 2003). The employment opportunities generated by foreign firms in the whole industry indicate the significance of the foreign firms' participation in the country. Apart from that, foreign firms are also the best source for knowledge transfer where the local firms could learn the new skills and technologies from abroad. Foreign firms have helped Malaysia to be one of the world's largest exporters of semiconductor devices; electrical goods, and appliances. This assistance continues to be necessary in order to make Malaysia a leading producer and developer of high-tech products, including software.

Figure 1.3: Employment Generated by Foreign Investment and Industry (thousands)

Industry / Year	Textiles	Chemicals	Petroleum & Gas	Fabricated Metals	Electrical & electronics	Automotives	Total
1999	15	14	21	23	259	44	523
2000	48	14	14	22	331	62	738
2001	27	25	2	83	438	30	894
2002	20	26	7	34	248	33	647

Sources: MIDA for Malaysian Economic Report 2003

The key manufacturing sectors that are encouraged according to the Second Industrial Master Plan (IMP2), are high technology industries such as electronics and electrical sectors especially semiconductors and other electronic products, petrochemical sector, pharmaceuticals, automotives, and machinery and equipment (MIDA, Mar 2001).

These sectors not only contribute in terms of high production and high employment, but also help to boost the country's exports. For the year 2002, the electrical and electronic sector at 46.7% was the largest contributor, the petroleum and gas sector contributed 10.6%, chemicals and chemicals products, 7.6%, fabricated metal products 3.6% and transport 3.0% (Malaysian Economic Report, 2003). The electrical and electronics industry is Malaysia's leading industrial sector and accounts for about two-thirds of total manufactured exports. Exports by the electrical and electronics sector totalled MYR18.5 billion (USD4.9 billion) in 2001 (MIDA, Mar 2001). These figures reveal that the high technology industries are crucial to the country's development and they will remain important in future years. This is clear as the government has emphasized that the electrical and electronics' future thrust will involve the development of high technology industries which includes a higher level of R&D activities, the establishment of more water fabrication facilities, the manufacture of components to support the consumer and industrial electronics sector, the manufacture of computers and computer peripherals, telecommunications equipment and office equipment. The chemical industry is also gaining importance in Malaysia and has massive investments from MNCs. The sectors involves include petroleum products, petrochemicals, inorganic chemicals, oleochemicals and industrial gases. The oil and gas exports amounted to MYR25.5 billion (USD6.7 billion) in 2000 or 6.8% of the country's total export earnings (MIDA, Mar 2001).

Malaysia is aiming to be a centre for manufacturing-related services such as R&D, designing, sourcing and supply of parts and components, and activities related to sales, marketing, distribution and management. Thus, in its Second Industrial Master Plan (IMP2), 1996-2005, the focus is on further development of the manufacturing sector with the back-up of R&D and design capabilities, the development of supporting industries, packaging, distribution and marketing.

Realising the significance of the influence of foreign firms towards the development of skills and technology, the government encourages foreign firms to engage in joint ventures or contractual agreements with local firms. Alliance relationships are expected to speed up the learning process by the local firms, so that the locals are capable of accomplishing the country's aim to be the centre of manufacturing-related services. The number of joint ventures and alliances are increasing each year and their presence become more significant. In conjunction with that, MIDA has established a registry, known as Registry of Investor and Contract Manufacturers (RICOM). RICOM was established to assist local and foreign manufacturers to identify suitable partners for projects in Malaysia. It also assists Malaysian contract manufacturers in forging business links to supply to the world markets. Nonetheless, RICOM does not provide the full database for the joint ventures or contractual agreements established as it does not keep track of the progress of the relationship. It only has a database for Malaysian companies, which are seeking partners for joint ventures or contract manufacturing. Up to present, there is no single specific source for a joint venture or contractual agreement database. But generally, the involvement of foreign firms in Malaysia can be tracked using a database provided by Commercial Intelligence Service. Currently, there are about 55,000 foreign subsidiaries, joint ventures and associate companies that are active in the Malaysian markets (Commercial Intelligence Service, 2003). The roles of foreign joint ventures and contractual agreements are gaining more importance in order for Malaysia to realise its IMP2 as a centre for manufacturing-related services such as R&D, designing, sourcing and supply of parts and components, and activities related to sales, marketing, distribution and management.

As the role of manufacturing industry is becoming more important to the Malaysian economy, the growth of this sector has to be monitored closely by the government. Hence, two government agencies to monitor the growth of this sector were set up under the Ministry of International Trade and Industry (MITI). They are the Malaysian Industrial and Development Authority (MIDA) and the Small and Medium Industries Development Corporation (SMIDEC). MIDA is the Malaysian government's principal agency for the promotion and co-ordination of industrial development in Malaysia. It is the first point of contact for investors who intend to set up manufacturing and related services projects in Malaysia.

The major functions of MIDA are:

- to promote foreign and local investment in the manufacturing and related services sectors;
- to undertake planning for industrial development;
- to recommend to the MITI policies and strategies on industrial promotion and development;
- to evaluate applications for: incentives provided under the Promotion of Investments Act 1986 for promoted manufacturing activities, tourism, R&D, training institutions and software development; manufacturing licences under the Industrial Coordination Act 1975 and the Petroleum Development Act 1974; expatriate posts required by manufacturing projects; tariff protection/duty exemption for raw materials, components and machinery; joint venture, technical assistance/know how, licence, patent/trademark and management agreements;
- to facilitate new and existing companies in the implementation and operation of their projects, and to offer assistance through direct consultation and co-operation with the relevant authorities at both the Federal and State levels;
- to facilitate the exchange of information and co-ordination among institutions engaged in or connected with industrial development;
- to enhance MIDA's role of providing assistance to investors, senior representatives from key agencies are stationed in MIDA. These include officials from the Ministry of Finance, the Ministry of Human Resources, the Immigration Department, the Royal Customs and Excise Department, the Department of Environment and the Department of Occupational Safety and Health. (Sources: MIDA, 2001)

SMIDEC is the government agency responsible for the promotion and coordination of small and medium industries in Malaysia. The major functions for SMIDEC are:

- to promote and coordinate the development of small and medium industries in Malaysia;
- to undertake studies related to the development of small and medium industries;
- to undertake promotional activities in the country to promote the growth of small and medium industries;
- to establish a comprehensive database and information system on small and medium industries' development programmes;
- to become the centre of collection, reference and dissemination of information related to small and medium industries;
- to provide technical support and management counselling services with the co-operation of other agencies involved in the enhancement of small and medium industries;
- to promote mutual co-operation among small and medium industries through amalgamation of businesses, technical co-operation, establishment of mutual funds or co-operation enterprise and the procurement of common equipment;
- to encourage industrial linkages among small and medium industries as well as with large industries; and
- to promote human resource development in small and medium industries.

(Sources: SMIDEC, 2001)

Malaysian economic development is based on a ten-year economic plan known as the Industrial Master Plan (IMP). At present, Malaysia is in its second Industrial Master Plan (IMP2), 1996-2005. The IMP2 moves beyond a mere focus on manufacturing operations to include strengthening industrial linkages and enhancing productivity through a full integration of activities such as R&D and design capabilities, and development of supporting industries on one side, and packaging, distribution and marketing on the other. Under the IMP2, Malaysia's industrialisation will continue to be private sector and market driven with a strategic shift to knowledge-based, technology-intensive and high-tech industries. A package of fiscal and non-fiscal incentives have been drawn up by the government to encourage investments into these targeted sectors. The private sector is encouraged to take advantage of the business opportunities available and contribute towards the development of the Malaysian economy. The government, for its part, will continue to provide a conducive and competitive environment for private sector investment in Malaysia.

1.9 Conclusion

The current international business environment has forced firms to take the challenge of adopting the new form of organizational strategy known as strategic alliances. The globalisation of the world economy has hastened this process and brought changes in the design of strategic alliances. Firms no longer collaborate within the same industries, but also across industries and across borders. The cross border alliance is referred to as an international strategic alliance. The role of strategic alliances is widely accepted and acknowledged as one of the organizational forms to learn new technical skills or technological capabilities. Many studies show that it is one of the effective ways for firms to sustain their competitiveness. Though strategic alliances are not always successful, the inter-firm relationship does provide some learning experience and knowledge acquisition. This learning and acquisition process can be gained through the variety of modes available for firms to collaborate, from equity to non-equity alliances. Equity alliances involve investments from the partners while non-equity alliances are based on contractual agreement between the partners. The selection of mode depends not only on the motives for the collaboration, but also upon the agreement of the involved partners. Although numerous studies have been conducted on strategic alliances, understanding of the knowledge acquisition process, in particular where the local partner is from a developing country and the foreign partner is from a developed country is still unclear. The knowledge gap and cultural differences between the partners has added more challenge for the foreign partners from developed countries to deal with. These are the aspects that need further explanation and clarification from research. As knowledge acquisition is the hardest process in international strategic alliances and the most valuable motive for strategic alliances between local and foreign partners, this study attempts to assess the process of knowledge acquisition. This study will be carried out in the context of developing and developed countries' collaboration, namely Malaysian firms and their foreign partners. This process is conducted by evaluating the factors that influence knowledge acquisition in both modes, equity and non-equity alliances. In further analysing the process of knowledge acquisition, the firms' performance will also be evaluated as it indicates the extent of learning and acquiring knowledge. Finally, this study also aims to provide some recommendations to the Malaysian firms and government in improving the international strategic alliance relationship. As this study is conducted among Malaysian firms, some general information about the Malaysian economy was provided as an introduction. The information provides a background to the scope of this study and it should also enhance the understanding of the findings in later chapters.

Overall, this thesis contains ten chapters and the following explains how it is laid out. This thesis commenced with an overview of international strategic alliances (ISAs) and its importance at present. The significance of ISAs to the knowledge acquisition was discussed, and research problems and objectives were also presented. Following the background of the study, in the second chapter the link between the knowledge theory, organizational learning and learning organization is discussed. These are essential concepts that constitute knowledge acquisition. The theoretical discussion continues in chapter three, which focuses on specific theories and concepts related to strategic alliances, knowledge acquisition, culture and performance. The development of hypotheses is presented in this chapter. Subsequent discussion in chapter four focus on methodology where research design, population and sample, data collection and analysis are described. Next the discussion of the findings is shown from chapter five to chapter eight. Chapter five reviews the results for hypotheses testing, while chapter six reviews results for knowledge acquisition elements, which include technological expertise, product development and manufacturing process. Chapter seven continues to discuss the findings of the study by focusing on the results of knowledge acquisition and performance, while chapter eight provides findings involving tacit knowledge. Following the findings of the study, a summary of the key results is presented in chapter nine and the major implications were highlighted. The final chapter of this thesis presents the summaries of each chapter and provide recommendations for the international strategic alliances partners and Malaysian government. To end the chapter, limitations of the study and future research are also presented.

Chapter one provides an overview on background and objectives of this study. The next chapter will review the theoretical part for this study. Previous studies on related theories such as knowledge theory, organizational learning and learning organization are reviewed.

CHAPTER TWO : LITERATURE REVIEW ON KNOWLEDGE AND LEARNING

This study emphasizes two elements that are critical in the framework: knowledge and organizational learning.

2.1 Background of Knowledge Theory

Knowledge has begun to receive a new trend of attention in recent years. Socio-economic theorists such as Peter Drucker (1993) and Alvin Toffler (1990) together with other scholars in the related fields such as industrial organization, technology management, management strategy, and organizational theory, have focused their attention on the importance of knowledge. Drucker (1993) argues that the role of knowledge nowadays has changed, knowledge is not just another resource alongside the traditional factors of production like labour, capital and land, but the only meaningful resource today. Toffler claims that knowledge is the source of the highest quality power and the ultimate replacement of other resources. Similar to Drucker and Toffler, Quinn (1992) also stresses that the economic power of a modern corporation lies more in its intellectual and service capabilities than in its hard assets such as land, plant and equipment. The value of most products and services depends primarily on how 'knowledge-based intangibles' like technological know-how, product design, marketing presentation, understanding of the customer, personal creativity and innovation can be developed.

2.2 Definition of Knowledge

Knowledge is a concept that cannot be seen but can only be observed in its effects. Because knowledge is an invisible, intangible asset and cannot be directly observed, many people and organizations do not explicitly recognize the importance of knowledge compared to visible financial and capital assets (Sveiby, 1997). Sveiby (1997) suggests that because knowledge is invisible it lacks a "generally accepted definition and a measurement standard". Researchers have laid out various definitions of knowledge, however, no single definition is agreed to represent the terminology. Sveiby (1997) defines knowledge as "a capacity to act" and highlights that there must be a clear distinction between knowledge and behaviour. Bhatt (2000) defined knowledge as an organized combination of ideas, rules, procedures, and information, while Beeby and Booth (2000) view knowledge as a resource on which firms base their competitive strategies. Gaining knowledge represents Bloom's (1956) analysis and synthesis of increasing one's cognitive skill because it goes beyond seeing the content and structural form of something and formulating new structures based on it. Based on this notion, Bierly, Wessler and Christensen (2000) define knowledge as clear understanding of information and their associated patterns and learning about knowledge as the process of analysis and synthesis of information. Knowledge involves both knowing how, which is generally more tacit knowledge, and knowing about, which is more explicit knowledge (Grant, 1996). He argues that the primary role of the firm is to increase its capability through the integration of knowledge. Knowledge is a key competitive asset for firms and the capacity to integrate knowledge particularly tacit knowledge will create competitive advantage (Grant & Baden-Fuller, 1995; Conner & Prahalad, 1996).

Nonaka & Takeuchi's (1995) views on knowledge are different from these of Western scholars. They claimed that Western philosophy and Japanese philosophy differ in their understanding on the role of knowledge. Western philosophy views the individual as the principal agent who possesses and processes knowledge while Japanese philosophy views knowledge as a substance where the individual interacts with the organization through knowledge. Thus, Nonaka (1994) defines knowledge as 'justified true belief' and considers knowledge as a personal belief and emphasizes the importance of the justification of knowledge. Nonaka & Takeuchi 1995 believe that knowledge creation is the most important source of firms' international competitiveness and knowledge needs to be processed and created. Hence, the organizational knowledge process and creation are needed as they allow the knowledge held by individuals to be amplified and internalised.

2.3 Types of Knowledge

Knowledge can be classified into two types; explicit and tacit knowledge (Polanyi, 1966) and there is a clear distinction between them. These two types of knowledge will be explained separately.

2.3.1 Explicit Knowledge

Explicit knowledge is deep-rooted in the traditions of Western management from Frederick Taylor to Herbert Simon. Organization is viewed as a machine for information processing. Western managers have been more accustomed to dealing with explicit knowledge and believed that knowledge can be taught through education and training.

Explicit knowledge is a kind of knowledge, which can be articulated in formal language including grammatical statements, mathematical expressions, specifications, manuals, and so forth (Nonaka & Takeuchi 1995). It can be expressed in words and numbers, and easily communicated and shared in the form of hard data, scientific formulae, codified procedures, or a set of general rules. Thus, it can be transmitted across individuals formally and easily. This kind of knowledge has been the dominant mode of knowledge in the Western philosophical tradition. It is also known as codified knowledge as it is transmittable in formal and systematic language, and easily communicated in the form of hard data or codified procedures. It is also discrete or digital and can be captured in records of the past such as libraries and databases, and is assessed on a sequential basis.

2.3.2 Tacit Knowledge

On the other hand, tacit knowledge is highly personal and hard to formalize, making it difficult to communicate or to share with others (Nonaka & Takeuchi 1995). Furthermore, tacit knowledge is deeply rooted in an individual's action and experience, as well as in the ideas, personal beliefs, values, or emotions he or she embraces. It is also embedded in individual's commitment, and involvement in a specific context. Johnson-Laird (1983) claimed that tacit knowledge is comprised of two elements: cognitive and technical elements. The cognitive elements lead people to create and manipulate analogies in their minds in the form of schemata, paradigm, beliefs, and viewpoints, which provide perspectives that help individuals to perceive and define their understanding (Johnson-Lairds, 1983). In other words, it refers to an individual's images of reality and visions for the future – what is and what ought to be (Polanyi, 1966). By contrast, the technical element of tacit knowledge covers concrete know-how, crafts, and skills that apply to a specific context. Tacit information and knowledge that cannot be easily transmitted or expressed in written form, is passed on in-day-to-day contact. It can be expressed through skilful execution and transmitted by apprenticeship and training. The greatest potential for fast learning is at the plant site or design site where employees from the alliance firms interact daily.

Polanyi (1966) defines tacit knowledge as 'knowing more than we can tell', it can be seen through actions rather than explanations. The tacitness of knowledge is hard to estimate, but it can be seen in a spectrum where at one end it is completely tacit and at the other end it is completely explicit (Polanyi, 1966). Polanyi sees tacit knowledge as a personal form of knowledge, which individuals can only obtain from direct experience. Wagner (1987) and Jagmin et al. (1989) view tacit knowledge as the acquisition of practical know-how through experience, usually by observing others and without direct instruction. Nonaka & Takeuchi (1995) argue that tacit knowledge, which is hard to articulate with formal language, is more important than explicit knowledge. It is personal knowledge embedded in individual experience and involves intangible factors such as personal belief, perspective and the value system. They claimed that this knowledge has been overlooked as a critical component of collective human behaviour.

The role of tacit knowledge can be seen in various perspectives which include objective theory (Imre 1985, Holland 1985); anthropological perspective (Heath 1984); cognitive psychology perspective (Reber 1989) and business perspective (Schon 1983). Schon's (1983) views are closely related to Polanyi (1966) and Wagner (1987). He refers to tacit knowledge as 'knowing-in-action', while Polanyi refers it as 'knowing more than we can tell, and Wagner refers it as 'practical know-how'. Schon (1983) argues that managers cannot fully explain why or how they make right decisions. This is because tacit knowledge is held in a non-verbal form, and therefore, the holder cannot provide a useful verbal explanation to another individual. In contrast, explicit knowledge can be expressed in symbols and communicated to others by use of the symbols (Schulz, 1998). Wagner (1987) has developed a model of tacit knowledge, which applies to managerial selection. He argues that the amount of experience is not a sole factor to assess tacit knowledge. The ability of individuals to learn and apply knowledge gained through experience is more important to assess tacit knowledge.

2.3.3 Importance of Tacit Knowledge

Tacit knowledge is typically embedded in routines, organizational culture and cognitive schemes (Haldin-Herrgard, 2000). It can be obtained by internal individual's process like experience, reflection, internalisation or individual talents. Thus, it cannot be managed and taught in the same manner as explicit knowledge (Haldin-Herrgard, 2000). While explicit knowledge is possible to store in a mechanical or technological way, like in handbooks or information systems, tacit knowledge is mostly stored only in human beings. Tacit knowledge cannot be found in databases or manuals, it has to be internalised in the human. Different methods like apprenticeship, direct interaction, networking and action learning that include face-to-face social interaction and practical experiences, are appropriate for sharing tacit knowledge.

Jacob & Ebrahimpur (2001) stress the importance of tacit knowledge, they argue that tacit knowledge should be the focus of knowledge transfer efforts. The reasons are: first, explicit knowledge is easier to access compared to tacit knowledge; and second, tacit knowledge is always in the shortest supply where there is limited person acquire through experience or learning by doing. They describe tacit knowledge as experience and expertise. Experience is comprised of :

- credentialized experience - the knowledge which one would need to have in order to be granted a degree
- cultural knowledge – knowledge of the company and how things are done generally

- practise-based knowledge – knowledge of company specific routines and how to apply them that the manager would have acquired through learning by doing in a number of different projects
- personal experienced based knowledge – knowledge that the manager may have acquired outside the company, for instance in a previous job

Expertise, on the other hand is comprised of two components :

- credentialed knowledge - the knowledge that one obtain certification
- specialist knowledge – the deep understanding of a particular scientific area, highly personal and a unique blend of public knowledge and experience-based knowledge.

There are two schools of thought regarding externalisation and codification of tacit knowledge. One believes that tacit knowledge must be made explicit for sharing and another regards tacit knowledge as always being tacit. Nonaka & Konno (1998) created a model of how tacit knowledge can be made explicit – it involves socialization, externalisation, combination and internalisation modes. Polanyi (1966) believes that there is no need to express explicitly tacit knowledge. To make all knowledge explicit and eliminate the tacit personal elements in it could even be destructive to all knowledge. To diffuse tacit knowledge, the exertion should not be in externalizing it but in understanding entities by their particulars.

Realising the importance of tacit knowledge in knowledge acquisition and the difficulties in quantifying it, this study will examine this issue qualitatively. Qualitative analysis is crucial in order to provide further understanding of the knowledge acquisition process and to further clarify issues that are tacit in nature. Detail of the discussions on tacit knowledge is presented in chapter four and chapter eight.

2.4 Knowledge Acquisition and Learning

The core component in the knowledge acquisition process is learning. Without the learning process, knowledge is not possible to be transferred and acquired by others. Learning involves more than the mere taking in of information. Learning, instead, is a process that is about enhancing capacity. Learning is about building capability to create that which the firm previously could not create and is ultimately related to action, which information is not. Learning within the organization can occur at three levels: individual, team and organizational. Senge (1996) asserts that organizations learn only through individuals, however, individual learning does not guarantee organizational learning, but without it no organizational learning occurs. Argyris and Schon (1978) also emphasize that individual learning is a necessary, but insufficient condition for organizational learning.

As organizations must deal with increasingly more complex problems, they are discovering the importance of team learning, which requires teams to think, create, and learn as an entity. Marquardt & Reynolds (1994) caution that team learning differs radically from team training. Team learning is more than just acquiring group skills. The emphasis is on self-managed learning and a free flow of ideas and creativity. Learning at a team level requires practice and reflection. High-level team learning enables high-level collective thinking and communication as well as the ability for working creatively and constructively as a single entity.

Learning at the organizational level involves a much broader set of social, political and structural variables. It involves the sharing of knowledge, beliefs, or assumptions among individuals and groups. Organizational learning differs from individual and team learning in two ways; first organizational learning occurs through the shared insights, knowledge, and mental models of members of the organization; second, organizational learning builds on past knowledge and experience to retain knowledge.

As strategic alliances involve learning at the organizational level, organizational learning is the major focus of this study rather than individual and team learning. The role of organizational learning is more obvious in inter-firms collaborations as it provides avenues for knowledge to be acquired. Harrigan (1988) stresses that acquisition of knowledge or capabilities can only be done through organizational learning. As strategic alliances could create direct and indirect opportunities for firms to gain knowledge, knowledge can be acquired through alliance mechanisms. Knowledge or capabilities can only be acquired when partners learn from each other, without the learning process, the knowledge cannot be transferred between the partners. Thus, learning is a fundamental ingredient in strategic alliances as it facilitates the transfer of knowledge. The process of learning among firms can be conducted through organizational learning. As Huber (1991) points out, when the organization's components obtain knowledge and recognize it as potentially useful, the process of organizational learning has occurred within the organization.

Organizational learning is a necessary mechanism for the evolution of the firm. It enables a firm to utilize, change and develop corporate knowledge. As firms can only acquire the knowledge of the alliance partners through the process of organizational learning, it is vital to use the process in order to assess the knowledge acquired by the partners in the alliance relationship. Organizational learning is the essence of knowledge acquisition as it creates and develops a shared knowledge among firms. It develops the insights knowledge of the firm and the effectiveness of past and future actions (Fiol & Lyles, 1985; Lyles, 1988). Organizational learning is about the creation and further development of shared knowledge and much of this knowledge is tacit in nature (Marengo, 1992). In fact, Lawson & Lorenz (1999) emphasize that learning is developed based on three major ideas; the first is that learning depends on some knowledge being shared amongst the members of the organization and this knowledge is mostly tacit and is embodied in organizational routines and procedures. Secondly, learning generates new knowledge within the organization where it depends on combining diverse knowledge and thirdly, learning involves organizational inertia where firms find it difficult to make effective use of new knowledge because of resistance to change. As organizational learning is a concept at the system level, it can only be useful when it can be thoroughly understood and brought down to an operational level (Inkpen, 1996). Hence, firms have to make the concept understood by the organizational members before it can be fully applied.

2.5 Concept of Organizational Learning

Scholars in the organizational learning field tend to show a new movement of interest since 1990s. There are four approaches that contribute to the framework regarding organizational learning, they are psychological, information theory, system dynamics and contingency theory. The psychological perspective emphasizes collective perceptions of organizational environments (Argyris & Schon 1996); information theory perspective focuses on the processes of acquisition, distribution, interpretation and storage of information (Nonaka, 1991), system dynamics perspective deals with human organizations who are complex and dynamic (Senge, 1990) and contingency theory perspective highlights the need of organizations as a systems to continuously adapt to their environment (Romme and Dillen, 1997). Consistent with contingency theory, Rahim (1995) argued that it is essential for organizations to improve their knowledge through organizational learning in order that organizations can effectively respond to the changing environment. The most recent view by Beeby and Simpson (1998) stresses that organizational learning requires new forms of thinking and acting, a transformation of mental models, systems values and mental frames and processes of dialogue rather than of skilful discussion.

The environment around the organization can be considered as a driver for organizational learning, since organizations learn in order to improve their adaptability and efficiency during times of change. According to Dodgson (1993), organizational learning is driven by rapidly changing technology, increased industrial competition, as well as pressure from the customers, suppliers and the environment. Organizational learning enables quicker and more effective responses to a complex and dynamic environment. However, responding to change does not mean that the organization will accept information that comes from outside; the organization will have to process this information efficiently as well as to create information and knowledge itself in order to internalise the environmental influences.

Huber (1991) emphasizes that knowledge acquisition is one of the constructs that is linked to organizational learning, thus it is essential for this study to expand an understanding on this concept. Organizational learning can be defined as a process that generates knowledge, which concerns the methods that can be used to improve existing competencies or to develop new ones (Lawson & Lorenz, 1999). It involves linking, expanding and improving data, information, knowledge and wisdom. Dodgson (1993) regards organizational learning as the way a firm can build, supplement and organize knowledge and routines around its activities and within its cultures, and adapt and develop organizational efficiency by improving the use of the broad skills of the workforce. Organizational learning enables a firm to utilize, change and develop corporate knowledge. It is vital for a firm to use the process to assess the knowledge acquired by the partners. Organizational learning is the essence of knowledge acquisition as it creates and develops a shared knowledge among firms. Its also determines the firm's effectiveness of past and future actions (Fiol & Lyles, 1985; Lyles, 1988; Marengo,1992).

Closely related to the concept of organizational learning is the concept of the learning organization. The learning organization, which is a more recent concepts involves learning and organization, as proposed by Peter Senge (1990). Both concepts are significant to learning, the difference between them lies in their focus and process. Organizational learning is concerned with enhancing processes of learning in order to improve individual and collective organizational actions via improved knowledge and understanding. The learning organization focuses on the design of organizations to deliberately facilitate the learning of members and therefore improve collective adaptation (Coopy, 1995). The learning organization concept approaches learning differently from the organizational learning concept, it tends to be more focused and clear than the organizational learning concept itself. The focus of the learning organization is more on the mind of the organizational members towards learning, whereas the organizational learning concept is a vague and slower process. Therefore, the learning organization concept could be a catalyst in speeding up the learning process within the organization.

Senge (1990) utilizes systems thinking to shift the mind from seeing the parts to seeing the whole. Systems thinking, according to Senge (1990) is a conceptual framework, a body of knowledge and tools that has been developed to help people see the full patterns more clearly. The focus of the learning organization is clearly on learning with the mind, not with the body. From the learning experiences, Senge (1990) recognised that many organizations experience "learning disabilities" and the only way to overcome this is by becoming a "learning organization". He argued that the learning organization has the capacity for both generative learning (active) and adaptive learning (passive) as a source of competitive advantage. In order to build a learning organization, Senge (1990) proposes that managers must have five "disciplines": adopt "systems thinking"; encourage "personal mastery" of their own lives; bring prevailing "mental models" to the surface; challenge the build " a shared vision" ; and facilitate "team learning".

The tools for system thinking are designed for understanding dynamic complexity as an aspect of people's minds that deals quite well with detailed complexity. Personal mastery involves constantly clarifying and intensifying personal vision, focusing energies, developing patience and seeing reality objectively. It suggests that an aspect of mind has enormous capacities to deal with detailed complexity at the subconscious level that we do not have at the conscious level. Working with mental models is a process of learning to bring the internal pictures of the world to the surface and hold them rigorously to detailed examination. Building shared vision means that the organizations is capable of holding a shared picture of the future, people excel and learn in achieving the vision not because they are told to, but because they want to. The practice of shared vision involves skills of detecting shared pictures of the future that promote genuine commitment and employment rather than compliance. Team learning develops extraordinary capacities, when teams are really leaning, not only the results are remarkable but the individual members also grow more quickly. Team learning starts with dialogue, the capacity of members of a team to suspend assumptions and enter into a genuine 'thinking together'. Dialogue involves learning how to recognize the patterns of interaction in teams that gradually weaken learning. If recognised and emerged resourcefully, they can actually accelerate learning.

2.5.1 Types and Levels of Organizational Learning

Organizational theorists agree that learning consists of two kinds; first is obtaining know-how to solve specific problems based upon existing premises, and second is establishing new premises to override the existing ones. Bateson (1973) referred to these as "Learning I" and "Learning II", while Argyis and Schon (1978) referred to "single-loop learning" and "double- loop learning". Single-loop learning is a form of instrumental learning and concerned with detection and correction of errors in pursuing goals in a routine condition. Unlike single-loop, double-loop learning involves non-routine conditions and is based on cognitive processes and thus concerned with changes in mental frameworks such as theories in use, assumptions, organizational strategies and norms, and the ways competencies and environments are interpreted. It occurs when members of the organization respond to changes in the environment by changing the core set of the organizational norms and assumptions.

However, these two levels of learning do not incorporate the behavioural world of the organization, which constrains and shapes their development (Argyis & Schon 1996). The behavioural world that consist of qualities, feelings and meanings, together with the organizational structure and information networks constitute a learning system and this learning system would determine the effectiveness of organizational learning in the organization. Argyis and Schon refer to this as deutero learning, which involves learning how to learn and it requires organizational members to inquire into the nature of their learning system and its effect on their inquiry. Isaacs (1993) and Senge (1990) regard this type of learning as significant in the practice of dialogue in organizational learning.

Argyris and Schon (1996) emphasize that the theory of organizational learning has to incorporate both the actions and interactions of higher-level organizational entities such as departments, divisions or groups of managers. Coghlan (1997) focuses on the inter-level learning process and defines learning as the ability to sense disconfirming data and act on it. Based on his definition, he claims that four levels of complexities are involved in organizational learning, they are; individual, team, interdepartmental group and organizational levels. These levels have an impact on the development of learning in organizations. Thus, he defines organizational learning as the capacity or processes within an organization to maintain or improve performance based on experience and sees it as occurrence that goes beyond the learning of individuals. Coghlan focuses on the processes of individual learning becoming organizational learning, which involve a flow of change through the individual, team, interdepartmental group and organizational levels. This flow of change is highly dependent on the effective management of inter-level activity and is a cyclical process. The four stage processes are: experiencing, processing, interpreting and taking action, which blends action and conceptualisation when engaging with change issues.

The concept of dialogue is the latest development in the theory and practice of organizational learning (Schein 1993) and of the learning organization (Kofman and Senge 1993). Issacs (1993) argues that dialogue is vital in the organizational learning concept as it promotes collective thinking and communication. Dialogue makes use of collective thinking and inquiry as an approach, which enables people to develop collaborative thought and co-ordinated action. The focus of inquiry is on surfacing underlying, collective patterns of thinking in order to enable individuals and organizations to examine and change the underlying assumptions or theories behind their actions. Hence, dialogue involves people in the creation of shared meaning through participation in unfolding meaning in contrast to the more superficial, surface level communication process of conversation, debate and consensus which leave existing mindsets unaltered. Schein (1993) views dialogue as a crucial element for understanding organizational subcultures on which any form of organizational learning ultimately depends. He considers dialogue as essential technology and fundamental in organizational transformation. As dialogue attempts to get people in touch with their underlying assumptions and thought processes to build a creative thinking among groups, it involves the evolution of shared mental models and thinking processes which cut across the existing subcultures and thereby enables groups of people to attain a higher level of consciousness and creativity together. In sum, dialogue involves learning how to learn from one's own experiences and learning how to learn from the knowledge and experience of others.

Learning from the experience of others is a continuing topic in the organizational learning literature. This concept has been reviewed as a source of knowledge acquisition from the perspective of information theory by Romme and Dillen (1997) and discussed as a specific technique to help development and transformation into learning organizations by Luthans, Rubach & Marsnik (1995). Locke and Jain (1995) classify learning from the experience of others under the following tools and techniques: training and development, external benchmarking, consultants, customers and suppliers, factory visits, trade shows, online data-bases, magazines and journals, mergers, acquisitions, strategic alliances, licensing and franchises. Learning from the experience of others is also closely related to the relationship between individual and organizational learning with regard to the diffusion of learning from the individual to the organizational level and vice versa. Lundberg (1995) suggests that individual learning is a necessary condition for organizational learning. He argues that individual learning must first be shared through communication for the process of transferring what is learned by individuals to the organizations and for storing and accessing. Locke and Jain (1995) propose that several factors can hinder individual learning from spreading to the whole organization. There are organizational policies and procedures; lack of a critical mass of people with new skills and knowledge, and the ability to work together for change. To resolve these barriers, organizations need to have a sufficient number of knowledgeable people, value-driven leadership and a culture that rewards the application of new learning. Romme and Dillen (1997) view dialogue as the key element in team based learning as it encourages people to think together and alleviate learning disturbances that may limit learning to the individual level.

In linking organizational learning and diffusion, Tompkins (1995) defines collective learning as the diffusion of knowledge and skills from the individuals to members of the collective, which increases the organization's capacity to take effective action. He clarifies that collective learning occurs because of diffusion and is achieved when members of the collective are no longer dependent on the original learners. Tompkins presents a model of collective learning where the inputs to the system are individual skills and knowledge in these categories: technical, embedded in the technology; unique, embedded in personal mastery; and internalised, deeply embedded in attitudes. In the transformation stage, the model incorporates three diffusion styles which are: sequential, critical mass, and cycles. The output for the learning system is collective knowledge and skills.

2.5.2 Organizational Learning Process

Organizational learning requires individual learning by single members, but that alone is not enough. Organizational learning must be a collective process by all members of the organization. It includes all processes, which lead organizations to question and alter existing procedures in corporations. A common feature of the approaches toward organizational learning can be seen in a hierarchy of learning modes, which include perception, internalisation and abstraction (Richter & Vettel, 1995). In the first learning step, perception, environmental knowledge becomes internal knowledge. Firms detach themselves from isolation and sound out their corporate environment for knowledge potential. They utilize environmental knowledge potential without internalising it. In the next step, the environmental knowledge is actively introduced into the closer organizational boundary. Market and technology know-how of the corporate environment become an asset of the organization. By the process of internalisation, environmental knowledge transforms into internal knowledge. In the last step, abstraction, virtual knowledge comprising the organizational basic assumptions about the environment, is transferred across the organizational boundaries of the corporation. Culture bound behaviour of the environment changes the organizational behaviour of the corporation. Simpler learning modes like perception, constitute an integral part of more complex learning modes like abstraction.

2.5.3 Unlearning

Though learning is crucial to acquire knowledge, organizations must also unlearn to survive (Nystrom and Starbuck, 1984). Much of the basis for productive learning resides in unlearning (McGill et al, 1992). Hedberg (1981: 4) defines unlearning as 'the process through which learners discard knowledge'. Unlearning is not the opposite of learning. Unlearning involves breaking with current behaviours and or mental modes, while learning can either lead to whole new ways of understanding and acting or build on that which exists. Hamel and Prahalad (1989) note that unlearning must take place before learning can begin. Unlearning is an important element of strategic renewal and organizational transformation (Talwar, 1994). In order for management in manufacturing organizations to adopt and learn new approaches to work and management, such as business process re-engineering, concurrent engineering, and activity-based costing or management, they must first begin to unlearn. Fundamentally, it is suggested that before manufacturing organizations consider forming an effective alliance, a degree of unlearning must take place. In other words, current modes of operation are disregarded, so that a different behaviour can be used and encouraged, which can lead to the formation of an effective learning partnership (Love & Gunasekaran, 1999).

2.6 Conclusion

This chapter covers two major parts of the literature involved in this study: knowledge and learning. It begins with an introduction of knowledge theory and its evolution in recent years. The view on knowledge has changed recently. Knowledge is no longer viewed as a thing together with other factors of production, but is now seen as the most meaningful resource that every organization has to own. The primary value of knowledge to the firm lies in the tangible knowledge-base such as technological know-how, product design, personal creativity and innovativeness. The definition of knowledge was presented at length in order to provide a better understanding on the concept. Knowledge was further discussed by looking into the types of knowledge, i.e. explicit knowledge and tacit knowledge. This chapter distinguishes between explicit and tacit knowledge, which later helps to develop a construct for tacit elements. Explicit knowledge in contrast to tacit knowledge is a kind of knowledge that can be expressed in words and numbers. Unlike explicit knowledge, tacit knowledge is hard to express and involves intangible factors such as personal beliefs, experience, values, and cognitive and technical elements. Tacit knowledge was discussed at greater length due to its complexities. The importance of tacit knowledge was highlighted as studies have shown that it is significant to the knowledge acquisition process. Following the concept of knowledge and its development, learning was discussed and the link between the two concepts was examined. From the literature, it is clear that knowledge acquisition is a subset of learning and organizational learning. Knowledge cannot be acquired without these processes taken place. The concept of learning is viewed in terms of organizational learning as it is a necessary process for knowledge to be acquired. Thus, the concept of organizational learning was thoroughly assessed. The development of organizational learning was reviewed and how the learning process takes place through several stages was elaborated. The link between organizational learning and the learning organization was also clarified, as both are significant in the knowledge acquisition process.

Following the discussion on knowledge theory, organizational learning theory and the learning organization theory, next chapter will remain to review the theoretical aspects of this study. However, the concentration is more specific to strategic alliances, knowledge acquisition determinants, cultural differences and performance. Hypotheses and framework development for this study will also be presented.

CHAPTER THREE : LITERATURE REVIEW ON INTERNATIONAL STRATEGIC ALLIANCES, KNOWLEDGE ACQUISITION AND PERFORMANCE

Chapter two discussed the basic concepts of the knowledge acquisition process, which include the concepts of knowledge and learning. As learning is focused on the organization, the centre of attention in this study is organizational learning rather than learning in general. Nonetheless, organizational learning is a broad and long process. Thus, a specific discussion on certain issues are needed in order to understand the concept clearly. As knowledge acquisition is part of the knowledge and organizational learning process, an examination on the knowledge acquisition process itself tends to be more significant rather than the broader scope. Hence, this chapter continues the discussion of literature from the previous chapter, but the concentration is on a specific part of knowledge and the organizational learning process, which is the knowledge acquisition process. The specific context of the knowledge acquisition process is also highlighted, which involves strategic alliances, factors influencing the process, and the impact of the process on performance. This concentration also facilitates the development of the hypotheses for this study.

3.1 Development of Strategic Alliances

In analysing international strategic alliances and knowledge acquisition, two major disciplines are involved, the field of strategic management and organizational behaviour. Since the mid 1980s (Jarillo 1988, Thorelli 1986) strategic alliances and networks have received growing interest by strategic management scholars. In the organization theory fields for examples Benson (1975), the literature on inter-organizational relationships started even earlier. In the organizational behaviour field, the areas of organizational learning and the learning organization (Argyris 1982, Senge,1990) have turned into a major centre of attention. The most current development of literature concerning learning in strategic alliances and between organizations have been conducted by Dodgson (1993), Hanssen-Bauer & Snow (1996), Lei et al., (1997) Steensma (1996).

In the strategic management literature, two significant themes that are closely related to this study are networks and alliances, and the knowledge-based view of the firm (Grant 1996). Networks and alliance arrangements are a means of transferring and exchanging knowledge between organizations. Strategic management theory has started to give more interest to the body of knowledge regarding inter-organizational relationships and with that using various descriptions. Jarillo (1988) and Thorelli (1986) refer to the relationship as "strategic networks"; Borys & Jemison (1989), Devlin & Bleackley (1988), Hamel (1991) refers to "strategic alliances"; Nielsen (1988) refers to"co-operative strategies"; Harrigan (1988) and Kogut (1988) refer to "joint ventures"; Bresser (1988) refers to "collective strategies"; and Johnston & Lawrence (1988) refer to "value-adding partnerships". These literatures have developed in various directions, among the significant themes are the opportunities and drawbacks of collaboration in R&D and new technological development (Smith et. al., 1991; Dodgson, 1992; Nueno & Oosterreld, 1988); identification of success factors and pre-conditions for effective management of inter-firm relationships within partnerships and networks (Bresser, 1988; Devlin & Bleackley, 1988; Dodgson, 1992); organizational learning through collaborative arrangements (Hamel, 1991; Kogut, 1988); and the emerging literature on networks as a new paradigm for organization structure and inter-organizational infrastructure (Miles & Snow, 1986,1992; Snow et al., 1992).

3.1.1 Reasons for Strategic Alliances

Firms engage in different forms of strategic alliances for various reasons, the major reasons being economic and technological change. The perceived benefits of alliances can be categorised into two parts. The first is concerned with building new businesses or with introducing new products and the second is concerned with improvement of the current business (Beeby & Booth, 2000). Primary reasons for engaging in strategic alliances include gaining economies of scale and of learning, accessing the benefits of other firms' assets, reducing risk by sharing the capital requirements of new product development, reaching new markets, enjoying first mover advantage by exploiting speed to market, and achieving synergies, systems improvement and other benefits of learning. The major concern about engaging in alliances is its effect on the firm's competitiveness. Despite enhancing firms' competitiveness, alliances also pose some drawbacks. The most common drawbacks are diffusion of the firm's strategic assets and the appropriation of competences and capabilities by their partners (Jarillo & Stevenson, 1991). They argued that alliances create dependency relationships, which lead to a narrowing of expertise and to a limitation of creativity and competitiveness. Quinn (1992) identifies this problem as a threat and alliances are assumed to limit the firm's future. Mowery et al. (1996) claim that Japanese firms have drawn off technological capabilities from their American partners. Inkpen (1998) views this drawback as knowledge protectiveness. The extent of protectiveness on knowledge by a partner will depend on the potentiality of the local firm to become a competitor. A low degree of knowledge protectiveness between the partners would increase the risk of knowledge spillover. These issues have drawn attention and raised a concern regarding learning and knowledge management within strategic alliances and networks.

Though knowledge and knowledge management have received substantial interest in strategic management, it did not obtain special attention until the mid 1990s. Attention given by scholars tends to show a changing pattern from explanation of competitive success based on creating and sustaining successful market positions towards a view of strategic success based on the resources and capabilities of the organization. This interest has developed from a static theory of the firm based in classical industrial economics and the structure-conduct-performance concept which has been replaced by a more dynamic perspective based on firms' resources and capabilities and known as the 'resource-based view' (Wernerfelt, 1984). The principal contribution of the resource-based view of the firm has been a theory of competitive advantage where firms focus on how to achieve and sustain advantages. This is known as sustainable competitive advantage (Grant, 1991). The resource-based view argues that firms must possess certain key resources, that is, resources that have characteristics such as valuable, rare and inimitable, very hard for competitors to substitute and limited tradeability (Barney, 1991; Peteraf, 1993). Sustainable competitive advantage can be obtained if the firm effectively develops and deploys the firm's resources and capabilities in its product-markets (Grant, 1991). Of these resources, the ability to acquire and integrate knowledge has increasingly been accepted as the most important and valuable. As knowledge is seen as a resource on which firms base their competitive strategies, thus Grant (1996) and Beeby & Booth

(2000) argue that the primary role of the firms and the essence of organizational capability is the integration of knowledge. Knowledge management requires not only the combination of different types of knowledge, but also the combination of present and past knowledge, or knowledge and memory. Cohen and Levinthal (1990) state that the basis of the absorptive capacity concept in the organization is the need of prior related knowledge to assimilate and use new knowledge. As learning is cumulative and as the organizational absorptive capacity is dependent on the individuals in the organization, knowledge acquisition, integration and dissemination will be capabilities that need to be built up slowly over time and are unlikely to be greatly speeded up through investment (Bell, 1984). However, failing to invest in current knowledge development or acquisition will tend to mean that future opportunities for learning are inhibited. Failing to learn and develop absorptive capacity will be costly, thus firms need to emphasize more on learning (Beeby & Booth 2000). Grant (1996) not only focuses on the issue of the integration of specialist knowledge which is the core of the firm's organizational capability, he also clearly raises the issue of knowledge integration within networks. He points out that there are three possible modes of knowledge transaction: internalisation through hierarchy, externalisation through market contracts, and the intermediate mode of relational contracts or alliances and networks. However, Grant indicates that only explicit knowledge can be integrated through networks.

3.1.2 Knowledge Acquisition in Strategic Alliances

Chesbrough and Teece (1996) argue that tacit knowledge is more important than explicit knowledge as it is more difficult to manage and represents the more important strategic asset. They add that tacit knowledge and the activities that depend on it need to be kept within the organization. Hamel (1991) highlights a difference between the firm's motives when engaged in alliances. Firms that ally for the reason of accessing the partner's knowledge, skills and expertise require less cultural fit, mutual trust and commitment compared to firms that ally for the reason of internalising the knowledge. However, the latter is more difficult to achieve. Following Hamel (1991), Lei, Slocum & Pitts (1997) claim that alliances based on explicit knowledge tend to be a more simple relationship than alliances that are based on tacit knowledge. The latter requires more thought in management and maintenance of knowledge and apprenticeship needs to be built up. They also argue that as tacit knowledge is often culturally and organizationally specific, such arrangements are only likely to be successful between firms of similar cultural contexts. Mowery, Oxley & Silverman (1996) argue that formal joint ventures and other equity alliances experienced more comfort than non-equity alliances. This means that successful knowledge transfer is more likely to take place in formal alliances rather than informal networks or contract-based alliances. They add that knowledge transfer is more likely to be successful in alliances that show convergent development than those that show divergent development. Thus, knowledge and learning should be seen in a context of past, present and future.

Learning in international joint ventures is perceived as a means of knowledge transfer (Child 1994, Child & Rodrigues 1996) and gaining collaborative know-how and collective experience (Hamel 1991, Simonin & Helleloid 1993). However, in international joint ventures between firms from developing and developed countries, learning is largely a one-way process (Liu & Vince 1999). Foreign partners that possess the technology tend to assume superiority in both technology and management and can feel that they have little to learn from the local partners. As alliances are a platform for firms to learn and acquire knowledge, it is essential to identify the determinants that would encourage firms to enhance their learning from the partners. These factors not only affect the knowledge acquisition process, but also the firms' performance. They also could reveal the extent of learning that take place within the alliances.

The formation of alliances could provide learning opportunities as it involves a learning process where experience, actions, and strategic choices are created. Hence, this learning process becomes a strategic initiative for firms (Mintzberg, 1990). The alliance experience could trigger learning because it provides new stimuli that may force changes in the organization (Nonaka & Johansson, 1985). Knowledge creation through alliance is a multi-stage process (Inkpen & Dinur,1998; Inkpen & Crossan, 1995 ; Nonaka, 1994; Tushman & Scanlon, 1981). The first stage is the formation of the alliance and interactions between individuals from the two or more partners. The second stage is the transfer of knowledge from the alliance to the partners. Huber (1991) refers to this process as grafting where organizations increase their store of knowledge by internalising knowledge not previously available within the organization. For internalisation to occur, the partners must engage in efforts to transfer partner skilled-related knowledge from the alliance to themselves. These efforts create the 'connections' through which individuals can share observations and experiences (Von Krogh et al. 1994). The intensity of the partner's learning effort reflects the degree to which the partner is actively trying to internalise the skills and capabilities of its partner.

Knowledge connections are formed through formal and informal relationships between individuals and groups (Inkpen, 1996). Internal managerial relationships facilitate the sharing and communicating of new knowledge and provide a basis for transforming individual knowledge to organizational knowledge. Grant (1996) argued that organization structures can be designed to maximise the efficiency of knowledge integration.

Inkpen & Dinur (1998) identify four processes that are involved in alliance knowledge acquisition. The four are: technology sharing, alliance/joint venture-parent interaction, personnel transfers and strategic integration. These processes represent a knowledge connection, which creates the potential for individuals to share observations and experiences. Each of the four processes provide an avenue for managers to gain exposure to knowledge and ideas outside their traditional organizational boundaries and create a connection for individual managers to communicate their alliance/joint venture experiences to others. Through these four processes, different types of knowledge converge and become accessible.

3.1.3 Types Of Strategic Alliances and Knowledge Acquisition

As strategic alliances can be classified into two types, equity and non-equity alliances, this might have some implication on the knowledge acquisition process. This is due to the fact that the nature, behaviour and the goals of the two types of strategic alliances are different, thus the relationship and commitment between the partners might also vary. These variations could lead to a different impact on the learning and knowledge acquisition processes of the local partners.

a) Equity Alliances

Several studies conducted by scholars tend to agree that equity alliances are more effective in facilitating knowledge transfer among the partners. Equity-based joint ventures are a more effective means for the transfer of knowledge particularly tacit knowledge (Kogut, 1988). Other forms of alliances such as licensing, are less effective since the knowledge that is transferred is embedded in the particular organization. Consistent with Kogut (1988), Mowery, Oxley and Silverman (1996) also found that equity joint ventures are more effective for the transfer of knowledge among partners compared to contract-based alliances.

Killing (1983) and Lyles & Salk (1996) identify that types of ownership in international joint ventures influence the effectiveness of knowledge acquisition. These two types of ownership are known as shared management and dominant partner. The dominant partner is defined as the relationship where one partner has more equity than the other, and has dominant control on the relationship. While, the shared management, is defined as the relationship where partners have equal participation such as 50-50 equity and no partner has a significant control on the relationship.

Lyles & Salk (1996) found that shared management alliances tend to face more difficulties compared to dominant partner alliances. This is because shared management allows frequent interactions to be conducted while carrying out jobs and, consequently, the situation leads to more conflicts among the employees. In spite of the high number of conflicts, shared management tends to result in higher knowledge acquisition due to the frequency of interactions among organizational members (Brown & Duguid 1991, Westney 1988, Lyles & Salk 1996). Pertaining to that, Bleeke & Ernst (1993) also found that joint ventures with equal ownership have a higher success rate than those in which one partner holds a majority stake. The reason is because equal ownership builds trust by ensuring that each partner is concerned about the other's success. In dominant ownership, the dominant partner exercises control, which sometimes is not in the interest of the minority partner.

b) <u>Non-Equity Alliances</u>

Considering non-equity alliances, Inkpen & Beamish (1997) point out that knowledge acquisition is less likely to take place in international joint ventures rather than in joint development agreements and technology sharing modes. This is because a joint venture, which has its own governance structure, is a separate entity, thus, local partners may have difficulties in gaining access to the foreign partner's skills. On the contrary, the possibilities to appropriate knowledge by the local partner is greater in a joint development agreement or technological sharing relationship, as there are fewer boundaries or differences found in the relationship.

The above observation seems to be in contradiction with Kogut's (1988) and Mowery's, et.al (1996) findings on equity-based joint ventures. The different findings reveal that the behaviour of equity and non-equity alliances is not yet well understood and this opinion is shared among some scholars in the field. Nevertheless, Kogut's and Mowery's, et.al results are supported by other scholars. Several scholars point out that the joint venture tends to be more effective at transferring knowledge particularly tacit knowledge, as it is more conducive to organizational learning (Polanyi, 1967); joint ventures also tend to be more conducive to organizational routines and skills (Nelson & Winter, 1982); as well as to experiences, reputation and goodwill (Berg & Friedman 1981; Duncan 1982). Hence, despite the contradictory findings of scholars, there is more evidence to support the view that equity-based alliances are more effective modes in transferring knowledge compared to non-equity alliances. This is because equity joint ventures can provide a superior means of gaining access to technological and other complex capabilities.

In non-equity alliances, unilateral contract-based alliances such as licensing depict a limited knowledge transfer as they involve a one way knowledge flow (Kogut, 1988). The technology that is exchanged for cash payments is more tightly 'packaged' than is the case in bilateral contractual arrangements such as technology sharing or joint development agreements. As a result, unilateral alliances create fewer opportunities for inter-firm knowledge transfer. On the other hand, bilateral-based alliances such as joint development agreements and technology sharing relationships, exhibit a different behaviour and tend to provide more opportunities for knowledge acquisition compared to unilateral alliances. This is because bilateral-based alliances involve two ways of knowledge flow , thus the level of interaction between the employees in these modes tend to be higher than in unilateral alliances (Mowery, Oxley & Silverman, 1996).

These observations provide a basis for a number of hypotheses on the type of alliances.

> **H1: Equity alliances generate a higher level of knowledge acquisition than non-equity alliances**
>
> H1a: Shared management ownership generates a higher level of knowledge acquisition than in a dominant partner relationship.
>
> H1b: Bilateral contract-based agreements generate a higher level of knowledge acquisition than in unilateral contract-based agreements.

The hypotheses set out above can be simplified in the form of a matrix as shown in Figure 3.1.

Figure 3.1 : Types of Alliances vs Level of Knowledge Acquired

Hypotheses	H1	H1a	H1b
Level of knowledge acquisition	Alliance type	Equity type	Non-equity type
Higher	Equity	Shared	Bilateral
Lower	Non-equity	Dominant	Unilateral

3.2 Determinants of Knowledge Acquisition

When knowledge is to be acquired from the strategic alliances, the factors that facilitate or hinder the process have to be recognized. This would speed up the acquisition process and make it more efficient and effective. There are studies conducted that identify the link between knowledge acquisition, learning and strategic alliances, however, these factors were looked at as individual factors rather than combining all the relevant factors together. Hence, the present study endeavours to put together the factors that are related to knowledge acquisition and examine their effect concurrently to the international strategic alliances. The acquisition of knowledge from the foreign parent is affected by several factors within the organization, which might expedite or hinder the exploitation of the knowledge process. These factors may also determine the amount of knowledge acquired by the local partner from the alliance relationship. Among the factors identified by scholars that might affect the level of knowledge acquired between firms are:

a) Learning capacity (Cohen & Levinthal, 1990)
b) Experiences (Prahalad & Betti 1986, Marquadt & Reynolds 1994, Lyles 1988, Cohen & Bacdayan, 1994)
c) Articulated goals (Hill & Hellriegel 1994, Nonaka & Takeuchi 1995, Lyles & Salk 1996)
d) Active involvement from the foreign partner (Markoczy 1993, Lyles & Salk, 1996)
e) Accessibility of knowledge (Inkpen 1998, Yan & Gray 1994)

3.2.1 Learning Capacity

Learning capacity also known as 'absorptive capacity' is a concept that indicates the learning speed that a firm has where absorption and utilization of information is concerned. This learning speed varies among firms, that is some firms learn faster than others. In other words, this absorptive capacity creates an ability for the firm to absorb the capabilities or knowledge outside its boundaries, and development of this capacity will result in the accumulation of knowledge (Cohen & Levinthal, 1990). The development of absorptive capacity is influenced by four major components, which are:

i) firm's prior related knowledge
ii) flexibility of a firm
iii) determination of a firm to learn
iv) Research and development (R&D) activities

i) Firm's prior related knowledge

Cohen and Levinthal (1990) argue that prior related knowledge that a firm has, is the most important component that determines the ability of the firm to absorb the new knowledge. This knowledge includes basic skills, and technological development in the industry such as product markets, lines of R&D and other technical activities. The participation of a firm in the related areas will enhance its ability in acquiring capabilities through alliances (Mowery, Oxley & Silverman, 1996). Indeed, this historic participation is an essential determinant of absorptive capacity.

ii) Flexibility of a firm

A firm's flexibility is also thought to be linked with the level of capacities in acquiring knowledge (Dodgson, 1993; Lyles & Baird, 1994). A firm is considered flexible when it is non-bureaucratic and non-hierachical in terms of its structure and management approach. A firm's flexibility boosts the capacity to absorb knowledge and increases the receptivity among members of the organization. Flexibility also encourages cooperation and information exchange among the members and allows them to adjust their way of conducting things to the changes needed (Brown & Duguid 1991, Fiol & Lyles 1985, Hedlund 1994, March 1991). It is expected that a flexible firm encourages more information to be absorbed and utilized thus more knowledge is expected to be acquired from the relationship. Bleeke and Ernst (1992) regard flexibility as a crucial feature in successful alliances. Flexibility allows alliances to overcome problems and to adapt to changes over time. Both partners can resolve and avoid conflicts when they have their own management teams with operational decision-making authority.

iii) Determination of a firm to learn

Hamel (1991) argues that the intention of a firm to learn from the partner is closely related to absorptive capacity. Valuable competences cannot be transferred without the intention to learn. Intention to learn represents the firm's determination to learn from the other partner and it is linked with receptivity, transferability and transparency. Receptivity is the ability of a recipient firm to exploit the learning potential; transferability is the extent to which knowledge can be transferred; and transparency is the willingness of firm to release information and explain difficulties to the learning partner (Cohen & Levinthal 1990). Transparency facilitates the transferability of technologies, market knowledge and competences. Indeed, Hamel, Doz & Prahalad (1989) assert that firms become stronger than the partner when they make a greater effort to learn from the relationship (Mansfield 1988).

Even though the knowledge provided by the partner in the alliance/joint venture is useful, a firm will not necessarily actively seek to acquire knowledge (Inkpen, 1998). Some partners aggressively seek to acquire knowledge, while others might take a passive approach to knowledge acquisition. A firm using an alliance/joint venture as a substitute for knowledge it cannot create on its own may remain dependent on a foreign partner and may place low value on knowledge acquisition (Inkpen, 1998). This situation would erode the knowledge of dependent partner (local partner) if the alliance/joint venture is terminated.

The alliance/joint venture approach to knowledge acquisition is closely related to the perceived value of alliance knowledge. The perception on partners could be based on values such as ambiguity about why the partner was successful and how the partner's skills could be utilized (Inkpen, 1998). Firms need to understand why the partner has a competitive advantage and what resources are required to imitate that advantage (Grant, 1996). Hence, the firm's ambiguity associated with the partner's skill needs to be resolved to enable learning to take place. The learning partner also has to believe that the partner's capabilities are different and useful. Thus, the learning potential should not be undervalued to allow learning to occur in the alliance/joint venture.

Determination to learn can be examined through the degree of dependency of firms on their foreign partners. The higher the dependency, the lower the determination to learn. Determination to learn can also be assessed through perceived values by looking at the ambiguity of knowledge and usefulness of the knowledge to the local partner. The ambiguity of knowledge is inversely related to the determination to learn. The higher the ambiguity of knowledge to the local partner, the lower the determination to learn. On the other hand, the usefulness of knowledge is positively related to the determination to learn, the more useful the knowledge of foreign partner, the higher the determination to learn. This variable is crucial to the knowledge acquisition process as it could act as a catalyst to the process.

iv) Research and development (R&D) activities

Knowledge and particularly technology can only be acquired through a learning process. One of the activities that leads firms to learn and acquire knowledge is through R&D activities that take place within the firms. Knowledge will only diffuse to another firm when the firm has sufficient technical expertise, thus the firm's research activity would enhance its ability to learn (Cohen & Levinthal, 1990). In fact Cohen & Levinthal (1990) emphasize that the firm's R&D activity reveals the firm's effort to learn and develop its absorptive capacity. R&D activities will not only encourage new knowledge, they will also boost the firm's absorptive capacity in the learning process. The level of R&D activities and the firm's incentives to learn and acquire knowledge can be indicated by the allocation of expenses spent on these activities. The higher the spending on the R&D, the more knowledge is expected to be acquired from the activity.

The following hypotheses are designed to test the level of knowledge acquired through the learning capacity:

> **H2: The greater the ability of firms to learn, absorb and utilize the knowledge from the foreign partner, the greater the amount of knowledge acquired by the local partner.**
>
> H2a: The greater the prior related knowledge that the partner has, the greater the knowledge acquisition
>
> H2b:The greater the firm's flexibility, the greater the knowledge acquisition
>
> H2c:The greater the determination of the local firms to learn, the greater the knowledge acquisition
>
> H2d: Existing R&D activities in the relationship will increase the knowledge acquired
>
> H2e: The greater the R&D expenditure, the greater the knowledge acquired

Previous literature has not shown the relationship between R&D activities and the local firm involvement in these activities. Nonetheless, it is believed that the involvement of the local firm and the degree of control that the local firm has on the R&D activities would increase the local firm's experience and thus increase the level of knowledge acquired. Previous studies revealed that the involvement of the receiver or learner in the learning process, such as R&D activities, would encourage more knowledge to be acquired (Lyles & Salk 1996, Huber 1991). Hence, this study attempts to discover whether direct local firms' involvement and local firms' control has some effect on the knowledge acquisition process. The following hypotheses are designed to test the effect on knowledge acquisition:

> H2f: The more local firms are involved in R&D activities, the higher the knowledge acquisition
> H2g: The local control of R&D activities will increase knowledge acquisition

3.2.2 Experiences

New knowledge can also be acquired through organizational members sharing experiences and prior learning (Prahalad & Betti 1986; Lyles & Schwenk 1992; Von Krogh, Roos & Slocum 1994). Experience is determined not only by the frequency with which a firm has collaborated with other firms, but also by the intensity, longevity and types of collaborations. Most likely, a firm's propensity to transform collaborative experience into a form of competitive advantage will depend on its capacity to internalise and routinise lessons drawn from a variety of organizational and individual experiments (Cohen & Bacdayan, 1994; Nelson & Winter, 1982; Nonaka, 1994). In fact, a critical foundation for a learning organization is this ability to build from experience (Marquardt & Reynolds, 1994).

Lyles (1988) found that firms had changed their approach to collaboration on the basis of their experiences with past collaborations. Indeed, Powell, Koput and Smith-Doerr (1996: 120) argue, ' experience at collaborating is necessary to manage a diverse portfolio of ties'. 'Hence... firms learn from exploration and experience how to recognize and structure different types of alliances'. Firms' experience in collaborations either domestically or internationally, can enhance their learning capabilities in the new relationship particularly if the experience is related to a firm's core business (Barkema, Shenkar, Vermeulen & Bell, 1997). Alliances experience that the firm has becomes a major factor that influences its performance (Inkpen & Beamish 1997, Makino & Delios 1996). The learning can occur through a by-doing process or accessing knowledge from other firms (Chang, 1995).

In acquiring and creating knowledge, two major processes have to take place; firstly is the transfer of knowledge from the expert partners to the learning partners (Huber, 1991), and secondly the process of internalisation of knowledge and knowledge connections (Von Krogh et.al.1994). The development of the first process can occur either through direct collaborative experience, or through non-experiential methods like congenital learning, imitation, grafting, and searching (Huber, 1991). The role of grafting in collaboration efforts as direct experience is significant and undeniable. In fact Huber (1991) highlighted that the first process is referred to as grafting where organizations increase their store of knowledge by internalising knowledge not previously available within the organization. Lyles and Salk (1996) suggest that grafting can be conducted when individuals with special expertise such as using expatriates are located in the collaboration. Firms that have greater levels of collaborative experience are also in a better position to recognize the similarities and differences between their own situations and those of other firms. The effectiveness of imitating, grafting, and searching forms of learning can all be enhanced with prior experience, and even the ability to tap into congenital knowledge may be enhanced through experience.

The second process of knowledge acquisition and creation involves the internalisation of knowledge and the connections between individuals. This study refers to this process as indirect interaction as experiences are unconsciously accumulated through the socialisation and internalisation process (Nonaka & Takeuchi, 1995). Socialisation and internalisation process of knowledge via exposure to reference individuals, groups and organization allow the learning process to take place (Nonaka & Takeuchi, 1995). Von Krogh et al. (1994) argue that the internalisation of knowledge can only occur when the partners engage in efforts that create the connections through which individuals can share observations and experiences. Organizational routines store organizational experience in a form that allows for a rapid transfer of that experience to new situations (Cohen & Bacdayan, 1994). Simonin (1997) and Lyles (1988) found that experience is critical in creating know-how, nevertheless, experience is only valuable if the lessons are internalised by the firm and used for future actions.

The following hypotheses are designed to test the level of knowledge acquired through experiences are:

H3 : The greater the experience that the local firm has, the greater the knowledge acquired from the foreign partner

H3a (i) : Firms that have previous relationships will acquire more knowledge

H3a (ii): The longer the term of previous relationships, the higher the knowledge acquired

H3a (iii) : The more the previous relationship succeed, the higher the knowledge acquired

H3a (iv): Previous alliances or joint ventures helps in acquiring knowledge from the current foreign partner

H3 b: The greater the grafting experience that the local firm has, the greater the knowledge acquired from the foreign partner

H3c : The greater the indirect experience that the local firm has, the greater the knowledge acquired from the foreign partner

3.2.3 Articulated goals

An articulated goal is another factor that can indicate the level of knowledge acquisition (Hill & Hellriegel 1994, Nonaka & Takeuchi 1995, Lyles & Salk 1996). Lyles and Salk (1996) examined the articulated goals factor in terms of its role in facilitating the knowledge acquired. Articulated goals which are explicitly documented allow firms in alliances to know in advance what the mission of the relationship is and what the expectations are from the organizational members in order to achieve the goals. The goals can also be used as a benchmark for the organization to assess the action of its members and their output performance, and enable them to create their own plans and goals concurrently. This situation can generate the organizational members' freedom and flexibility in the organization. The articulated goals can also be used as assessment mechanisms for alliance firms in terms of understanding and performing the desired outcome, the gap between goals and plans, members development at a specific time, and new knowledge to improve difficulties.

Goals can be assessed in terms of written objectives and written long term plan. An unambiguous written objectives and long term plan will enhance the understanding of organizational members on articulated goals. Hence, it is expected that the explicit written articulated goals will allow more knowledge to be acquired through alliances by the local firm than those alliances that do not have the goals in written form or have unclear articulated goals.

The following hypotheses are designed to test the level of knowledge acquired is :

H4: The more explicit the articulated goals, the greater the knowledge acquired by the local firms

H4a : The objectives that are written down help knowledge to be acquired

H4b : The long term plan that is written down helps knowledge to be acquired

H4c : Better understanding of the mission of the alliance/joint venture increases knowledge to be acquired

3.2.4 Active involvement

The active involvement of foreign firms is essential in alliances relationships as it is a source of information and experience (Lyles & Salk, 1996). Information is a flow of signals and knowledge can be viewed as the interpretations of those signals. Therefore, firms need to have a means of conveying the information as it is a substance for knowledge creation (Nonaka & Takeuchi, 1995). Since foreign parents are perceived as possessing technology, administrative and management know-how, they are expected to offer this knowledge to the local firms (Child & Markoczy, 1993).

Knowledge can only be transferred through documents and people, thus active involvement through direct interactions or routines among individuals and organizations is vital (Hall & Johnson, 1970). Abernathy (1978) and Rosenberg (1982) point out that direct interaction allows the local partner to learn faster about the product market and the method of production through technical training. Lyles & Salk (1996) found that foreign partners' active involvement, particularly in terms of explicit contributions indicate that the local firms acquire knowledge. These contributions were viewed in terms of technical knowledge, managerial knowledge, division of labour and training.

Explicit contribution refers to how members of the foreign parent convey their information and experience through communication such as signals and other means to the learning partner (Lyles & Salk, 1996). Managerial contribution refers to the extent to which the foreign parent contributes in terms of sales or marketing support, managerial resources, administrative support, emotional support, training and time. Technical contribution considers factors like product-related technology, manufacturing related technology and manufacturing support. Division of labour refers to the extent of task division between local and foreign parents in terms of technology and manufacturing capability. Training considers the extent to which foreign parent provides education and training to local managers. The socialization and internalisation of knowledge from these factors are essential in acquiring the knowledge. Ounjian & Carne (1987) assert that knowledge can be transferred through documentation, training, demonstration and collaborative technical work. Documentation refers to documents that are available in written form such as reports, job manual, and assessment or programs. Training includes formal and informal training, either on-site (on-the-job) or off-site (Ounjian & Carne, 1987). Hence, it is expected that explicit contributions of the foreign firms and documentation would have a positive relationship with the level of involvement of foreign firms.

The following hypotheses are designed to test the level of knowledge acquired:

H5: The greater the active involvement of the foreign firms, the greater the knowledge acquired by the local firm.

H5a : Technical contribution helps to increase the knowledge acquired

H5b : Managerial contribution helps to increase the knowledge acquired

H5c : Contribution of the partner helps to increase the knowledge acquired

H5d : Training of the employees helps to increase the knowledge acquired

H5e : Written documents help to increase the knowledge acquired

H5f : The existence of knowledge documentation increase the knowledge acquired

3.2.5 Accessibility of Knowledge in Alliances

In order for knowledge to be acquired it must be accessible. Inkpen & Dinur (1998) address the issue of how firms access and transfer knowledge across organizational boundaries. They claim that accessing to the partner's knowledge is a process as firm is a dynamic system of processes involving different types of knowledge. In order for knowledge to be accessed, there must be a knowledge connection through formal and informal relationship (Inkpen, 1996). These internal managerial relationships facilitate the sharing and communication of new knowledge and provide a basis for transferring individual knowledge to organizational knowledge (Inkpen & Dinur, 1998). The knowledge may be further developed and move upward in the organization. The knowledge connection was referred to as knowledge overlap by other earlier studies. Simon (1985) argues that a sufficient level of knowledge overlap will ensure effective communication, and interactions across individuals would create knowledge links and associations. The knowledge overlap is also studied by Clark & Fujimoto (1987) who conform that the overlapping knowledge facilitates communication and coordination across organizational subunits. When one individual's knowledge connects with other knowledge, it can be discussed, debated and possibly discarded. Individual knowledge is fragile, thus without knowledge connections, new knowledge may be ignored or viewed as irrelevant (Von Krogh et al., 1994). Hence, knowledge connections provide mechanism for knowledge to be accessed and acquired (Inkpen & Dinur, 1998). Based on this argument, knowledge connections and knowledge overlap can be used to access the extent of accessibility of knowledge from the foreign partner. The greater the knowledge connections and the knowledge overlap, the higher the potential for knowledge to be accessed and acquired by the local firms. In developing the hypothesis, the higher the potential access, the higher the accessibility to the knowledge of foreign partner.

Inkpen (1998) also highlighted that accessibility to a partner's knowledge is constrained by a partner's protectiveness and knowledge tacitness. The extent of protectiveness by a foreign partner will depend on the potentiality of the local firm to become a competitor.

In a situation of high competitive overlap between the partners, a foreign firm may be reluctant to share knowledge because of the risk of knowledge spill-over. Indeed, a firm may work hard to prevent knowledge leakage to the local partner. This can be implemented through the employees' access to plant and the recruitment of key personnel. On the other hand, a high degree of trust between partners would lessen the partner protectiveness of knowledge. This would lead to a mutual understanding among the partners.

Knowledge protectiveness is significantly influenced by trust (Inkpen, 1998). The higher the degree of trust, the lower the protectiveness of knowledge. March & Olsen (1990) assert that trust facilitates learning between partners and the decisions to exchange in knowledge under certain conditions are based on trust.

Tacitness of knowledge is related to knowledge that is difficult to be communicated and shared by others (Nonaka & Takeuchi, 1995). Inability to describe how and why things are done within the organization indicates that the knowledge is highly tacit. The more tacit the knowledge sought, the more difficult the knowledge acquisition. The absence of highly visible changes to systems and processes could be associated with low knowledge acquisition (Inkpen, 1998; Yan & Gray, 1994). As accessibility deals with knowledge in particular the tacit knowledge, the hypotheses developed could not measure directly the extent of tacit knowledge that has been acquired. The tacitness of knowledge is difficult to measure directly using specific elements, nonetheless, analysing factors that are closely affected by the tacit knowledge is thought to be useful. The extent of tacit knowledge that has been acquired could be identified by examining the changes in the organizational systems and organizational processes. The greater the changes in the organizational systems, the greater the knowledge acquired (Inkpen, 1998). The greater the changes in organizational processes, the greater the knowledge acquired. The tacit elements of accessibility is examined and discussed in chapter eight.

The following hypotheses are designed to test the level of knowledge acquired:

H6: The higher the accessibility to knowledge of the foreign partner, the higher the knowledge acquired.

H6a : The higher the potential access of knowledge, the higher the accessibility

H6b : The higher the degree of protectiveness by the foreign firms, the lower the accessibility

3.3 Culture and Knowledge Acquisition

The level of knowledge acquired is also believed to be moderated by yet another factor. Lyles and Salk (1996) claim that cultural differences tend to moderate the level of knowledge acquisition in alliances by negatively affecting their performance.

Cultural differences between the partners can distract or hinder the flow of information in alliances and if they exist agreements on goals of the relationship cannot be achieved. The crossing of different cultures in alliances, either national culture or organizational culture, can lead to a decrease in social effectiveness of the partner firms (Pierre-Xavier & Alain, 1994). The national culture of a MNC has been found to reduce the firm's ability to learn from the partner in alliances (Hickson 1996; Hosfstede 1983). Cultural differences can affect the understanding between the partners and thus minimize the flow of information and learning (Fiol & Lyles 1985, Lane & Beamish 1990, Parkhe 1993, Salk 1992, Lyles & Salk 1996). Prolonged cultural conflicts also result in instability and poor performance of firms in the alliances (Killing 1983, Lane & Beamish 1990, Lyles & Salk 1996). Therefore, it is expected that a high level of cultural difference will lower the level of knowledge acquired.

Organizational theorists regard culture as embedded in social interaction and that culture is an outcome from the interaction among organizational members over time. Moran & Volkwein (1992) and Meek (1992) stress that culture plays a pivotal role in creating systems of beliefs and values which influence organizational behaviour. It is also commonly accepted in the organizational behaviour literature that culture has a significant impact on organizations (Bhagat & MacQuaid 1982; Denison 1990).

As the culture of the organization influences the functions of the organization, Kilmann et. al (1985) define culture as the 'invisible force behind the tangibles and observable in any organization'. The establishment of international alliances would result in the crossing of parental cultures. Anglo-Saxon scholars regard this phenomenon as 'cross-culture' (Laurent 1986; Adler 1986; Beamish & Lane 1990) or 'cultural collision' (Nahavandi & Malekzadeh 1988; Bowditch & Buono 1989). When cross culture occurs, it has a negative effect on organizational involvement and the work climate in alliances (Cullen et al. 1991). The effects are greater if the cultural distances between partners are large (Bowditch & Buono 1989). Cultural distance not only adds to the information costs of foreign parents in the host country, it also creates difficulties in transferring management skills (Buckley & Casson 1976, Vachani 1991). Conflicts and tensions that arise due to the cultural differences between partners contribute to the failure in achieving desired organizational performance.

3.3.1 Organizational Culture and Knowledge Acquisition

Cultural differences tend to have a profound effect on the performance of international joint ventures. The compatabilility between partners is the most important factor in the international alliance (Lane & Beamish, 1990). Cultural issues can arise between expatriate and local professionals working in international joint ventures (Pierre-Xavier, 1997). Personal, interpersonal, group and intergroup dynamics involving employees from different companies are elements that could affect the success of international joint ventures (Perlmutter & Heenan 1986, Lane& Beamish 1990, Pierre-Xavier& Alain 1994).

Pierre-Xavier (1997) claims that organizational culture tends to be pervasive and powerful than national culture in shaping the behaviour of different employee groups . In fact, Adler (1986) argues that employees from different countries become similar when working for the same organization. Pierre-Xavier (1997) defines organizational culture as the beliefs, values, assumptions, and customs shared by the members of an organization. In international joint ventures, the different cultures are highlighted particularly when the parties involved are obliged to accommodate a different set of standards. Cultural differences are often expressed in the form of conflictual behaviour between individuals working in the international joint venture or alliance. In his study, Pierre-Xavier (1997) identifies cultural differences of the international joint venture based on the perceived distance between the organizational culture of the foreign partner and local partner. The higher the perceived distance between the partners, the greater the cultural differences.

As the international joint venture or alliance brings two or more companies together, the local employee must deal with the expatriate employee and both may have experienced different cultural environments. The joining of these two different cultures is known as culture collision and this may produce culture shock. Culture shock might disrupt the operation of the newly-formed alliance and might influence the operational performance of the alliance. Indeed, Cullen et al (1991) claim that cultural shock is often accompanied by negative effects on organizational involvement and work climate in the international joint venture. The larger the cultural distance between the partners of the international joint ventures, the more evident the organizational effects of the shock.

The stress and anxiety caused by the shock of cultural collision in the international joint venture might also lead to other unproductive employee behaviours, which could reduce the overall effectiveness of the firm. Organizational members may spend disproportionate amounts of time worrying and gossiping about the joint venture and the parent companies, and battling with co-workers. Furthermore, other subtle costs might be incurred due to declining morale, loyalty, commitment and trust of those who work in the international joint venture (Schweiger & Ivancevich 1987, Bowditch & Buono 1989).

The effect of cultural collision could be lessened if the cultural difference is managed effectively. This could be attained if employees understand the cultural differences of the different companies prior to dealing with them (Berg, 1985). The understanding is important, as it would enable employees to learn to cope with changes in the work environment.

As both national culture and organizational culture lead to cultural differences and affect the performance of international joint ventures, both types of cultures are being examined. Therefore, cultural differences contain the two elements, national culture and organizational culture. The following hypotheses are designed to test the effect of cultural differences on performance and knowledge acquisition:

H7 : Cultural differences between the partners tend to negatively effect the level of performance in the relationship.

H7a : Cultural differences between the partners tend to negatively effect the level of knowledge acquired.

3.4 Knowledge Acquisition and Performance

Knowledge acquired through international strategic alliances can expand the partner firms' competitiveness and capabilities. The utilization and internalisation of the capabilities can lead to the creation of competitive advantage and sustain competitiveness, and at the same time enhance the long-term performance of the alliances. Nonetheless, knowledge acquisition is a process that is more difficult to measure than performance. As the ultimate goal of knowledge acquisition is to improve firms' competitiveness and performance, performance is used in this study as an indicator to represent the acquired knowledge.

Looking at performance itself, there is no consensus on the appropriate definition and measurement on this concept. A firm's performance needs to be looked at in various ways, as one way of looking at it would not reflect the true picture of the alliances' performance. Performance can be assessed through financial or market objectives (Geringer & Herbert 1989, Hill & Hellriegel 1994, Parkhe 1993), nonetheless, using financial measures alone may fail to adequately reflect the extent of the alliances achievement on its other objectives (Killing 1983, Geringer & Herbert 1991). Despite poor financial results, an alliance may have exceeding its parents' objective and thus be considered successful by one or all of the parents. Conversely, an alliance may be viewed as unsuccessful despite good financial results. This is because financial measures evaluate only one dimension of performance (Anderson, 1990).

Other factors, including qualitative measures, must also be examined in order to adequately evaluate alliance performance. Accumulated competencies for instance (Hamel, Doz & Prahalad 1989, Kogut & Zander 1992),is one of the qualitative measures that can be used to indicate the level of performance in alliances. Another qualitative measure to evaluate performance is via the satisfaction level of stakeholders (Killing, 1983; Beamish, 1984;Lyles & Salk, 1996), which can be found by measuring the extent of the alliance's achievement towards it overall objective. Other methods used by scholars to assess performance are: the duration of the alliance relationship (Harrigan, 1986; Kogut, 1988) where the longer the duration indicates a higher level of performance; instability of alliance ownership or contract where significant changes indicate poorer performance (Franko, 1971; Gomes-Casseres, 1987; Blodgett, 1992); and renegotiation of the alliance contract (Blodgett, 1992).

Hill & Hellriegel (1994) and Lyles & Salk (1996) analysed three aspects of performance including both qualitative and quantitative measures, in order to ensure that the operationalization of performance was adequately conducted. These were: – business criteria (Harrigan, 1986); human resource management criteria (Kogut, 1988; Brown & Duguid, 1991; Lyles, 1988; Szulanski, 1993; Lyles & Salk, 1996); and general performance (Lyles & Salk, 1996). Business performance was measured using factors such as volume growth, profits, employee productivity and overhead costs. Human resource management performance was measured in terms of competencies building by the workforce, accumulated management skills and organizational capabilities. General performance was measured by the local partner evaluation on the overall performance of the alliance.

Killing (1983) and Beamish (1984) used single-item perceptual measures of a parent's satisfaction with alliance performance. For instance, the question asked was 'to what extent has the performance met the expectation of your firm?' This kind of measurement can provide information regarding the extent to which the alliance has achieved its overall objectives. When greater knowledge is acquired, human resource performance, particularly in terms of capabilities and competencies tends to be higher than business and general performance. Thus, the level of knowledge acquired in the alliance tends to be closely related with human resource performance rather than the other two.

This study will use a qualitative measure of performance as researchers studying international joint ventures agree that quantitative measure is not always appropriate to measure joint venture performance (Hill & Hellriegel, 1994). Many studies also have shown that there is a significant positive relationship between managers' perception and objective measures, also significant relationship between perception of parent and actual evaluation. In other words, there is a consistency between manager's perception on performance and objective measures (Geringer & Herbert, 1989, 1991; Dess & Robinson, 1984; Hansen & Wernerfelt, 1989; Lyles & Salk, 1996; Dess, 1987; Golden, 1992; Hart & Banbury, 1994; Powell, 1992; Covin et al., 1994; Venkatraman, 1990; Venkatraman & Ramanujam, 1986; Vernhage & Waarts, 1988). In addition, absolute performance figures such as Return on Investment (ROI) and profit levels are difficult to compare between firms of different sizes, operating in different industries and markets, using different accounting standards, and defining their markets in different ways (Hooley et al., 2003).

The following hypotheses are designed to assess the alliance's performance through the level of knowledge acquired:

H8 : The greater the level of knowledge acquired, the higher the alliance/joint venture's overall performance

H8a : The greater the level of knowledge acquired, the higher the human resource performance

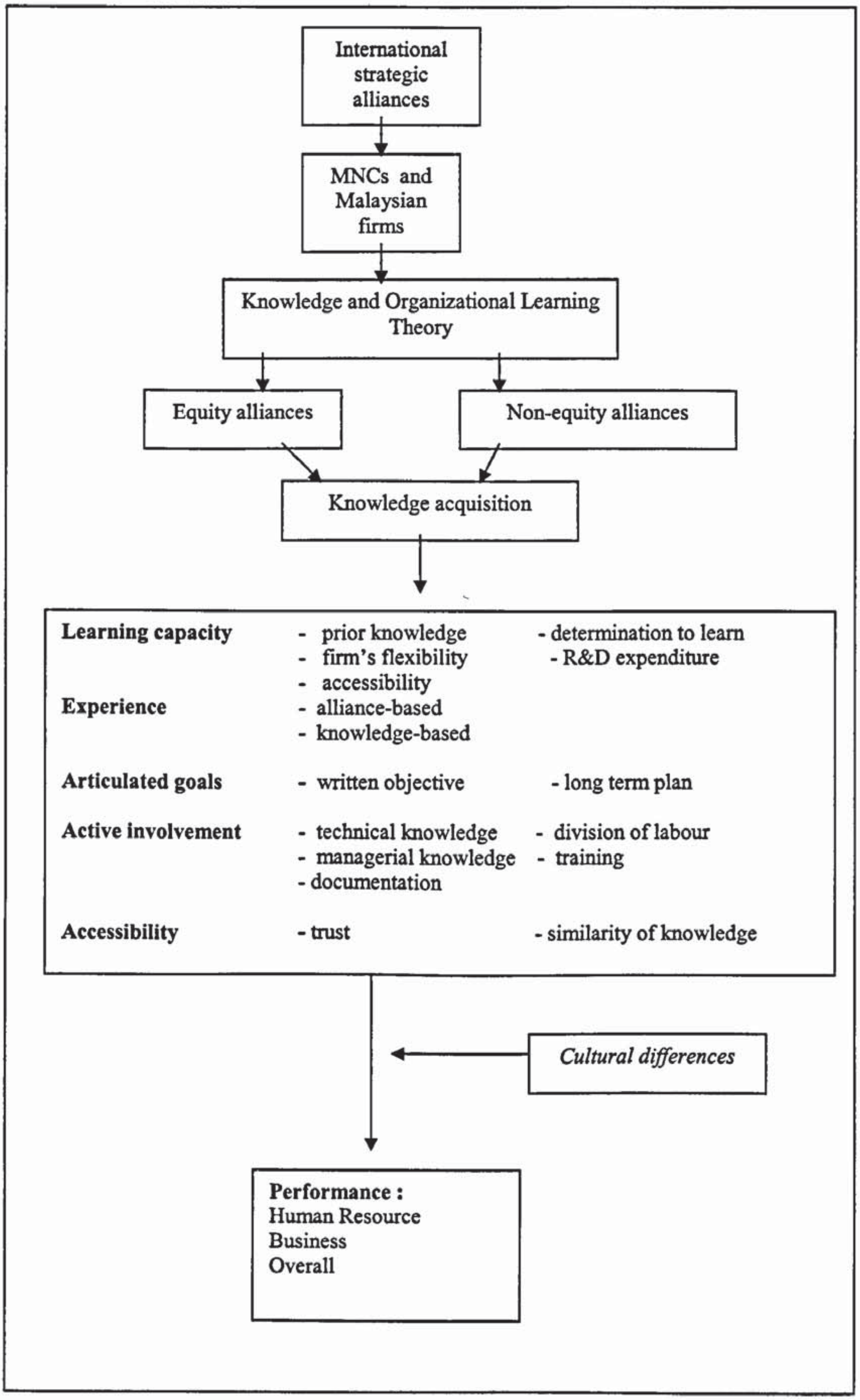
H8b : The greater the level of knowledge acquired, the higher the business performance

H8c : The greater the level of knowledge acquired, the higher the general performance.

3.5 Conceptual Framework for Knowledge Acquisition

Figure 3.2 shows a conceptual framework that can be developed based on the literature. The framework summarises the variables involved in the present study and reveals their connections to each other. Thus, this study attempts to confirm the relationships between the variables.

Figure 3.2 : Conceptual Framework



3.6 Conclusion

This chapter has discussed the development of research in the strategic management field pertaining to strategic alliances, alliance learning and knowledge acquisition. It shows the evolution and progress of the literature that the field has experienced up to the present time. Knowledge acquisition behaviour in strategic alliances is unique as the types of strategic alliances themselves might have an influence on it. Thus different types of strategic alliances were described in detail and the way they influence knowledge acquisition were clarified. Equity alliances were further analysed to ascertain the effect of ownership types on the knowledge acquisition process. Non-equity alliances involve bilateral and unilateral contract agreement. Factors affecting the knowledge acquisition process were clarified. The determinants of knowledge acquisition identified as having an influence on the knowledge acquisition process are learning capacity, firms' experiences, articulated goals, active involvement from the foreign partner, and accessibility to the foreign knowledge. Each factor was individually described. Finally, performance, which represents the knowledge acquisition itself, was elaborated at length. Performance was categorised into three types, human resource performance, business performance and overall performance. All hypotheses that will be tested in this study were presented in the last section of the chapter. Based on prior literature, a set of hypotheses was derived which will be tested using data from Malaysian alliances. The research method for the study is set out in the following chapter.

CHAPTER FOUR : RESEARCH METHOD

This study examines the level of knowledge acquired through strategic alliances among firms in Malaysia. The methodology for this research is mainly quantitative as it is believed that this method facilitates answering the study's research objectives. Nonetheless, some aspects of the data are qualitative in nature, thus qualitative methods are applied as well. This chapter discusses the methodology applied in conducting this study and consider issues such as research design, research instruments, sampling methods, and data analysis and measurement. These issues will be examined individually.

4.1 Research Design

Surveys were used to collect the data, which enables the researcher to generalise the findings from a sample of responses to a population and make inferences about some characteristics involved such as level of knowledge acquired and performance (Creswell, 1994). A survey was preferred over other methods since the results can be generalised and information can be gathered by using questionnaires. This method which involved using a sample to represent a large population, helped to lower the costs in terms of time and money and so is economic compared to other qualitative methods such as an ethnographic approach. The information gathered also enabled the researcher to identify patterns in the data and association between the variables. This provided a basis for a formulation of explanations and theories, and for achieving the research objectives (Fowler, 1988; Fink & Kosecoff, 1985).

A cross-sectional survey approach was conducted where information was collected at one point in time. Two questionnaires were used in the survey. The first was designed to collect quantitative data on a cross section of Malaysian partners in joint ventures and other alliances. It was also designed to directly address the hypotheses outlined in chapter three. This second questionnaire was a follow-up questionnaire to the first one and tended to be more open-ended than the first one. These open-ended questions were designed in order to address some of the issues of tacit knowledge transfer, which have been discussed in chapter two. Principally, the questions in the second questionnaire are qualitative but there are some quantitative elements in them. Both questionnaires were answered through personal interviews.

4.2 The Questionnaires

This study uses questionnaires as an instrument of data gathering and to answer the objectives of the study. Two questionnaires were used as instruments of getting data, the first is for assessing the determinants of knowledge acquisition and the second is for assessing tacit knowledge. All the data used to test the hypotheses comes from Malaysian alliance partners themselves which may pose some potential weaknesses. Because the measurement of dependent variables and independent variables come from the same source, there is a possible problem of endogenity. Therefore, the questionnaires are carefully constructed to avoid leading the respondents toward any particular conclusion. For instance, question 9.1 is phrased as 'estimate the national cultural differences between local and the foreign partner'. The phrasing of the question is made to avoid the endogenity issue. However, it should be noted that the design of the first questionnaire was based on and guided by Lyles and Salk (1996), nonetheless in order to suit the present research and Malaysian context, some additional information was added and some changes were made to the questions. The endogenity issue is also recognised and presented in Lyles & Salk (1996) and other literature. Generally, the first questionnaire was divided into three major sections. Detailed discussions on the first instrument used for this research is provided below and a copy of the questionnaire is in Appendix 1.

Section one covers information on the company's profile, such as years of involvement in alliances or joint ventures, types of industries, types of alliances, equity involvement, and technology flow. Most of the questions in this section are fill-in-the-blank types as it involves specific information from them (refer to Appendix 1). Question 1 asked about the length of operation of the alliance and sectors that the company was involved in. This question is necessary in order to confirm that the respondents fit the requirement of high technology firms in Malaysia. This question also is needed to analyse the types of sectors as a moderating variable to the knowledge acquisition. Question 2 focuses on the types of engagement by the respondents in alliances, either joint venture or contractual agreement. This answer is required to confirm the two groups of alliances and essential in order to test hypothesis 1, which examines the contribution of types of alliances to the level of knowledge acquired. Question 2 was divided into two parts, the first part (2.1) covered questions for firms involved in joint ventures while the second part (2.2) covered questions for firms engaged in contractual agreements. Different types of alliances required different kinds of information from the respondents. The first part of question two, which relates to joint ventures and equity involvement of the local and foreign firm, is essential to test hypotheses 1a and 1b. These two hypotheses examine the ownership percentage; either shared management or majority foreign ownership contributes to the level of knowledge acquired. The second part of question two focuses on contractual agreements and the direction of technology flow. This question is essential to test hypothesis 1c, which examines the contribution of bilateral and unilateral communication flows to the level of knowledge acquired.

Section two covers specific information on knowledge determinant variables such as learning capacity, firms' experiences, knowledge accessibility, active involvement, articulated goals, and types of knowledge acquired. Though the questions in this section are also closed-ended type as in section one, unlike section one, this section provides subjective answers by the respondents. Thus, respondents could just choose the most appropriate answers for the questions. Nonetheless, several questions were not provided but left to respondents to complete. Three types of close-ended questions were used in this section, one is yes-no type, the other is Likert-scale type where the respondents were given a five-point scale to choose from, and the third type is fill-in the blank. Section two contains six parts from question three until question eight. It covers variables for learning capacity, experience, accessibility, active involvement, articulated and knowledge acquired (refer to Appendix 1).

Question 3 looked into learning capacity as a determinant of knowledge acquisition. Four dimensions were included to measure learning capacity, they include prior related knowledge (Q3.1 and 3.2), flexibility of the firms (Q3.3), determination to learn (Q3.4a and 3.4b) and Research and Development (R&D) expenditure (3.5a-d). These four dimensions have been discussed in chapter three. Prior related knowledge is measured through the degree of involvement in two elements, technology-related knowledge and skills-related knowledge. Flexibility of firms is measured through degree of centralisation and decentralisation of the decision making within the firm. Determination to learn is measured by analysing the extent of dependency on the foreign partners for core manufacturing activities and their contribution of capabilities to the local firms. R&D expenditure was examined in terms of the amount of money spent on R&D itself; involvement of local employees in the R&D activities, and degree of control by the locals on the activities. Question 3 was intended to test hypothesis 2 and all its sub-hypotheses 2a, 2b, 2c, 2d, 2e, 2f, and 2g.

Question 4 (refer to Appendix 1) focused on experience as a determinant of knowledge acquisition. Previous collaboration experience that firms obtained were examined by asking the relationship history that the firms had with previous partners. The length of relationship and percentage of success were also asked to identify their influence on knowledge acquisition. This question is necessary to test hypothesis 3 and its sub-hypotheses 3a (i) to 3a (iv). Question 5 was intended to collect data to examine three major hypotheses; hypotheses 3, 5 and 6. Though it was headed "Accessibility", it was not intended to measure solely accessibility, but also other related hypotheses.

Question 5 was designed this way due to the fact that the questions asked tended to be closely related to accessing knowledge from the foreign partner, therefore, by grouping the questions together it was hoped to facilitate and increase the respondents' understanding of the questions. Nonetheless, for the purpose of statistical analysis they were kept separate. Question 5.1a, which asked about similarity of knowledge and 5.2b, which asked about the degree of trust were aimed to measure accessibility and to test hypotheses 6, 6a and 6b. Question 5.1b, which is about the involvement of documentation in transferring knowledge was aimed to measure documentation involvement and to test hypotheses 5e and 5f. Question 5.1c, 5.1d, 5.1e and 5.1f are related to the degree of involvement of expatriates within the firms and were aimed to examine grafting or direct interaction experiences between the local employees and foreign partners. These questions were designed to test hypotheses 3 and 3b. Finally, question 5.2a, which asked about the degree of internalisation and socialisation between the local employees and the foreign partners, was aimed to measure indirect interaction experiences. These questions were designed to test hypotheses 3, 3b and 3c.

Question 6 (refer to Appendix 1) focused on the active involvement variable, which refers to the contribution provided by the foreign partners to the locals, measured by and Likert scales. Question 6.1a was designed to measure managerial contribution from the foreign partners and to test hypotheses 5 and 5b. Question 6.1b was designed to measure technical contribution from the foreign partners and to test hypotheses 5 and 5a. Question 6.1c (i) was designed to measure the contribution in terms of foreign technology and local firm's manufacturing capabilities and to test hypotheses 5 and 5c. Finally question 6.1c (ii) was designed to measure the contribution of foreign training and to test hypotheses 5 and 5d.

Question 7 focused on articulated goals, which refers to the objectives and missions of the partners in forming the strategic alliances. Question 7.1 asked specifically about the goals of the alliance relationship and was not pre-coded. This question is aimed to test hypothesis 4a. Questions 7.2, which asked about objective and long terms plans and question 7.3, which asked about understanding of the mission of the relationship, directly measured the articulated goals in knowledge acquisition. These two questions are closed-ended with "yes" or "no" as an answer and were aimed to test hypotheses 4, 4b, 4c and 4d.

Question 8 concentrated on knowledge acquired, which refers to the knowledge gained by the company from the foreign partner, measured by five-point Likert scales. Knowledge acquired is a dependent variable in assessing the level of knowledge acquisition, thus it also needs to be measured. In this study six elements of knowledge were examined, they are new technological expertise, new marketing expertise, product development, foreign culture, managerial techniques and manufacturing process. These six elements are used for three main reasons; firstly, based on the literature these six elements are among the main motives for firms seeking strategic alliances (Mariti & Smiley, 1983; Porter & Fuller, 1986; Contractor & Lorange, 1988; Hamel et al., 1989; Shan, 1990; Hamel, 1991; Powell & Brantley, 1992; Mody, 1993; Hagedoorn, 1993; Grindley, 1995; Khanna, 1996); secondly guided by the work of

Lyles & Salk (1996); and thirdly because it matches the kinds of knowledge that are sought by Malaysian firms from foreign partners.

Section three covers necessary information related to cultural differences, performance, and comments and suggestions. Questions 9 (refer Appendix 1) focused on cultural differences, which refers to the differences in beliefs and value systems, measured by five-point Likert scales. Question 9.1 asked about the differences in national culture while question 9.2 asked about he differences in terms of organizational culture. Both questions were intended to measure cultural differences and to test hypotheses 7 and 7a.

Question 10 focused on performance, which is the second dependent variable in this study. Performance refers to the achievement made by the company based on human resource, business and general factors measured by five-point Likert scales. Question 10.1a, which measures the human resource performance was designed to test hypotheses 8 and 8a. Question 10.1b, which measures the business performance was designed to test hypotheses 8 and 8b. Question 10.1c, which measures the overall performance was designed to test hypotheses 8 and 8c. In contrast to questions 9 and 10, which are closed-ended type, question 11 had an open-ended format. These questions were designed in such a way to enable the respondents to freely express their opinions and ideas based on their experiences in the alliance relationships. Question 11.1 asked about ways to improve the current alliance relationship and question 11.2 asked about the significant areas of strategic alliances that were not covered in the present study. These questions were not designed for hypotheses testing, but they were expected to provide some inputs to the findings. The final part of this section is question 12, which asked about the respondents' profiles, which include the respondents' position, their working experiences and their highest education level. These questions were not pre-coded and were not intended for hypotheses testing, but were essential to establish the credibility of the answers provided by the respondents based on their positions in the companies.

The second questionnaire focused specifically on tacit knowledge in the knowledge acquisition process. This questionnaire is different in nature from the first questionnaire. Semi-structured questions were set in order to gather the information and the respondents were required to answer them in a specified format. There were two types of questions, closed-ended and open- ended, which allows respondents to provide additional information to the questions. Nine questions were posed and two columns were provided for the answers, one is for the structured answer (closed-ended) and the second is non-structured (open-ended). The information was gathered through personal interviews with the key managers of the local firms. The interviewed firms were the same firms that were interviewed for the first questionnaire, however, due to the time constraint of the respondents, the interview period was shortened and the second questionnaire failed to be completed by all firms. This has contributed to the lower number of responses, which is forty-two responses compared to the first questionnaire, which was sixty-five. Coincidentally the number of joint venture and contractual firms were equal, twenty-one firms involved in joint ventures and twenty-one in contractual agreement.

The personal interviews for the second questionnaire were conducted differently from the first one. Before the interview, the questionnaire was given to the respondents for an overview of the issues that would be asked. In average, each interview session took nearly two hours. Information was gathered using two methods, recording and documenting, to ensure that the information given is not being left out. The information provided during the interviews was written down in a specific column in the questionnaire and with the respondents' permission, the information was also being recorded concurrently. In analysing the feedback of the interviews, four major steps were conducted. Firstly, the researcher identified the answers or reasons provided by the interviewee and organise them in a simpler format. Secondly, these reasons were evaluated and classified according to their common themes and were put into several categories. Thirdly, the information was interpreted and summarised. Fourthly the information about the tacit issues was finally clarified and described. The detail discussion of this questionnaire is deferred until chapter 8, and a copy of this questionnaire is in Appendix 2.

4.2.1 Research Variables

This study involves three types of variables - independent variables, dependent variables and moderating variables. Research questions for each variable were answered based on the constructs and items developed. The independent variables comprise strategic alliance types and determinant factors for the knowledge acquisition process. They are types of alliances, learning capacity, experiences, knowledge accessibility, active involvement, and articulated goals.

The dependent variables include types of knowledge acquired and performance of the alliances in terms of human resource performance, business performance and overall performance of the alliance. Cultural difference acts as a moderating variable as it might have effects on the relationship between types of alliances and performance, and determinant factors of knowledge acquisition and performance (refer to Figure 3.2: Conceptual Framework).

4.2.2 Operationalisation of Variables

Several dimensions and elements have been constructed for each variable. As two questionnaires were used, discussion will cover both questionnaire A, the first questionnaire and questionnaire B, the second questionnaire.

a) <u>Questionnaire A</u>

Questionnaire A covers all the variables involved in the present research, which include dependent variables, independent variables and moderating variables. As discussed in 4.2, each variable were measured using several items necessary. For instance, in looking at factors affecting knowledge acquisition, four dimensions of knowledge acquisition were used, they are learning capacity, experience, articulated goals and active involvement. In order to measure each dimension, several elements that represent the dimensions need to be identified. For instance, learning capacity is measured using four elements, which include prior knowledge, firm's flexibility, determination to learn and R&D expenditure. These factors are measured further using several items. Another example of constructing elements to measure variables is types of knowledge acquired from the alliance or joint venture. Six elements of knowledge were used, there were new technological expertise, new marketing expertise, product development, knowledge about foreign cultures, managerial techniques and manufacturing processes. Another instance is performance, where several dimensions and elements were constructed in order to measure the variable. In this study, performance was divided into three major dimensions – human resource, business and general. The human resource dimension was further measured using training and improving management skills. The measured items were designed to be simple for the respondent to answer and meaningful for the researcher to analyse.

b) Questionnaire B

Questionnaire B covers most of the independent variables that have tacit elements, which are difficult to be measured through close-ended questions. The purpose of having this questionnaire is to examine the tacit elements that are embedded in the independent variables as closed-ended questions are not appropriate. Semi-structured questions were set up to enable the respondents to answer. Two types of questions were used, closed-ended and open-ended which allows respondents to provide details of information. Nine questions were asked and two columns of answer for the same questions were provided, thus respondents can explain and justify their answers.

In measuring the variables involved, tacit elements and tacit dimensions of the variables were used. For instance, in measuring the extent of learning capacity, the extent of dependency, areas of dependency and usefulness of dependency on the foreign firms were used as its elements. Accessibility was measured by examining the extent of the local firm's access, degree of trust, types of manufacturing control adopted and the learning methods local firm's used to learn from the foreign partner. The level of knowledge acquired is being assessed through the degree of changes take place in the organizational systems and organizational process. These sorts of information are very valuable in order to complement the statistical analysis findings. Further discussion on the tacit element is in chapter eight.

4.2.3 Pilot Study

A pilot study was conducted to identify the consistency of the questions and an understanding of the respondent to the questionnaire. It was conducted on six Malaysian firms with UK-based operations and some changes that were identified from the study were incorporated. From the interviews conducted, several weaknesses of the questionnaire were identified. As expected, the terms of alliance and joint venture were misunderstood by most of them. Even though definitions for both terms were available, most of them did not read them. When they were not involved in any joint venture, they assumed that their company was not relevant to the study anymore. As detailed clarification of the study was given during the interview, the respondents' understanding on the questions was improved and this enable them to answer the questions.

Several questions were also identified as being vague and quite confusing. For instance, the use of the word "alliance" and "joint venture" in almost all questions was quite disturbing and confusing to the respondents particularly if they were not involved in a joint venture. The pilot study helped to identify this flaw in the questionnaire and thus improved the understanding and reliability of the questions posed. All the necessary changes and amendments to the questionnaire were completed before the data collection was carried out.

4.3 Population and Sample

The population of the present study is Malaysian high-technology manufacturing firms that are involved in collaborations with foreign firms. High technology industries were selected as a population because they are believed to have a higher level of knowledge and skills compared to other industries such as low technology and medium technology industries. High technology firms, which operate in a dynamic environment, have to always keep up with new technological advances and new knowledge. Hence, the core technological expertise has to be constantly updated in order to remain competitive in the industry. Firms in these industries are prone to engage in alliances or joint ventures with foreign firms as they expect that partner firms particularly those from developed countries such as the United States, Japan and European countries, possess special technology, skills and expertise in certain areas. Therefore, it is hoped that the alliance or joint venture with them will provide new lessons and new knowledge to the local firms. High technology firms include firms from the electrical and electronic industry, computer industry, chemical oil and gas industry and telecommunication industry.

Manufacturing firms are chosen rather than services or trading firms due to the nature of the activities, where knowledge such as product development and manufacturing process, is created and invented from this sector. By focusing on manufacturing firms, the present study is able to increase the value of the sample distribution by controlling external factors.

4.3.1 Sampling Frame

There is no single authoritative source of data on companies with international alliances in Malaysia. The sample was therefore drawn from four major sources produced by independent agencies and government agencies. Two of them are from printed directories, the Federation of Malaysian Manufacturers (FMM), and Foreign Companies in Malaysia: Yearbook. The other two sources are from government agencies' databases, the Malaysian Industrial Development Authority (MIDA), and the Malaysian Trade Development Corporation (MATRADE).

The FMM directory is published by the Federation of Malaysian Manufacturers Association. The directory provides a list of manufacturers from various industry sectors and service companies for the government and private sector. The directory is an official authoritative publication in the country. The database from this directory provides information about the background of the firms such as year of incorporation, full address, telephone number, fax number, e-mail address, names of the Chief Executive and the person to contact for Business Enquiries. It also provides information on annual sales, number of employees, products manufactured, brand names, export markets, quality standards achieved and Kuala Lumpur Stock Exchange listing.

Foreign Companies in Malaysia: Yearbook 2001, is a directory published by the Commercial Intelligence Service, a corporate research division of Business Monitor International. The Foreign Companies Yearbook includes fully researched corporate data on thousands of American, Japanese, German, British, French, Dutch, Swiss, Australian and many other foreign subsidiaries, joint ventures, and associate companies doing business in Malaysia. The information provided includes senior personnel and titles, full company name, full postal address, telephone and fax numbers, e-mail and website addresses. The range of senior executives and their titles including Chairman, CEO, Finance Director, Marketing/Sales Director and Managing Director are also provided. Information on corporate profiles are provided by employee size, registration date, description of business activity and, where available, US$ sales volume.

Databases from the government agencies were used both to add to the number of the sample and to check and reconfirm the list from the directories noted above. The database provided by MIDA covers manufacturing firms that have investments in the country, in other words, it provides a list of manufacturing firms that might have a joint venture with other firms in Malaysia. This list is available as MIDA is the government agency that approves applications for manufacturing activities in the country either from local or foreign investors. The information provided includes the name of the company, full address and telephone number, fax number, and also types of products manufactured by the company.

MATRADE has a different function from MIDA. It was formed to promote Malaysian firms abroad and help them to expand their business activities in foreign countries. Hence, the database provided by MATRADE covers firms that might have alliances with foreign firms in order to ensure their products are available in other countries. The information provided contains full company name and address, telephone and fax number, email number, website address, contact person, and range of products that they manufacture.

4.3.2 Sampling Design

As there is no single authoritative source for the population, the sampling design has to be carried out in several stages in order to get the real population. Hence, the sampling design for this population was multistage, otherwise known as clustering, according to which the researcher needs to identify the respondents through several steps (Fink & Kosecoff, 1985). Firstly, the researcher sorted the companies into groups based on sectors in the high-technology industry, obtained names and addresses of companies within each group or cluster, and then sampled within the cluster. A census method was used to ensure that all the companies in the databases were included as the population. At this stage, all Malaysian manufacturing companies involved in high technology industries and that have any kind of collaboration with foreign firms were identified from the above databases. This stage concerned filtering the databases in order to identify the real population. This is because the whole population includes manufacturing firms that do not have the required characteristics such as purely foreign owned companies, purely local owned companies, and companies that engaged in low and medium technology industries. Thus, the filtering process had to be conducted in order to get the real population that has the characteristics required, which are manufacturing firms, locally owned and have collaborations with foreign firms, and are involved in high technology industries. The process involved two major steps before the final list could be obtained. All the databases were compared and redundant companies, those purely foreign owned and the locally owned companies with no foreign involvement, were omitted from the list. The databases which initially provided more than 3000 companies were sorted and 823 companies were identified to fulfil the characteristics of the population. This number represents the real population. Though this list provides companies that have collaborations with foreign firms, the types of collaborations engaged were still unknown. This required the next step to be carried out.

Secondly, the population had to be divided into two groups; equity or joint ventures and non-equity or contractual agreements. Therefore, the population had to be stratified in order to identify them. This stratification of the selected population enabled specific characteristics to be represented in the sample and thus reflects the true characteristics of the population (Fowler, 1988). The 823 companies were contacted through telephone calls in order to identify their types of engagement with the foreign partners. These companies were stratified based on their types of collaborations either equity joint ventures or non-equity contractual agreements. Census sampling was used as all these companies were contacted for interview.

4.4 Data Collection

Data were collected using two techniques, one was through face-to-face interview, the other was through a postal questionnaire. Even though both techniques were conducted concurrently, it was started with face-to-face interviews. After three weeks of conducting face-to-face interviews, there was a public holiday for nearly two weeks in Malaysia for the Chinese New Year celebration. Hence, interviews could not be conducted due to the public holiday. A postal questionnaire was administered during this period, therefore, the time for data collection was fully utilized. Once business operations reopened, face-to-face interviews were resumed.

Telephone calls were made to all selected firms and arrangements for the interviews were planned ahead. Appointments for the interviews with the respondents were made prior to the interviews. Several ways were used concurrently to speed up the process of getting the appointments with the respondents. Appointments were made using telephone calls, electronic mail and faxes, while questionnaires were sent by faxes and mails prior to the meeting. This enabled the respondents to have some idea of the types of questions that would be asked and to be ready with some answers. In fact, most of the respondents requested the questionnaire before the interview was conducted. This situation not only helped to shorten the period of interview, it also created a comfortable condition from the respondents during the interview session. Respondents who were reluctant to be interviewed but willing to fill in the questionnaire were also identified and contacted. Questionnaires were sent to them through mail and faxes and normally they replied via the same method. Their responses were also taken into account. These two approaches, interviews and self-administered approaches, were conducted simultaneously as it helped to increase the number of responses. It was at the same time convenient for the respondents, who were holding top management positions in the companies and had very tight work schedules. Reminders were sent to the postal respondents in order to increase the response rate.

For face-to-face interviews to be conducted, telephone calls were made with the particular person and appointments were set up prior to the interview. Respondents interviewed were key people in the management of the organization, such as Vice-President, Chief Executive Officer, Managing Director, General Manager, Production Manager (normally referred to as Senior Engineer) and Human Resource Manager. The process of getting the right companies to participate involved two steps. First, telephone calls were made to the companies and information such as involvement with foreign firms and ownership status were sought to confirm that they were local companies and had links with foreign companies, either through joint ventures or strategic alliances. Secondly, companies that fulfilled the criteria had to be followed up for their approval for the face-to-face interviews. Not all companies were willing to participate, some of them clearly stated that they did not want to cooperate in the study. Some provided reasons such as they were very busy, the study was not related to their business, and the study did not provide any benefit to them. Only 51 companies were willing to participate and willing to be interviewed. The interview sessions took about twenty minutes to one hour depending on the respondents' availability. Those companies that did not fulfil the criteria were not recontacted. All interviews were conducted at the respondents' offices.

For the postal technique, two steps were involved before the questionnaires were sent. First, companies that were purely foreign-owned or locally-owned with no foreign involvement were identified and their names were taken off the list. This helped to reduce the number of non-respondents, as only companies that were locally owned with foreign involvement were selected. As mentioned in section 4.3.2, based on this process, 823 companies were identified. In order to maximise the possible response, it was decided that postal questionnaires be sent to all 823 companies previously identified less those which had already agreed to be interviewed. A three-week period was given to the respondents to answer and reply to the questions. After this time period a total of 139 replies were received, however, only 14 could be accepted because 126 replies could not be used as they were not filled in at all. Out of 126, number, 106 were returned because they were not at the address, this was due either to the operation closing down or to moving to a new place address. The other 20 were not involved in either joint ventures or strategic alliances with foreign firms.

The total number of companies that responded to the questionnaire were 65 of which 51 were from face-to-face interviews and 14 from the postal questionnaire. This represents about eight percent of the identified potential population of 823 companies. Out of this figure, 31 respondents were joint ventures and 34 were strategic alliances. For joint ventures, the percentage of equity controlled by the local firm varies from minority to majority holding depending on the goal of the relationship. For contractual agreements, most of the relationships were contract manufacturing, joint development, licensing, and technical assistance.

4.5 Data Analysis and Measurement

Data from the questionnaires were coded and entered into a computer database using two software packages, theStatistical Package for Social Science (SPSS), Version 11.0 and Limited Dependent Variables (Limdep), Version 7.0. A descriptive and inferential analysis of all independent and dependent variables was conducted to provide meanings to the data. Descriptive analysis provides simple summaries about the sample and general information about the data set. SPSS was used to analyse the descriptive statistics, such as means, standard deviations, and range of scores for the data set. The main descriptive statistics are summarised and presented in Table 4.1, the detailed descriptive statistics are in Appendix 3.

Table 4.1 : Summary of Descriptive Results

Variables	N	Range	Mean	Std Deviation
Learning capacity	65	2.00	3.48	0.44
Relationship experience (previous relation)	65	5.00	1.40	1.87
Knowledge experience (graft + indirect exp)	65	3.00	3.17	0.86
Accessibility	65	2.75	3.40	0.63
Managerial contribution	65	2.75	2.59	0.69
Technical contribution	65	2.67	3.57	0.65

Active involvement	65	2.30	3.03	0.49
Objective	65	1.00	0.85	0.36
Long term plan	65	1.00	0.78	0.41
New technological expertise	65	3.00	3.72	0.67
Product development	65	4.00	3.18	0.95
Manufacturing process	65	4.00	3.34	0.85
Knowledge acquired	65	3.00	3.76	0.63
Cultural differences (national + organization)	65	3.00	3.33	0.58
Human resource performance	65	3.50	3.13	0.81
Business performance	65	2.50	3.64	0.50
Overall performance (local, foreign, overall)	45	3.00	3.66	0.61
Performance (human , business, general)	45	2.31	3.45	0.53

The statistical values shown in Table 4.1 are number of sample, range, mean and standard deviation. Ranges of values for a variable indicates a distribution of the variables, mean indicates the central tendency or centre of distribution values and standard deviation indicates dispersion values around the central tendency. As the standard deviation is a detailed estimate of dispersion, it allows some conclusions to be reached about the distribution. Only the key dependent, independent and moderating variables are presented in Table 4.1.

The total number of respondents is 65 and is shown as N for all variables. However, overall performance showed a smaller number of N, which is 45 instead of 65. This is because though the number of respondents remained the same, some of the respondents did not answer that particular questions, thus the responses received for that questions were less than 65. Respondents claimed that questions on overall performance, which include local and foreign performance were not relevant to joint venture companies as they are single entities compared to contractual agreements, which remained two or more entities. This explains the reason for the lower number of N in overall performance and performance, from 65 to 45.

Apart from descriptive statistics, a reliability test was also conducted to measure the internal consistency of the constructs. Some of the key variables are composite variables and are indicated in Cronbach alpha. The composite variables were derived from the components for each variable. For instance, for the prior knowledge variable, the value of alpha was derived from the components knowledge-related to core technology and skilled-related to core technology. Cronbach alpha, also known as coefficient alpha, is a useful tool to estimate the consistency of items. The calculation of alpha is based on the average correlation among pairs of items making up the scale and has a value between 0 and 1 (Bland & Altman, 1986). If the items are perfectly correlated then alpha is equal 1; if the items are completely unrelated then alpha is equal 0. If alpha is high, that is near to 1, then this indicates a high degree of internal consistency. A commonly adopted convention is to claim satisfactory internal consistency if alpha is greater than 0.7 (Bland & Altman, 1986). A higher value of alpha might arise if the scale involves many items (Bland & Altman, 1986). As the constructs of this study do not contain many items, the alpha values obtained are not expected to be very high. The results of this test are summarised and presented in Table 4.2 below and the detailed output is available in Appendix 4.

Table 4.2 : Results of Reliability Test

Variables	Components	Cronbach Aplha	N
Prior knowledge	Knowledge-related to core technology Skilled-related to core technology	0.9424	65
Flexibility	Centralization of technical decisions Centralization of managerial decisions	0.6608	65
Determination to learn	Dependency on manufacturing Dependency on new capabilities	0.5879	65
Grafting	Willingness to explain Willingness to work together	0.9979	65
Indirect interaction	Transfer new ways Release information Explain new ideas	0.8806	65
Similarity of knowledge	Technical knowledge Managerial knowledge	0.7988	65
Trust	Confidence Trust	0.8316	65
Technical contribution	Product-related technology Manufacturing-related Manufacturing support	0.7600	65
Managerial contribution	Marketing Managerial Administration Training	0.6479	65
Knowledge acquired	Technological expertise Marketing expertise Product development Foreign culture Managerial techniques Manufacturing process	0.6566	65

Cultural differences	National culture Organizational culture	0.7192	65
Human resource performance	Training Management skills	0.6254	65
Business performance	Business volume Market share Planned goals Profitability	0.7906	65
General performance	Local firms performance Foreign firms performance Overall performance	0.8754	45

Generally, the results of internal consistency are satisfactory and Cronbach alpha values are greater than 0.7 except for few items. The items that have alpha lower than 0.7 are flexibility, determination to learn, managerial contribution, knowledge acquired and human resource performance. The lower value of these item indicate that the construct contains multidimensional items. For instance, the alpha value for determination to learn is 0.5879, which is lower than 0.7. Such a value is reflected because the construct, which measures dependency on manufacturing and new capabilities received different kinds of responses from these two items where respondents tend to depend more on new capabilities than on manufacturing. The discrepancies between the items evaluated by the respondents have contributed to the lower value of alpha.

In interpreting further the data set, inferential statistics were calculated as they enable the study to reach conclusions that extend beyond the immediate data alone. Inferential analysis, which includes applying several statistical techniques such as t-test and multivariate analysis, was also carried out to demonstrate and examine the association between the variables and in order to test the hypotheses. The detailed discussion of these analyses is presented in chapter five. Data that have been gathered have been analysed in order to assess and accomplish the research objectives. Data analysis was conducted in three major stages based on the types of analysis conducted. Firstly, all the hypotheses were tested using univariate analysis. Secondly, multivariate analysis was conducted, which involved three phases of further analysis. Multivariate analysis was conducted using the statistical package, Limdep Version 7.0. Phase one focused on data related to factors affecting knowledge acquisition, which has been analysed by censored regression. The discussion for this part is presented in chapter five. The second phase of multivariate analysis was conducted on factors affecting the elements of knowledge acquisition. This part of the analysis has been conducted by using another statistical technique known as ordered probit. The detailed discussion of this part is in chapter six. The final phase of multivariate analyses focused on knowledge acquisition and firms' performance. This part has once again used censored regression as its statistical technique. The detailed discussion on this part is presented in chapter seven.

The final part of the whole findings, which is the third stage of the data analysis involved a different kind of data and analysis compared with the previous one. This data is considered as qualitative data as it contains few numbers and figures. This data covers important information about tacit knowledge, which is very difficult to put in figures, numbers or pictures. The discussion on this part of the analysis is presented in chapter eight. Though the data was not amenable to put in figures, data responses have been codified in order to facilitate analysis. The nature of this data is quite descriptive, so it was collected via personal interviews. Due to the nature of the data set, this section does not involve inferential statistics instead it presents descriptive statistics. The next chapter will discuss the findings of this study and confirm the hypotheses tested.

CHAPTER FIVE : RESULTS OF HYPOTHESES TESTING

Data that has been gathered has to be analysed to become meaningful and informative. Therefore, analysis and hypotheses testing will be conducted and discussed in this chapter. Hypotheses testing will initially be conducted through univariate analysis, then it will be conducted through multivariate analysis to see the consistency of the results.

5.1 Descriptive Analysis and Reliability Test

A descriptive analysis was first conducted on the whole data set in order to understand its nature and types of distribution. The analysis includes calculation of the mean, standard deviation and range for each variable. The output for this analysis is in Appendix 3. A reliability test was also conducted to assess the consistency of the answers from the respondents. The detail of the results from the reliability test is in Appendix 4, which shows the value of Cronbach alpha for each of the composite variables. Univariate analysis involves the examination across cases of one variable at a time. T-tests and correlations were used to examine the variables involved. T-tests were conducted in order to compare the means of two groups and assess whether the means of two groups are statistically different from each other (Trochim, 2000). Correlation was conducted in order to examine the relationship between two variables. Correlation describes the degree of relationship between the two variables (Trochim, 2000).

5.2 Hypotheses Testing with Univariate Analysis

5.2.1 Hypothesis 1

The hypothesis was tested using t-test and is summarised in Table 5.1. Details of the results are in Appendix 5.

H1: Equity alliances generate a higher level of knowledge acquisition than non equity alliances

H1a: Shared management ownership generates a higher level of knowledge acquisition than in a dominant partner relationship

H1b: Bilateral contract-based agreements generate a higher level of knowledge acquisition than in unilateral contract-based agreements

Table 5.1 : Results for Hypothesis 1

Hypotheses	Group sample	Mean value (N)	Test used	Sig	Reject/Not reject
H1	Alliance Joint venture	3.65 (34) 3.90 (31)	t-test t = - 1.652	0.103	Do not reject H0
H1a	Dominant Shared	3.86 (23) 4.03 (8)	t-test t = -0.668	0.509	Do not reject H0
H1b	Unilateral Bilateral	3.60 (7) 3.66 (27)	t-test t = -0.211	0.834	Do not reject H0

The table shows that equity alliances, which are represented by joint ventures do not generate a significant difference in terms of knowledge acquisition compared to non-equity alliances such as contractual agreement, licensing and contract manufacturing. However, the difference between means is almost significant at the 10% level.

Looking at joint ventures, the extent of ownership or percentage of equity had no significant effect on knowledge acquisition. Neither equal nor dominant ownership between the partners contributed to greater knowledge acquisition. For alliances, the direction of technology in the relationship, either one-way or two-way flow, did not pose any significant difference to the knowledge acquired by the locals. This means that even though the flow might be one-way, the knowledge is still learnt by the local partner.

5.2.2 Hypothesis 2

The hypothesis was tested using t-tests and correlation. The results are summarised in Table 5.2.

H2: The greater the ability of firms to learn, absorb and utilize the knowledge from the foreign partner, the greater the amount of knowledge acquired by the local partner

H2a: The greater the prior related knowledge that the partner has, the greater the knowledge acquisition

H2b:The greater the firm's flexibility, the greater the knowledge acquisition

H2c:The greater the determination of the local firms to learn, the greater the knowledge acquisition

H2d: Existing R&D activities in the relationship will increase the knowledge acquired

H2e: The greater the R&D expenditure, the greater the knowledge acquired

H2f: The more local firms are involved in the R&D activities, the higher the knowledge acquisition

H2g : The local control of R&D activities will increase knowledge acquisition

Table 5.2 : Results for Hypothesis 2

Hypotheses	Group sample (Correlation between)	Mean value (N)	Test used	Sig	Reject/Not reject
H2	Learning capacity and knowledge acquisition	N = 65	Pearson r = 0.435	0.000	Reject H0 at 0.1%
H2a	Prior knowledge and knowledge acquisition	N = 65	Pearson r = 0.276	0.013	Reject H0 at 5%
H2b	Flexibility and knowledge acquisition	N = 65	Pearson r = 0.169	0.089	Reject H0 at 10%
H2c	Determination to learn and knowledge acquisn	N = 65	Pearson r = 0.312	0.006	Reject H0 at 1%
H2d	No R&D Has R&D	3.56 (28) 3.93 (37)	t-test t = -2.440	0.017	Reject H0 at 5%
H2e	R&D expenditure and knowledge acquisition	N = 56	Pearson r = 0.104	0.222	Do not reject H0
H2f	Locals involvement and knowledge acquisition	N = 37	Pearson r = 0.023	0.446	Do not reject H0
H2g	Local Foreign	3.91 (14) 4.11 (7)	t-test t = -0.782	0.444	Do not reject H0

The results from Hypothesis 2 show that learning capacity has a relatively strong relationship with the knowledge acquired by the local partner. The higher the learning capacity the local firms have, the more knowledge is acquired by them. Prior related knowledge that the local firms have and their determination to learn from the foreign partner are among the major factors that support the learning capability of the firm. In addition, the firm's flexibility in implementing the learning process in the relationship will enhance and expedite the learning process and will eventually boost the level of knowledge acquired by the local firms.

Having Research and Development (R&D) activities within the company is an advantage to the local firms as firms learn more from the foreign partner when this kind of activities are available. Nevertheless, it is not clear that the amount spent by the firms on these activities will generate more knowledge acquired by the locals. The involvement of the local firm in the R&D activities is believed to depend on the types of activities carried out and the extent to which locals were given opportunities to conduct the whole of these activities. Hence, it not possible at this level of analysis to generalise that R&D expenditures and local control will increase the level of knowledge acquired.

5.2.3 Hypothesis 3

The hypothesis was tested using t-test and correlation. The results are summarised in Table 5.3.

H3 : The greater the experience that the local firm has, the greater the knowledge acquired from the foreign partner

H3a (i): Firms that have previous relationship will acquire more knowledge
H3a (ii): The longer the term of previous relationships, the higher the knowledge acquired
H3a (iii): The more the previous relationships succeed, the higher the knowledge acquired

H3a (iv): Previous experience in alliances or joint ventures helps in acquiring knowledge from the current foreign partner

H3 b: The greater the grafting experience that the local firm has, the greater the knowledge acquired from the foreign partner

H3c : The greater the indirect experience that the local firm has, the greater the knowledge acquired from the foreign partner

Table 5.3 : Results for Hypothesis 3

Hypotheses	Group sample (Correlation between)	Mean value (N)	Test used	Sig	Reject/Not reject
H3	Current experience = grafting + indirect	N = 65	Pearson r = 0.533	0.000	Reject H0 at 1% level
H3a (i)	Not involve Had involved	$\mu = 3.79$ (40) $\mu = 3.73$ (25)	t test t = 0.413	0.681	Do not reject H0
H3a (ii)	Previous relationship term and knowledge acquired	N= 65	Pearson r = 0.031	0.402	Do not reject H0
H3a (iii)	Previous relationship success and knowledge acquired	N=65	Pearson r = 0.024	0.424	Do not reject H0
H3a (iv)	Previous experience and knowledge acquired	N=65	Pearson r = -0.058	0.323	Do not reject H0
H3b	Grafting and knowledge acquired	N=65	Pearson r = 0.446	0.000	Reject H0 at 1% level
H3c	Indirect experience and knowledge acquired	N=65	Pearson r = 0.312	0.006	Reject H0 at 1% level

Hypothesis 3 shows that experience plays a significant role in generating more knowledge from the foreign partner. However, the experience that plays a vital role is not the past experience, but the current experience where firms can learn through a grafting process where expatriates are placed in the organization, and the indirect experience where the integration process between the local firms and the foreign firms is conducted systematically. Because different partners posed different behaviour in the relationship, the firm's previous experience and its long term relationship with other firms does not help much in running the current alliance. Even though firms succeeded in their previous relationship, they are still subject to failure in their current relationship. This is because normally firms will not reengage with the same type of partner.

5.2.4 Hypothesis 4

The hypothesis was tested using t-tests and correlation. The results are summarised in Table 5.4.

H4: The more explicit the articulated goals, the greater the knowledge acquired by the local firms.

H4a : The objectives that are written down help knowledge to be acquired
H4b : The long term plan that is written down helps the knowledge to be acquired
H4c : Better understanding of the mission of the alliance/joint venture would increase knowledge to be acquired

Table 5.4 : Results for Hypothesis 4

Hypotheses	Group sample (Correlation between)	Mean value (N)	Test used	Sig	Reject/Not reject
H4	Either written Both written	$\mu = 3.35$ (4) $\mu = 3.85$ (51)	t test $t = -1.563$	0.124	Do not reject H0
H4a	No written objective Written objective	$\mu = 3.50$ (10) $\mu = 3.82$ (55)	t test $t = -1.476$	0.145	Do not reject H0
H4b	No written long term plan Has written long term plan	$\mu = 3.46$ (14) $\mu = 3.85$ (51)	t test $t = -2.141$	0.036	Reject H0 at 5% level
H4c	Understanding of mission and knowledge acquired	N=62	Pearson $r = 0.422$	0.000	Reject H0 at 0.1% level

Hypothesis 4 shows the roles played by the objective and long-term plan of the firm in the relationship. Written objectives seem not to pose any significant difference to the firms, nonetheless, the long term plan and the understanding of the mission played a significant role towards the knowledge acquired by the local firms. This is perhaps due to the fact that when employees know and understand the purpose of the relationship and the learning process that they are involved in, the commitment given by them improves significantly. This explains why the level of knowledge acquired by the locals is higher when they spell out their long term plan and mission clearly.

5.2.5 Hypothesis 5

The hypothesis was tested using t-tests and correlation. The results are summarised in Table 5.5.

H5: The greater the active involvement of the foreign firms, the greater the knowledge acquired by the local firm.

H5a : Technical contribution helps to increase the knowledge acquired
H5b : Managerial contribution helps to increase the knowledge acquired
H5c : Contribution of the partner helps to increase the knowledge acquired
H5d : Training of the employees helps to increase the knowledge acquired
H5e : Written documents help to increase the knowledge acquired
H5f : The existence of knowledge documentation increases the knowledge acquired

Table 5.5: Results for Hypothesis 5

Hypotheses	Group sample (Correlation between)	Mean value (N)	Test used	Sig	Reject/Do not reject
H5	Active involvement and knowledge acquired	N= 65	Pearson r = 0.716	0.000	Reject H0 at 0.1% level
H5a	Technical contribution and knowledge acquired	N=65	Pearson r = 0.572	0.000	Reject H0 at 0.1% level
H5b	Managerial contribution and knowledge acquired	N=65	Pearson r = 0.624	0.000	Reject H0 at 0.1% level
H5c	Partner contribution and knowledge acquired	N=65	Pearson r = 0.186	0.069	Reject H0 at 10% level
H5d	Training and knowledge acquired	N=65	Pearson r = 0.540	0.000	Reject H0 at 0.1% level
H5e	Not written Is written	$\mu = 3.31$ (7) $\mu = 3.84(55)$	t test $t = -2.068$	0.043	Reject H0 at 5% level
H5f	Document and knowledge acquired	N=65	Pearson r = 0.252	0.021	Reject H0 at 5% level

Table 5.5 shows that an active role played by the foreign firms in the relationship is a significant factor in generating higher knowledge acquired by the local firms. The active involvement that the foreign partner showed particularly in terms of technical contribution, managerial contribution and training of the employees, helps in enhancing the level of knowledge acquired from the foreign partner. The relationship is significantly and positively strong where the higher the active involvement, the higher the knowledge acquired. The foreign partners contribution in terms of technology and local partners contribution in terms of manufacturing capability is also significant in generating the knowledge acquired from the foreign partner although the relationship is not as strong as technical, managerial and training. Having a written document in the relationship also shows a significant difference as more knowledge is expected to be acquired by the local firms.

5.2.6 Hypothesis 6

The hypothesis was tested using Pearson correlation, the results are summarised in Table 5.6.

H6: The higher the accessibility to knowledge of the foreign partner, the higher the knowledge acquired.

H6a : The higher the potential access of knowledge, the higher the accessibility

H6b : The higher the degree of protectiveness by the foreign firms, the lower the accessibility

Table 5.6 : Results for Hypotheses 6

Hypotheses	Group sample (Correlation between)	Mean value (N)	Test used	Sig	Reject/Not reject
H6	Accessibility and knowledge acquired	N=65	Pearson r = 0.356	0.002	Reject H0 at 1% level
H6a	Potential access and accessibility	N=65	Pearson r = 0.210	0.046	Reject H0 at 5% level
H6b	Protectiveness and accessibility	N=65	Pearson r = -0.356	0.002	Reject H0 at 1% level

Table 5.6 shows that there is a positive and significant relationship between the accessibility of knowledge and the level of knowledge acquired.

5.2.7 Hypothesis 7

The hypothesis was tested using Pearson correlation, the results are summarised in Table 5.7.

H7 : Cultural differences between the partners tend to negatively effect the level of performance in the relationship.

H7a : Cultural differences between the partners tend to negatively effect the level of knowledge acquired.

Table 5.7: Results for Hypothesis 7

Hypotheses	Group sample (Correlation between)	Mean value (N)	Test used	Sig	Reject/Not reject
H7	Cultural difference and performance	N=65	Pearson r = -0.273	0.035	Reject H0 at 5% level
H7a	Cultural difference and knowledge acquired	N=65	Pearson r = -0.060	0.316	Do not reject H0

Table 5.7 shows that cultural differences do have a significant effect on the level of performance in the relationship. However, the cultural difference does not show any significant differences on the level of knowledge acquired.

5.2.8 Hypothesis 8

The hypothesis was tested using Pearson correlation, the results are summarised in Table 5.8.

H8 : The greater the level of knowledge acquired, the higher the alliance/joint venture's overall performance.

H8a : The greater the level of knowledge acquired, the higher the human resource performance

H8b : The greater the level of knowledge acquired, the higher the business performance

H8c : The greater the level of knowledge acquired, the higher the general performance.

Table 5.8: Results for Hypotheses 8

Hypotheses	Group sample (Correlation between)	Mean value (N)	Test used	Sig	Reject/Not reject
H8	Knowledge acquired and overall performance	N= 45	Pearson r = 0.677	0.000	Reject H0 at 0.1% level
H8a	Knowledge acquired and human resource performance	N=65	Pearson r = 0.694	0.000	Reject H0 at 0.1% level
H8b	Knowledge acquired and business performance	N=65	Pearson r = 0.339	0.003	Reject H0 at 1% level
H8c	Knowledge acquired and general performance	N=45	Pearson r = 0.430	0.002	Reject H0 at 1% level

Table 5.8 shows that there is a strong positive relationship between the level of knowledge acquired and the level of performance of the alliances. The higher the level of knowledge acquired, the higher the performance of the alliances. Performance was assessed in terms of human resource performance, business performance and general performance. The three types of performance show a significant positive relationship with the level of knowledge acquired indicating that if the firms learned extensively from the foreign partner, the performance of the firms improved.

5.3 Hypotheses Testing with Multivariate Analysis

In analysing the data and in testing the hypotheses, both univariate and multivariate analysis was used. Univariate analysis was used in testing Hypothesis 1 while multivariate analysis was used in testing Hypotheses 2, 3, 4 5, and 6. This section will explain the multivariate analysis that was used to test the five hypotheses. Multivariate analysis is applied as it allows several independent, moderating and dependent variables to be tested concurrently in a relationship.

The multivariate test incorporates several variables, which include independent variables, dependent variables and moderating variables. Independent variables consist of five major variables, these are learning capacity, experience, goals, active involvement, and accessibility. These variables were also tested based on their elements. Learning capacity consists of four elements: Research and Development (R&D), prior knowledge, flexibility of firms, and determination to learn. Experience consists of two major elements: previous experience and current experience. Previous experience is measured by previous involvement, and previous skills and style, while current experience is measured by grafting and indirect interaction. Goals consist of two elements, explicitness of goals and understanding of the mission. Active involvement consists of five elements: managerial contribution, technical contribution, foreign technology, foreign training, and written document. Finally, accessibility comprises two elements: trust and similarity of knowledge. All these variables and elements were tested together with moderating variables that are believed to have some effect on the relationship in the hypotheses. These variables are: number of years the relationship has been established, types of relationship either joint venture or contractual agreement, size of the firms, and the manufacturing sectors in which the firm is involved, which includes the electronic, electrical, telecommunication, and automotive sectors.

Censored regression or tobit analysis is the most suitable test to be used since the data obtained are censored data. Censored data occurs when the dependent variable is censored where values in a certain range are all transformed to a single value (Greene, 2003). The regression model for censored data is referred to as the censored regression model or the tobit model. The regression is obtained by making the mean in the latter correspond to a classical regression model (Tobin, 1958).

A sample is censored when observations at a certain threshold are included in the sample, but the exact values are not known. In other words, the values are grouped together at a certain point without knowing the precise range of the values in the group (Bowen, 1996). In this case, the dependent variable, which is knowledge acquisition, is censored at the values 1 and 5. Censoring a sample based on the dependent variable can lead to a violation of the ordinary least square regression assumption that error terms and independent variables be uncorrelated. When the data are censored, variation in the observed dependent variable will understate the effect of the regressors on the 'true' dependent variable (Chay and Powell, 2001). As a result, standard ordinary least squares regression using censored data will typically result in coefficient estimates that are biased toward zero. Hence, censored regression is the best option to make an estimation. Censored regression is estimated using statistical software named Limdep(Version 7.0), it is a general econometrics program for estimating linear and non-linear regression models and limited and qualitative dependent variable models for cross section, time series, and panel data. The general formulation usually given in terms of an index function is,

$$y^*i = x'i\beta + \varepsilon i,$$

$$yi = 0 \text{ if } y^*I \leq 0,$$
$$yi = y^*i \text{ if } y^*I > 0$$

5.3.1 Learning Capacity

Hypothesis 2 :

The greater the ability of firms to learn, absorb and utilize the knowledge from the foreign partner, the greater the amount of knowledge acquired by the local partner. The results for the hypothesis are summarised in Table 5.9.

Table 5.9: The result of censored regression on Learning Capacity and Knowledge Acquired

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	1.094 * (1.917)	1.037 ** (1.960)	1.002 (1.599)	1.058 * (1.748)	0.936 * (1.744)	0.878 (1.421)
Years	-0.015 (-0.155)		0.105 (0.944)			
Joint venture	0.326 ** (2.439)	0.321 ** (2.492)	0.296 ** (1.978)	0.327 ** (2.248)	0.350 *** (2.611)	0.340 ** (2.303)
Size of firms	0.179 ** (2.213)	0.170 ** (2.337)	0.183 ** (2.047)	0.187 ** (2.376)	0.168 ** (2.335)	0.181 ** (2.332)
Electronic industry	-0.226 (-0.607)		-0.191 (-0.497)			
Electrical industry	-0.255 (-0.675)		-0.174 (-0.442)			

Telecommunication	-0.482 (-1.225)		-0.340 (-0.831)			
Automotive industry	-0.607 (-1.432)		-0.596 (-1.340)			
Research & Development(R&D)	0.219 * (1.657)	0.170 (1.280)			0.181 (1.371)	
R&D Expenditure			-0.387 (-0.340)	-0.391 (-0.357)		-0.278 (-0.257)
Learning capacity	0.710 *** (4.813)	0.646 *** (4.394)	0.720 *** (4.257)	0.660 *** (3.939)		
Prior knowledge					0.152 ** (2.007)	0.152* (1.878)
Flexibility of firms					0.250 *** (3.052)	0.244 *** (2.628)
Determination to learn					0.276 *** (2.827)	0.317 *** (2.881)
N	65	65	56	56	65	56
Log likelihood	-46.348	-48.725	-41.482	-43.988	-48.160	-43.314
Wald test Chi-Square – 1 linear restriction (Sig))		1.13 (0.287)		0.72 (0.395)		

Notes:
t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Six models were used to examine the effect of learning capacity and its elements towards knowledge acquired. Learning capacity indicates the learning speed that a firm has where absorption and utilization of information is concerned. Model 1 showed a relationship between years, joint venture, firm size, manufacturing sector, Research and Development (R&D) and learning capacity towards knowledge acquired. For Model 1 (Table 5.9), joint venture, size of firm and learning capacity showed a significant contribution to the knowledge acquisition. Joint ventures lead to more knowledge acquisition by Malaysian partners than contractual agreements. In terms of size, the level of knowledge acquired is more obvious in large firms compared to small firms. Hence, this means that large firms have extra advantage in acquiring knowledge than small firms. In terms of learning capacity, the result showed that the higher the capacity that the firm has, the more knowledge could be acquired. Research and Development (R&D) also showed a significant effect on the knowledge acquired where a firm that has R&D activities tends to acquire more knowledge than a firm that does not have these facilities. As R&D activities reveal the firm's effort to learn and develop its absorptive capacity, the activities not only act as a platform for the local firms to learn new knowledge and skills from the foreign partner, but they also boost the firms' absorptive capacity in the learning process.

However, number of years and manufacturing sector were not influential factors in acquiring knowledge. This means that local firms could acquire the same level of knowledge regardless of the period of relationship and the types of sector. An exclusion test known as the Wald test was conducted to confirm the joint removal of non-significant variables ie years and types of sector. This exclusion results in Model 2. The results of the Wald test indicate that the exclusion of these variables is statistically valid. In Model 2, R&D, which was significant in Model 1, becomes insignificant when these variables are excluded, nonetheless, types of relationship, size of firm and learning capacity remain significant.

In Model 3 and Model 4 (Table 5.9) the simple R&D dummy variable is replaced by R&D expenditure. Model 3 differs from Model 4 in the sense that variables years and manufacturing sector were excluded in Model 4 based on the result of the Wald test which indicates the exclusion is statistically valid. Model 3 and Model 4 show that joint venture, size of the firm and learning capacity have significant effect on knowledge acquired. Joint venture firms and large firms tend to acquire more knowledge compared to contractual relationships and small firms. Learning capacity also showed a positive relationship with knowledge acquisition. Unlike R&D activities in Model 1 and Model 2, both Model 3 and Model 4 showed that R&D expenditure has no effect in acquiring knowledge from the foreign partner. R&D expenditure refers to the allocation of expenses spent on the activities. The result indicates that the knowledge acquired by the local firm was not influenced by how much the firm spent on the R&D activities. A firm might spent a large amount of money on the R&D activities, but this is not a guarantee that much knowledge could be acquired. How the R&D activities were conducted between the foreign and local partner is more important. Some firms might have to spend a large amount of money on equipment and materials depending on the industries. However, if smaller amount of money is spent on human factors, the return of investment cannot be seen in terms of knowledge. Investing in equipment and materials will not involve much knowledge to be transferred as it is limited to the knowledge of handling the machinery to produce finished goods. Knowledge of learning how to develop or innovate the products is more significant and essential for firms to acquire. This scenario is worse when the maintenance and repairing activities depends on the foreign firms. The reason is that some of the local firms are not willing to train the employees abroad to learn the technical knowledge about the capital equipment as it quite costly for the organization. As a result, the dependency on the foreign partner becomes greater. This situation would further limit the knowledge that could be acquired by the local firm. Hence, the large amount of money spent is not rewarded in terms of knowledge, which is an intangible asset, instead, the money is rewarded in terms of equipment, which is a tangible asset.

Model 5 and Model 6 (Table 5.9) show a relationship between joint venture, size of firm, R&D activities, R&D expenditures, and individual learning capacity elements which are, prior knowledge, flexibility of firms and determination to learn towards knowledge acquired. Model 5 differs from Model 6 in the sense that R&D activity is exchanged with R&D expenditure in Model 6. Prior knowledge refers to knowledge that the local firm has before the relationship was established, this includes basic skills and technological development in the industry such as product markets and other technical activities. Flexibility of firm refers to the extent of bureaucracy and hierarchy in its structure and management approach. Determination to learn represents the intention of the firm to learn from the foreign partner where valuable competences can be acquired. In these relationships, the same pattern of significance was found where joint venture, size of firm and all the learning capacity elements showed a significant positive effect on knowledge acquisition. Joint venture relationships and large firms would generate more knowledge to be acquired compared to contractual relationships and small firms. The results also indicate that firms that have prior knowledge, flexible management, and high determination to learn from the foreign partner tend to acquire more knowledge from the relationship. The higher the prior knowledge of the locals firms, the more flexible is the management, and the higher the determination of the local employees to learn, the greater the knowledge that could be acquired by local firms.

From the above results, it can be concluded that learning capacity has a significant positive effect on the knowledge acquired from the foreign partner. Firms that have a greater learning and absorptive capacity are more likely to acquire more knowledge, while firms that have less learning and absorptive capacity acquire less knowledge from the foreign partner. This implies that firms that have previous knowledge of the technologies or products, a flexible management in terms of the relationship, and are keen to learn from the foreign partner, are more likely to acquire greater knowledge from the foreign partner compared to firms that do not have previous knowledge, not flexible in managing the relationship, and not keen to learn from the foreign partner. In addition, the knowledge acquiring process is also greater in a joint venture relationship and a large firm compared to a contractual relationship and a small firm. Hence, joint venture and large firms would have advantages in terms of acquiring knowledge from the foreign partner.

5.3.2 Experience

Hypothesis 3:

The greater the experience that the local firm has, the greater the knowledge acquired from the foreign partner.

Table 5.10: The result of censored regression on Experience and Knowledge Acquired

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	2.495*** (5.725)	2.645*** (10.516)	3.149*** (7.482)	3.375*** (21.401)	2.064*** (4.603)	2.178*** (6.210)
Years	0.004 (0.438)		-0.0089 (-0.748)		0.0051 (0.479)	
Joint ventures	0.104 (0.694)	0.114 (0.818)	0.260* (1.666)	0.257* (1.774)	0.036 (0.249)	0.0549 (0.402)
Size of firm	0.142 (1.582)	0.154** (2.002)	0.273*** (2.694)	0.234*** (2.720)	0.161* (1.947)	0.165** (2.301)
Electronic	0.153 (0.387)		0.309 (0.719)		0.082 (0.204)	
Electrical	0.103 (0.257)		0.359 (0.821)		0.038 (0.093)	
Telecommunication	0.021 (0.052)		0.196 (0.433)		0.0072 (0.017)	
Automotive	-0.071 (-0.161)		0.0796 (0.166)		-0.171 (-0.395)	
Previous involvement			0.430 (0.878)	0.403 (0.819)		
Previous skills and style			-0.156 (-1.207)	-0.137 (-1.059)		

Grafting					0.137*** (3.630)	0.133*** (3.612)
Indirect interaction					0.288*** (2.811)	0.278*** (3.151)
Overall Experience	0.312*** (3.495)	0.3004*** (3.450)				
N	65	65	65	65	65	65
Log likelihood	-52.567	-53.336	-57.087	-58.015	-48.057	-48.944
Wald test of Chi squared – 1 linear restriction (Sig)		0.02 (0.891)		0.31 (0.578)		0.00 (0.981)

Notes:
t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

For a relationship that involved overall experience and knowledge acquisition, six models were tested to see the effect of the relationship. Overall experience is characterized by two major elements, previous experience and current experience. Previous experience is represented by two elements, previous involvement and previous skills and management style. Previous involvement refers to the number of relationships that the local firm had before the current relationship was established. Previous skills and management style refers to the extent to which the previous relationships enhanced the learning of the current relationship. Current experience also is represented by two elements, grafting and indirect interaction. Grafting refers to the extent of involvement by the foreign partner expatriates in the relationship. Indirect interaction refers to the extent of the interaction and action learning, which occurs in daily activities between the local employees and the foreign partners.

Model 1 (Table 5.10) shows a relationship between the variables years, joint venture, firm size, manufacturing sector, and overall experience; which are characterized by previous experience and current experience. In Model 1, overall experience shows a positive significant effect on the level of knowledge acquisition. The more overall experience that the firm has, the higher the knowledge that could be acquired. Model 2 shows a relationship between the variables years, joint venture, firm size and overall experience. Model 2 does not include manufacturing sector as the Wald test indicates that the exclusion of these variables is statistically significant. Firm's size, which was not significant in Model 1, shows a positive significant effect in Model 2. This implies that a larger firm would acquire more knowledge from the foreign partner compare to a smaller firm. This gives advantage for a large firm in acquiring knowledge from the foreign partner.

Model 3 shows a relationship between years, joint ventures, firm's size, manufacturing sector, previous experience elements which are characterised by previous involvement and previous skills and style. Previous involvement and previous skills and style are not statistically influential factors to the knowledge acquired. Firm size and joint ventures are positively significant in Model 3. This indicates that larger firms and joint ventures would acquire more knowledge than smaller firms and contractual agreements. The results indicated that joint venture firms would acquire more knowledge than contractual firms, as with large firms, which would acquire greater knowledge than small firms. Other variables such as years, types of sector, previous involvement, and previous skills and style, have no significant effect on the knowledge acquired. Despite its insignificant effect on the knowledge acquired, the previous skills and style variable showed a negative relationship with knowledge acquisition. This situation indicates that firms that had been involved in a previous relationship and had acquired certain skills and management style from the previous partner, do not regard such skills and management style as an advantage to the new relationship. This may be because different foreign partners bring different knowledge, skills and management styles, which the local firms have to adopt and learn when working together. Having a new partner means that they have to learn a new skill and work in a new management style, which may be very different from that of the old partner. Previous skills and management style from the last relationship may no longer be applicable in the new relationship particularly, if the new partner is not from the same country as the old partner. Even if the new foreign partner comes from the same country, adjustments still need to be made in terms of the new skills, new management styles, new management systems, and new organizational culture. Hence, the local firms may have to adjust themselves in this new environment and have to free themselves from the previous way of doing things within the organization. In order to do this, local firms need to unlearn from the previous partner and start learning the new way of do things from the new partner. Model 4 shows a relationship between joint ventures, firm size, previous involvement and previous skills and style. Model 4 does not include years and manufacturing sector as the result of Wald test indicates that the exclusion of these variables is statistically valid. Similar results to Model 3 is depicted in Model 4 where firm's size and joint venture are positively significant.

Model 5 shows a relationship between years, joint ventures, firm's size, manufacturing sector and current experience elements which are characterised by grafting and indirect interaction. Grafting, indirect interaction and firm's size are positively significant in Model 5. This indicates that grafting and indirect interaction would encourage more knowledge to be acquired from the foreign partner. The greater the grafting and indirect interaction, the greater the knowledge acquired. The results once again indicate that large firms would acquire greater knowledge compared to small firms. Larger firms would still gain benefit in acquiring more knowledge than smaller firms. Joint ventures do not show any significant influence on knowledge acquired in this relationship. Current experience showed a significant effect on the knowledge acquired as both elements, grafting and indirect interaction, are statistically significant. This indicates that the more the grafting and indirect interaction activities were conducted in the organization, the higher the knowledge acquired from the foreign partner. This implies that grafting and indirect interaction are meaningful activities, which enable employees from both local and foreign firms to socialise and internalise the knowledge through exposure to reference individuals, groups, and organization. These joint effort activities combine expatriates, the skilled employees from the foreign firm, and less skilled employees from local firms, and are likely to generate a synergy for the organization. This opens opportunities to the local employees to learn directly from the expatriates through several means, such as direct teaching, doing things together, direct and indirect observation. Model 6 shows a relationship between joint ventures, firm's size, grafting and indirect interaction. Model 6 does not include years and manufacturing sector as Wald test indicates that the exclusion of these variables is statistically valid. Model 6 reveals similar outcome as in Model 5 where grafting, indirect interaction and firm's size are positively significant.

The above results support the view that experience has an influence on the level of knowledge acquired. The greater the experience that the local firm has, the greater the knowledge that can be acquired. In general, the significance of the overall experience variable is influenced by the grafting and indirect interaction (current experience) rather than previous involvement and previous skills and style (previous experience). Hence, firms that require new knowledge and skills from the foreign partner need to ensure that the relationship established involves grafting and indirect interaction activities. These activities are considered as value added activities where they can act as a channel for transferring knowledge from the foreign employees to the local employees. This would encourage and boost the knowledge acquisition process in the relationship. However, previous involvement with foreign partners brings no benefits in terms of knowledge acquisition.

5.3.3 Goals

Hypothesis 4:

The more explicit the articulated goals, the greater the knowledge acquired by the local firms.

Table 5.11: The result of censored regression on Goals and Knowledge Acquired

	Model 1	Model 2
Constant	1.267**	1.395***
	(2.108)	(2.856)
Years	0.736	
	(0.700)	
Joint venture	0.122	0.152
	(0.858)	(1.127)
Size	0.235***	0.246***
	(2.675)	(3.214)
Electron	-0.0733	
	(-0.177)	
Electrical	-0.136	
	(-0.306)	
Telecommunication	-0.299	
	(-0.657)	
Automotive	-0.425	
	(-0.919)	
Mission	0.540***	0.488***
	(4.118)	(3.826)
Explicit	0.982	0.672
	(0.820)	(0.659)
N	63	63
Log likelihood	-47.934	-49.854
Wald test of Chi square – 1 linear restriction (Sig)		0.30 (0.581)

Notes:
t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Hypothesis 4 relates to the role of goals in acquiring knowledge. Goal in this relationship refers to the articulated goals established in terms of its role in facilitating the knowledge acquired. Two models were developed to test the hypothesis. Model 1 (Table 5.11) shows a relationship between years, joint venture, size, manufacturing sector, understanding of mission and explicitness of goals. Understanding of mission refers to the extent of understanding that the employees have of the mission of the relationship and the expectation from them, while explicitness of goals refers to the documentation of the goals. The results indicate that size of the firm and understanding of mission have a significant influence on the knowledge acquired. Large firms would generate more knowledge to be acquired compared to small firms. The variable joint venture does not show any effect on the knowledge acquired, which means that a joint venture or contractual relationship has the same opportunities to acquire knowledge from the foreign partner. The greater understanding of the mission within a firm would allow more knowledge to be acquired. However, the explicitness of goals is not significant to the knowledge acquired, similarly with the other variables. This means that though the goals were clear and known to the organization, this did not assist in acquiring more knowledge. Instead, understanding them was more important as it helped the organizational members to give full commitment to the learning process from the foreign partner. Model 2 (Table 5.11) shows a relationship between joint venture, firm's size, understanding of mission and explicitness of goals. Model 2 does not include years and manufacturing sector as the Wald test indicates that the exclusion of these variables is statistically valid. Similar outcomes to Model 1 are depicted in Model 2 where firm's size and understanding of mission are positively significant. Other variables are not significant.

From the above results, it can be concluded that understanding of goals is significantly important for the local firm to acquire more knowledge. This implies that the feeling of what the organization is doing and where the organization is heading is very important to the organizational members. By knowing the significance of their participation in the activities planned, the commitment and enthusiasm to actively learn and be involved in the knowledge acquisition process would be higher. Hence, in order to achieve this, firms need to disseminate clearly the goals of the relationship to the organizational members and ensure that they really understand the mission and objective of the relationship. This would be effective in boosting the knowledge acquiring process.

5.3.4 Active Involvement

Hypothesis 5:

The greater the active involvement of the foreign firms, the greater the knowledge acquired by the local firms.

Table 5.12: The result of censored regression on Active Involvement and Knowledge Acquired

	Model 1	Model 2	Model 3	Model 4
Constant	0.935** (2.232)	0.972*** (2.969)	0.738* (1.768)	0.834** (2.093)
Years	-0.0043 (-0.531)		-0.007 (-0.103)	
Joint venture	0.148 (1.312)	0.175* (1.672)	0.078 (0.722)	0.096 (0.947)
Size of the firm	0.0514 (0.721)	0.029 (0.469)	0.0232 (0.346)	0.017 (0.288)
Electronic	-0.112 (-0.360)		-0.0536 (-0.147)	
Electrical	0.003 (0.011)		-0.035 (-0.094)	
Telecommunication	0.041 (0.129)		0.195 (0.527)	
Automotive	-0.015 (-0.046)		-0.026 (-0.069)	
Active involvement	0.912*** (7.775)	0.879*** (7.760)		
Managerial contribution			0.439*** (4.958)	0.386*** (4.595)
Technical contribution			0.222** (2.229)	0.208** (2.128))
Foreign technology			0.005 (0.060)	0.015 (0.190)
Foreign training			0.180** (2.515)	0.199*** (2.769)
Written document			0.403** (2.129)	0.379** (2.260)
N	65	65	65	65
Log likelihood	-36.992	-37.731	-31.412	-32.865
Wald test of Chi square – 1 linear restriction (Sig)		0.01 (0.942)		0.00 (0.955)

Notes:
t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Hypothesis 5 relates to the effect of active involvement on the knowledge acquired. Active involvement refers to the extent of the foreign involvement in the activities of the established relationship. Active involvement activities are represented in terms of managerial, technical, foreign technology, training, and documentation activities. Model 1 (Table 5.12) depicts a relationship between variables years, joint venture, size of firm, types of industries and active involvement. Model 1 shows that active involvement has a significant positive effect on knowledge acquired while the other variables are not significant. The higher the active involvement of the foreign partner in the relationship, the greater the knowledge acquired by the local firms. Model 2 shows that the joint venture variable is significant when the years and types of sector variables are excluded in the relationship. Joint ventures show a significant positive influence on knowledge acquired, where it leads to more knowledge acquired compared to a contractual relationship. This indicates that joint venture relationships have an advantage over contractual relationships.

Model 3 (Table 5.12) includes the variables years, joint venture, size, manufacturing and individual active involvement elements which comprise managerial contribution, technical contribution, foreign technology, foreign training and written documents. Managerial contribution refers to the extent of foreign partner contribution in terms of sales and marketing support, managerial resources, administrative support, training and time. Technical contribution refers to the extent of foreign partner contribution in terms of product-related technology, manufacturing related technology, and manufacturing support. Foreign technology refers to the extent of foreign partner contribution in terms of technology while the local partner contributes in terms of manufacturing capability. Foreign training refers to the extent of foreign partner contribution in terms of training and education given to the local firms through all methods including formal and informal training, either on-site or off-site. Finally, written document refers to documentation available such as reports, job manual, assessment, or programs that are provided by the foreign partner in the relationship, and to what extent it provides understanding to the local firms.

The results show that four active involvement elements, managerial contribution, technical contribution, foreign training and written document, were significant to the knowledge acquired, while other factors were not significant. This means that the higher the managerial contribution, the greater the knowledge acquired. So as for the technical contribution, the more technical knowledge was given to the local firms, the more knowledge was acquired. Training provided by the foreign firm seemed to be an effective tools in teaching the locals about the new knowledge, therefore, the more training sessions were given to the local employees, the greater knowledge could be acquired. Documents that elaborate the job manuals and other technologies were also helpful in acquiring knowledge from the foreign partner. The availability of these documents would facilitate the local employees to learn and acquire the new knowledge from the foreign partner.

In contrast, one of the active involvement factors, which is foreign technology, was insignificant to the knowledge acquired. This means that the technology that is brought by the foreign partner in the relationship would not be a guarantee that it could be acquired. Indeed, proactive effort such as direct involvement in management and technical work, training given to the locals, and putting the job specification in writing, were more meaningful and helpful for the local firms to acquire the knowledge from the foreign partner. Hence, even though the local partner provides the manufacturing facilities and the foreign partner provide the technology, proactive efforts need to be taken to enable the knowledge to be gained. The pattern of results as depicted in Model 4 remain unchanged even though variables years and types of industries were excluded from the relationship.

The above results confirm that active involvement of the foreign firms in a relationship is significant and would generate more knowledge to be acquired by the local partner. This implies that active involvement of the foreign partner is essential to knowledge acquisition, therefore, local firms have to put more effort to ensure that the partner that they choose is participative and proactive in contributing to the relationship. The local firms also have to be proactive in identifying the types of skills and know-how required for the local employees, ensuring the participation of the local employees in the management activities together with the foreign employees, and documenting the job description that is considered new to the local firms. These efforts could boost the local firms ability to acquire more knowledge from the foreign partner.

5.3.5 Accessibility

Hypothesis 6:

The higher the accessibility to knowledge of the foreign partner, the higher the knowledge acquired.

Table 5.13: The result of censored regression on Accessibility and Knowledge Acquired

	Model 1	Model 2	Model 3
Constant	2.363*** (5.120)	2.259*** (5.845)	2.161*** (5.541)
Years	-0.004 (-0.039)		
Joint venture	0.238 (1.642)	0.239* (1.755)	0.246* (1.825)
Size	0.196** (2.222)	0.193** (2.501)	0.189** (2.471)
Electronic	-0.226 (-0.534)		
Electrical	-0.233 (-0.542)		
Telecommunication	-0.470 (-1.043)		
Automotive	-0.455 (-0.963)		
Accessibility	0.387*** (3.345)	0.334*** (3.093)	
Trust			0.261*** (2.846)
Similarity			0.092 (1.169)
N	65	65	65
Log likelihood	-53.000	-54.316	-53.524
Wald test of Chi square – 1 linear restriction (Sig)		0.68 (0.409)	

Notes:
t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Hypothesis 6 relates to the relationship between accessibility of the foreign partner and knowledge acquired. Accessibility refers to the extent of easiness in approaching and taking the foreign knowledge by the local firms. Accessibility of knowledge is characterised by two elements, degree of trust of the foreign firm and degree of similarity of knowledge. Model 1 (Table 5.13) shows a relationship between the variables years, joint venture, firm's size, manufacturing sector, and accessibility of the local partner to the knowledge of the foreign partner. The results indicate that size of the firm and accessibility have a significant positive effect on the knowledge acquired. Large firms would acquire more knowledge than small firms. In terms of accessibility, the results indicate that the higher the accessibility that the local firms have on the knowledge of foreign partner, the higher the knowledge that could be acquired. Model 2 excludes insignificant variables years and manufacturing sector as the Wald test indicates that the exclusion of these variables is statistically valid. Model 2 shows slight changes in the results where not only size and accessibility are positively significant, but joint ventures is also positively significant on the knowledge acquired. This implied that joint ventures would allow more knowledge to be acquired compared to contractual relationships. Large firm and accessibility remain significant in Model 2. Hence, large firm would encourage more knowledge to be acquired, as would the firms that have easy access to the foreign partner. These two factors would generate more knowledge to be acquired by the local firms.

Model 3 (Table 5.13) shows a relationship between joint venture, firm size and individual accessibility elements, which comprised degree of trust and degree of similarity of knowledge. Degree of trust refers to the partners' protectiveness on knowledge, the high degree of trust would lessen the partner protectiveness of knowledge. Degree of similarity of knowledge refers to the extent to which the technical and managerial knowledge of the two partners is close. Model 3 indicates that the variables joint venture and large firms were influential and significant to knowledge acquired. Joint venture firms and large firms would acquire more knowledge compared to contractual and small firms. Looking into the elements of accessibility, the results indicate that only trust is significant to the knowledge acquired, while similarity of knowledge is not significant. This implies that the higher the trust in the foreign partner, the more knowledge that could be acquired. This is because the foreign partner is less protective of their knowledge, therefore, it becomes quite easy for the local partners to access and gain the knowledge that they require. In contrast, the lower the trust in the foreign partner, the less knowledge that may be acquired as the foreign partner would tend to be more protective on their knowledge.

The above results support the view that accessibility to foreign knowledge is essential and would lead to more knowledge being acquired. This implies that the local partner has to be selective in searching for a foreign partner and to avoid protective partners. The willingness of the foreign partner to disclose its information, knowledge and skills to the local partner, would expedite the process of learning and acquiring knowledge. On the other hand, if the foreign partner is unwilling to disclose its information, knowledge and skills, less knowledge would be acquired from the relationship. Hence, the final objective of the relationship might not be achieved.

5.3.7 Overall Variables

This section summarises the results for all the five major variables involved in the knowledge acquisition process. They are analysed concurrently to see their joint effects on the knowledge acquisition process.

Table 5.14: The result of censored regression on Independent Variables and Knowledge Acquired.

	Model 1	Model 2
Constant	-0.720 (-1.552)	-0.743* (-1.692)
Years	0.002 (0.370)	
Joint venture	0.134 (1.268)	0.173* (1.749)
Size	0.097 (1.591)	0.073 (1.351)
Electronic	-0.255 (-0.918)	
Electrical	-0.164 (-0.590)	
Telecommunication	-0.149 (-0.501)	
Automotive	-0.033 (-1.071)	
Learning capacity	0.321*** (2.681)	0.305** (2.553)
Experience	-0.003 (-0.046)	0.0003 (0.000)

Accessibility	-0.095 (-0.993)	-0.104 (-1.186)
Active involvement	0.812*** (6.361)	0.810*** (7.022)
Mission	0.319*** (3.336)	0.304*** (3.252)
N	63	63
Log likelihood	-23.793	-24.910
Wald test of Chi square – 1 linear restriction (Sig)		0.67 (0.413)

Notes:
t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Model 1 in Table 5.14 shows the results of all the independent variables recognised against the dependent variable, which is knowledge acquired. This analysis is conducted not to test an individual hypothesis, but only to review the overall effect of the independent variables on the knowledge acquired. The variables years, joint venture, firm size, types of industries, learning capacity, experience, accessibility, active involvement and mission were tested against knowledge acquired. Model 1 (Table 5.14) shows that learning capacity, active involvement and mission have a significant effect on the knowledge acquired, the other variables are not significant. Model 2 in Table 5.14 shows a slightly different result when the variables years and types of industries are excluded from the relationship. Joint venture, learning capacity, active involvement and mission becomes significant to the knowledge acquired while the other variables remain insignificant. A joint venture relationship tends to encourage more knowledge acquisition in the local firm compared to a contractual relationship. In terms of learning capacity, the more capable the firm is of learning from the foreign partner, the more active the foreign partner is in their relationship and the higher the understanding of the mission, the more that knowledge can be acquired from the foreign partner.

5.4 Conclusion

By and large, this chapter depicts the findings of this study, which involve statistical testing for the independent and dependent variables. Determinants for knowledge acquisition, which are: learning capacity, experience, goals, active involvement, and accessibility are tested against knowledge acquisition. Six hypotheses have been tested and the results for each of them discussed. Hypotheses 1 was tested using univariate analysis, specifically a t-test, while the other five hypotheses were tested using multivariate analysis, specifically censored regression. Hypotheses 1 is unique in that it can be tested not only based on t-test results, but also by using censored regression. Based on the t-test result, joint ventures did not show a significant difference from contractual relationship but in censored regression analysis where joint venture was tested simultaneously with other variables, joint ventures have significant effects on knowledge acquired, particularly relationships that involved learning capacity and accessibility. This finding indicates that types of relationship i.e. joint venture or contractual agreement could be a moderating variable to the knowledge acquisition as it has a significant effect in certain relationships. This result would indicate some changes in the earlier conceptual framework. Firm size is another variable that showed a significant influence on knowledge acquisition. Even though firm size has not been tested as a hypothesis, its significance to knowledge acquisition is undeniable. The results indicate that firm size is significant to knowledge acquired in relationships that involved learning capacity, experience, goals and accessibility. As a result, size becomes an important variable to knowledge acquisition, and therefore should be included as a moderating variable in the conceptual framework. In the earlier conceptual framework, firm size was not included as there was no previous study to support its role in the relationship. The findings also indicate that there is no sectoral specific effect, suggesting that the same variables influence overall knowledge acquisition in all industries. Results for Hypotheses 2, 3, 4, 5 and 6 confirmed that learning capacity, experience, goals, active involvement, and accessibility have a significant effect on knowledge acquisition. In understanding further the influence of the determinants of knowledge acquisition of knowledge acquired, an ordered probit analysis is conducted on three elements of knowledge acquired: new technological expertise, product development and manufacturing process knowledge. The following chapter will contain discussion on this topic.

CHAPTER SIX : RESULTS OF THE STUDY ON THE ELEMENTS OF THE KNOWLEDGE VARIABLE

Following the hypotheses testing, ordered probit analysis was conducted on each independent variable to examine its effects on the elements of the dependent variable. The dependent variable, which is knowledge acquisition, consists of six elements: new technological expertise, new marketing expertise, product development, foreign culture, managerial techniques, and manufacturing process. However, for the purpose of further analysis, only three elements of knowledge acquisition were selected, these are: product development, new technological expertise, and manufacturing process. These elements are considered more important in terms of knowledge acquisition to the local firms compared to the other three elements, new marketing expertise, foreign culture, and managerial techniques. The three elements are the core knowledge that most of the local firms seek from the foreign partners and they are also essential in enabling the locals firms to be innovative and creative in the future.

In selecting the most appropriate statistical techniques, several regression techniques were considered such as ordinary least square (OLS) regression and multivariate discriminant analysis (MDA). Although both OLS and MDA are applicable for categorical data, the assumptions for both are not met. When the assumptions are not met, the results will pose serious inference problems (Borooah, 2002). OLS is not appropriate because its assumptions such as residual errors being normally distributed, equal variance at all levels of independent variables (homoscedasticity) and uncorrelated residual errors with the independent variables are not met (Schumaker et al., 2003). MDA is also not appropriate to be used in this analysis as its assumptions such as normal distribution, variance or covariance are homogenous across groups and low variability in a group are not met in the data of this study (Hair et al., 1998).

Maximum likelihood technique like ordered probit is more efficient and appropriate to be used when assumptions for OLS are not met (Borooah, 2002). Ordered probit is used when dependent variables are ordinal but are not continuous in the sense that the metric used to code the variables is substantively meaningful. In substantive terms, the difference between 0 and 2 on the scale may be quite different from the difference between 2 and 4, or 4 and 6. These variables are sometimes also called 'polychotomous' (Aldrich & Forrest, 1984). The dependent variable in this study is ordinal and discrete, thus matches the characteristics of ordered probit model. In addition, as ordered probit is a semi-nonparametric estimation, the distribution assumption, which is more relax are met (Stewart, 2003). When the outcome of the data set is discrete, ordered probit becomes the best framework for analysing such responses (Zavoina & McElvey, 1975). Therefore, ordered probit is the best choice and was used to analyse the sample instead of other regression techniques. The data were analysed using Limdep version 7.0 as for censored regression. The ordered probit model is based on the following general formulation in terms of an index function :

$$Y_{i*} = \beta' x_i + \epsilon_i, \ \epsilon_i \sim N[0,1],$$

$$Y_i = 0 \text{ if } y < \mu_0,$$

$$1 \text{ if } \mu_0 < y < \mu_1,$$

$$2 \text{ if } \mu_1 < y < \mu_2, \ldots\ldots\ldots$$

The findings regarding the independent variables and the knowledge acquisition elements will be presented in three major sections based on the elements, product development, technological expertise, and manufacturing process. For each element, the same independent variables used in testing knowledge acquisition (chapter 5) were used in the ordered probit analysis. The independent variables are learning capacity, overall experience, goals, active involvement, accessibility, and all variables. For the sake of brevity, the results that are different from their relationship with knowledge acquisition are highlighted below, while the results that are similar to knowledge acquisition are briefly explained without showing the ordered probit results. The values of μ are depicted in every table for each model shown. μ shows a median value of each group and whether they are significantly different from each other. In other words, it shows that there are some statistical differences between the categories.

6.1 <u>Product Development</u>

6.1.1 The Effects of Learning Capacity on Product Development

Analysis for the effects of learning capacity on product development was conducted using ordered probit. The results are summarised in Table 6.1.

Table 6.1: The Result of Ordered Probit on Learning Capacity and Product Development

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	-2.296 (-1.486)	-1.769 (-1.344)	0.104 (0.062)	0.327 (0.217)	-2.018 (-1.114)	-1.658 (-1.104)
Years	0.006 (0.271)		0.009 (0.053)		0.001 (0.066)	
Joint venture	0.356 (0.843)	0.215 (0.729)	0.169 (0.474)	0.142 (0.493)	0.445 (1.040)	0.338 (1.141)
Size	0.083 (0.398)	0.217 (1.241)	-0.065 (-0.300)	-0.028 (-0.153)	0.119 (0.547)	0.221 (1.196)
Electronic	0.871 (0.944)		0.451 (0.458)		0.685 (0.574)	
Electric	0.531 (0.600)		0.323 (0.322)		0.430 (0.356)	
Telecommunication	0.080 (0.083)		0.297 (0.291)		-0.143 (-0.095)	
Automotive	0.010 (1.066)		0.481 (0.444)		0.668 (0.503)	
Research & Development	0.724** (2.148)	0.663** (2.076)			0.821** (2.187)	0.741** (2.221)
R&D Expenditure			0.000 (0.007)	-0.000 (-0.012)		
Learning Capacity	0.797* (1.791)	0.794** (2.023)	0.127 (0.269)	0.163 (0.375)		
Prior knowledge					0.261 (0.844)	0.220 (1.093)
Flexibility					0.485** (2.060)	0.496** (2.469)
Determination					0.074 (0.227)	0.100 (0.378)
μ (1)	0.932(2.437)	0.856(2.569)	0.733(2.683)	0.733(2.781)	0.977(2.211)	0.903(2.413)
μ (2)	2.069(4.614)	1.970(4.680)	1.690(4.913)	1.690(5.124)	2.132(4.299)	2.036(4.486)
μ (3)	4.090(6.120)	3.931(6.424)	3.268(5.687)	3.268(5.866)	4.167(5.914)	4.015(6.404)
N	65	65	56	56	65	65
Log likelihood	-73.818	-76.116	-80.297	-81.110	-72.756	-74.840
Wald test Chi-square – 1 linear restriction (Sig)		0.52 (0.470)		0.16 (0.690)		0.11 (0.744)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Learning capacity, overall experience, goals, active involvement, accessibility and all independent variables were tested against product development (Table 6.1). Model 1 shows the output of the relationship between years, joint venture, firm size, manufacturing sector, R&D activities and learning capacity on product development knowledge. The results reveal that learning capacity and R&D activities are significant on the knowledge of product development. This implies that the higher learning capacity that the local firms have, the more product development knowledge could be acquired. The more R&D activities being carried out within a firm, the greater the product development knowledge. Model 2 shows a relationship between joint venture, firm size, R&D activities and learning capacity. Model 2 does not include years and manufacturing sector as the Wald test reveals that the exclusion of these variables is statistically valid. Model 2 shows a similar result to Model 1 where R&D activities and learning capacity remain to be positively significant on product development knowledge.

Model 3 tested variables such as years, joint venture, firm size, manufacturing sector, R&D expenditure and learning capacity against product development knowledge. Consistent with the result on knowledge acquisition, Model 3 also shows that R&D expenditure is not significant to product development knowledge. In Model 3, none of the variables is significant to product development knowledge. Model 4 shows a relationship on the same variables in Model 3 excluding years and manufacturing sector. Although variables years and manufacturing sector are excluded based on the result of Wald test, none of the variables is significant on the product development knowledge.

The effect on product development knowledge is different compared to the above results when the variables involved comprise of the learning capacity elements, prior knowledge, flexibility of firms, and determination to learn. Model 5 shows a relationship between years, joint venture, firm size, manufacturing sector, R&D activities, prior knowledge, flexibility and determination to learn. R&D activities nd flexibility of the firm shows a positive significant effect on product development knowledge. In comparing this result with the knowledge acquired result, all the three learning capacity elements were significant on knowledge acquired whereas for product development, flexibility of firms is the only element that is significant. This implies that flexibility of firms is important to encourage the learning process in firms, so that more knowledge on product development can be acquired. Prior knowledge and determination were not important to boost the learning process in acquiring the product development knowledge. Dissimilar to the knowledge acquisition, joint venture and size are not significant. This implies that firms that have a joint venture or contractual agreement have the same opportunities to acquire the product development knowledge. The same applies to firm size, large firms and small firms have the same chances to acquire the product development knowledge as it has no effect on the relationship. Model 6 shows a similar relationship of variables as in Model 5 excluding years and manufacturing sector. The exclusion of these two variables is statistically valid based on the Wald test. Nonetheless, despite of this exclusion, a similar pattern of effect is depicted on product development.

6.1.2 The Effects of Experience on Product Development

Analysis for the effects of experience on product development was conducted using ordered probit. The results for the analysis are summarised in Table 6.2.

Table 6.2 : The Result of Ordered Probit on Experience and Product Development

	Model 1	Model 2	Model 3	Model 4
Constant	-1.536 (-1.646)	-0.125 (-0.169)	-2.744** (-2.419)	-1.585 (-1.563)
Years	0.026 (0.983)	0.002 (0.094)	0.378 (1.292)	
Joint venture	-0.029 (-0.064)	0.327 (0.839)	-0.097 (-0.192)	-0.164 (-0.426)
Size	0.034 (0.184)	0.246 (1.124)	0.076 (0.401)	0.284* (1.656)
Electronic	1.361* (1.717)	1.475* (1.709)	0.930 (1.191)	
Electric	0.983 (1.271)	1.263 (1.535)	0.464 (0.526)	
Telecommunication	0.830 (1.070)	0.939 (1.034)	0.432 (0.521)	
Automotive	1.773* (1.953)	1.878** (2.139)	0.137 (1.562)	
Overall Experience	0.677*** (2.697)			
Previous involvement		1.572 (1.263)		
Previous skills & style		-0.419 (-1.195)		
Grafting			0.249** (2.030)	0.246** (2.571)
Indirect interaction			0.817** (2.288)	0.701*** (2.579)
μ (1)	0.891(2.938)	0.841(2.322)	0.956(2.774)	0.885(3.043)
μ (2)	2.048(5.999)	1.902(4.259)	2.209(5.186)	2.079(6.130)
μ (3)	4.144(7.523)	3.765(6.415)	4.474(6.115)	4.233(7.262)
N	65	65	65	65
Log likelihood	-73.892	-78.549	-69.837	-72.880
Wald test Chi-square – 1 linear restriction (Sig)	2.80* (0.094)	3.06* (0.080)		1.11 (0.291)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Model 1 in Table 6.2 shows the results of variables years, joint venture, firm size, manufacturing sector and overall experience on product development. Overall experience shows a significant positive effect on product development as it shows on knowledge acquired. This implies that the greater the overall experience that a firm has, the greater that the product development knowledge can be acquired. Model 1 also shows that manufacturing sector i.e. electronic and automotive sectors are significant to product development. This indicates that product development knowledge has a stronger effect on these two sectors. This result is support by the Wald test where it shows that the exclusion of the manufacturing sector is not valid. This implies that the activities involved in developing new products are crucial and important in these two sectors compared to other sectors. In other words, electronic and automotive sectors put a high priority in developing new products as it allows them to expedite the knowledge absorption from the foreign partners. As these two sectors are facing rapid change in technologies, constantly gaining new knowledge is crucial in order to sustain their competitiveness in the industries.

Model 2 shows a relationship between years, joint venture, firm size, manufacturing sector and previous experience elements: previous involvement and previous skills & style on product development. The results in Model 2 indicate that previous involvement and previous skills & style are not significant to product development. This implies that previous involvement and previous skills & style will not have any effect on product development knowledge. Model 2 also shows that product development knowledge has a stronger effect on manufacturing sector particularly electronic and automotive sectors as shown in Model 1. The Wald test supports this result as it shows that an exclusion of the manufacturing sector in the relationship is not statistically valid.

Model 3 shows a relationship between years, joint venture, firm size, manufacturing sector and current experience elements: grafting and indirect interaction on product development knowledge. The results in Model 3 show that grafting and indirect interaction has significant positive effect on product development. This implies that the higher the current experience that the local firms have, the more product development knowledge can be acquired. In terms of manufacturing sector, a different result is shown in Model 3 compared with Model 1 and Model 2. Model 3 indicates that manufacturing sector is not significant on product development when grafting and indirect interaction are involved. This implies that product development has no effect on any particular sector as it has when previous involvement and previous skills & style are involved.

The exclusion of manufacturing sector and years is statistically valid based on the Wald test and the result is shown in Model 4. Model 4 shows a relationship between joint venture, firm size and current experience elements: grafting and indirect interaction on product development. Model 4 once again indicates that grafting and indirect interaction is positively significant on product development. This implies that the greater the grafting and indirect interaction involved, the greater the product development knowledge can be acquired. Firm size also shows a significant effect on product development where larger firms will acquire more product development knowledge compare with smaller firms. This result is consistent with the result in knowledge acquired where size has a significant influence. Hence, large firms have an advantage over small firms in terms of level of knowledge attained from the foreign partners. Joint venture however is not significant to product development in this relationship.

The relationship between goals and product development was also similar to that depicted in the relationship with knowledge acquisition. As in knowledge acquisition, goals were significant to the product development. This also applies to the goals elements, understanding of mission and explicitness of goals which produced the same results as in knowledge acquisition where understanding of mission is significant to product development, while explicitness of goals was not significant. This means that the higher the understanding of mission, the more that product development knowledge could be acquired. Similar to the knowledge acquisition, firm size became significant to product development when years and sectors were excluded. This indicates that large firms would acquire more product development knowledge than small firms.

6.1.3 The Effects of Active Involvement on Product Development

Analysis for the effects of active involvement on product development was conducted using ordered probit. The results for the analysis are summarised in Table 6.3.

Table 6.3 : The Result of Ordered Probit on Active Involvement and Product Development

	Model 1	Model 2	Model 3	Model 4
Constant	-3.693**	-2.444***	-3.386	-1.660
	(-2.543)	(-2.703)	(-0.919)	(-1.555)
Years	0.009		0.016	
	(0.375)		(0.658)	
Joint venture	0.161	0.095	0.024	0.011
	(0.463)	(0.300)	(0.070)	(0.033)
Size	-0.079	0.060	-0.085	0.043
	(-0.324)	(0.304)	(-0.333)	(0.196)
Electronic	1.159		2.993	
	(1.118)		(0.823)	
Electric	1.054		2.823	
	(1.003)		(0.771)	
Telecommunication	1.054		3.187	
	(0.956)		(0.862)	
Automotive	0.210*		3.920	
	(1.896)		(1.068)	
Active involvement	1.481	1.394***		
	(3.390)***	(4.077)		
Managerial contribution			0.864***	0.756***
			(2.602)	(2.660)
Technical contribution			0.772*	0.488
			(1.904)	(1.370)
Foreign technology			-0.659	-0.149
			(-1.412)	(-0.508)
Foreign training			0.068	0.027
			(0.327)	(0.153)
Written document			-0.132	0.381
			(-0.168)	(0.683)
μ (1)	1.047(2.751)	0.963(3.066)	1.167(3.072)	0.985(2.912)
μ (2)	2.280(4.742)	2.143(5.542)	2.508(5.595)	2.210(5.422)
μ (3)	4.386(6.745)	4.201(7.295)	4.663(6.831)	4.262(6.813)
N	65	65	65	65
Log likelihood	-70.313	-73.122	-67.064	-72.321
Wald test Chi-square – 1 linear restriction (Sig)		1.71 (0.190)		0.78 (0.375)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Table 6.3 shows the results of ordered probit for the influence of active involvement on product development. Generally, the results for active involvement are similar to those of knowledge acquisition. Model 1 shows a relationship between years, joint venture, firm size, manufacturing sector and active involvement on product development. Model 1 shows that active involvement is significant to the product development. This implies that the more active the foreign partners, the more product development knowledge that could be acquired. Model 1 shows that product development knowledge has a significant effect on manufacturing sector in particular automotive sector. However, this result is not being supported in the Wald test, indeed it indicates that the exclusion of manufacturing sector and years is statistically valid. The exclusion of these two variables has created Model 2, which includes joint venture, firm size and active involvement. As in Model 1, active involvement is also positively significant on product development in Model 2. Other variables are not significant in Model 2.

Model 3 shows a relationship between variables years, joint venture, firm size, manufacturing sector and active involvement elements: managerial contribution, technical contribution, foreign technology, foreign training and written document on product development knowledge. Model 3 shows that managerial and technical contribution is positively significant to product development knowledge while other elements are not. This implies that the greater the managerial contribution, the more product development knowledge could be acquired. This result indicates that the role of management is vital in planning the product development activities to allow the learning process to occur. Without the concern and involvement of the management, the product development activities could not be planned. So as the technical contribution, the higher the technical contribution, the more product development knowledge can be acquired. These results were not consistent with the result in knowledge acquisition where except for foreign technology four of the elements were significant. Joint venture and firm size appeared not to be significant on product development. This indicates that joint venture, contractual agreement, large, or small firms has an equal chance to learn about product development. Model 4 shows a relationship between joint venture, firm size and active involvement elements: managerial contribution, technical contribution, foreign technology, foreign training and written document on product development. Years and manufacturing sector is excluded in Model 4 as the Wald test indicates that the exclusion of these variables is statistically significant. With the exclusion of these two variables, Model 4 indicates that managerial contribution is positively significant on product development while other variables are not.

For accessibility, the same result was found in a relationship with product development as in knowledge acquisition. Accessibility has a significant influence to product development. This means that the higher the accessibility for the foreign partner, the more knowledge of product development that could be acquired. Once again consistent with knowledge acquisition, the results for the elements of accessibility show that only trust played a significant role to product development with similarity of knowledge not being significant. This implies that the greater the degree of trust with the foreign partner, the more product development knowledge that could be acquired from them. Joint venture and firm size show a different picture where they are significant with knowledge acquired, but not significant with product development. Large and small firms have equal opportunities to learn about product development from the foreign partners.

In terms of the relationship between all the independent variables and product development, only active involvement is significant to product development while other independent variables are not significant. The more active the foreign partners in the relationship, the greater the product development knowledge that could be acquired. This result was different from the results with knowledge acquisition where learning capacity, active involvement and goals were significant to knowledge acquisition.

6.2 Technological Expertise

6.2.1 The Effects of Learning Capacity on Technological Expertise

Analysis of the effects of learning capacity on technological expertise was conducted using ordered probit. The results for the analysis are summarised in Table 6.4.

Table 6.4 : Result of Ordered Probit on Learning Capacity and Technological Expertise

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	-1.306 (-1.029)	-1.825 (-1.624)	0.287 (0.242)	0.544 (0.501)	-1.283 (-0.812)	-2.036 (-1.582)
Years	0.0007 (0.033)		0.003 (0.173)		0.008 (0.343)	
Joint venture	0.412 (0.916)	0.545* (1.655)	0.066 (0.221)	0.075 (0.286)	0.315 (0.683)	0.445 (1.276)
Size	-0.189 (-0.808)	-0.241 (-1.060)	-0.026 (-0.137)	-0.015 (-0.100)	-0.249 (-0.899)	-0.256 (-1.052)
Electronic	-0.937 (-1.465)		0.434 (0.585)		-1.070) (-0.952)	
Electric	-0.484 (-0.783)		0.429 (0.811)		-0.716 (-0.646)	
Telecommunication	-0.645 (-0.824)		0.461 (0.700)		-0.857 (-0.581)	
Automotive	-0.713 (-0.726)		0.047 (0.501)		-0.066 (-0.489)	
Learning Capacity	1.075** (2.424)	1.028*** (2.742)	0.063 (0.164)	0.115 (0.362)		
Research & Development	0.714* (1.904)	0.674** (2.057)			0.665 (1.620)	0.634* (1.869)
Expenditure			-0.000 (-0.024)	-0.000 (-0.015)		
Prior knowledge					0.492 (1.315)	0.405** (2.411)
Flexibility					0.131 (0.521)	0.132 (0.643)
Determination					0.450 (1.218)	0.514* (1.957)
μ (1)	1.513(3.592)	1.512(3.773)	1.289(3.369)	1.289(3.544)	1.526(3.512)	1.505(3.715)
μ (2)	3.705(6.980)	3.636(7.248)	3.148(6.302)	3.148(7.235)	3.786(6.649)	3.713(7.217)
N	65	65	56	56	65	65
Log likelihood	-56.197	-57.280	-70.525	-70.343	-55.132	-56.190
Wald test Chi-square – 1 linear restriction (Sig)		1.11 (0.292)		0.48 (0.490)		0.49 (0.484)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Table 6.4 shows the results for a relationship that involves learning capacity and technological expertise. Generally, the results depicted are not much different from the relationship between learning capacity and knowledge acquisition. In Model 1, variables years, joint venture, firm size, manufacturing sector, learning capacity and R&D activities are tested against technological expertise. As in knowledge acquired, learning capacity and Research and Development (R&D) are positively significant to technological expertise knowledge. This means that the greater the learning capacity and the more R&D activities are conducted, the more technological expertise could be acquired. The Wald test indicates that years and manufacturing sector can be excluded from Model 1 as they are statistically not significant in the relationship. This new relationship, which excludes the two variables and involves joint venture, firm size, learning capacity and R&D activities is shown in Model 2. In this relationship, not only learning capacity and R&D activities are positively significant on technological expertise, joint venture also is significant to the technological expertise. This indicates that joint ventures acquire more technological expertise than contractual agreements.

Model 3 analyse relationship between years, joint venture, firm size, manufacturing sector, learning capacity and R&D expenditure on technological expertise. As in knowledge acquired, learning capacity and R&D expenditure is not significant to the technological expertise. Similar results are shown even though variables years and manufacturing sector are excluded as indicated by the Wald test in Model 4. Model 4 shows that none of the variables involved is significant to technological expertise.

Model 5 shows a relationship between years, joint venture, firm size, manufacturing sector, R&D activities and other three elements of learning capacity: prior knowledge, flexibility of firms and determination to learn on technological expertise. None of the variable is significant to technological expertise. Model 6 shows a relationship between the same variables excluding years and manufacturing sector, as their exclusion is statistically valid based on the Wald test. In this relationship, R&D activities, prior knowledge and determination to learn are positively significant to technological expertise. This indicates that the more R&D activities are conducted, the more prior knowledge the local firms has and the greater the determination to learn, the greater the technological expertise can be acquired. All three learning capacity elements were significant to knowledge acquired, however only two elements: prior knowledge and determination to learn are significant to technological expertise. Knowledge that the local firms have is very valuable as it acts as a basis of knowledge to boost the learning process for technical know-how. In enhancing the knowledge acquisition process, a positive and keen attitude of the local firms is necessary to enable the technological knowledge to be internalised as much as possible. However, the flexibility of the local firms would not increase the level of technological expertise. Unlike in knowledge acquired, joint venture and firm size were not significant in technological expertise. Neither joint venture nor contractual firms would have an advantage over each other in acquiring technological expertise. So as with firm size, there is no difference between large firms and small firms in acquiring technological expertise.

In terms of overall experience and technological expertise, the relationship did not differ much from the relationship between overall experience and knowledge acquired. Overall experience was significant to the technological expertise, this means that the more overall experience that the local firms have, the more technological knowledge that could be acquired. Similar to the knowledge acquired, the overall experience elements: previous experience (comprise of previous involvement and previous skills and style) is not significant while current experience (comprise of grafting and indirect interaction) is significant to technological expertise. Joint venture also showed a similar result where it is not significant in both knowledge acquired and technological expertise. Hence, there was no difference between joint venture or contractual agreement in obtaining technological expertise knowledge from the foreign partners. On the other hand, size of the firms, which was significant in knowledge acquired, is not significant in technological expertise. Therefore, large firms and small firms would have a same chance in absorbing technological knowledge. Years and types of sectors were also insignificant in this relationship.

6.2.2 The Effects of Goals on Technological Expertise

Analysis of the effects of goals on technological expertise was conducted using ordered probit. The results for the analysis are summarised in Table 6.5.

Table 6.5 : Result of Ordered Probit on Goals and Technological Expertise

	Model 1	Model 2
Constant	-0.977 (-0.782)	-1.097 (-1.259)
Years	0.0178 (0.772)	
Joint venture	0.114 (0.252)	0.199 (0.596)
Size	-0.137 (-0.550)	-0.109 (-0.489)
Electronic	-0.945 (-1.059)	

Electric	-0.858 (-0.871)	
Telecommunication	-0.875 (-0.827)	
Automotive	-0.071 (-0.577)	
Mission	0.850** (2.489)	0.790*** (2.672)
Explicit	0.619 (1.417)	0.534** (2.284)
μ (1)	1.928(2.787)	1.925(2.960)
μ (2)	4.048(5.873)	3.995(5.761)
N	63	63
Log likelihood	-52.259	-53.060
Wald test Chi-square – 1 linear restriction (Sig)		0.86 (0.352)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Model 1 in Table 6.5 shows a relationship between years, joint venture, firm size, manufacturing sector, and articulated goals elements: understanding mission and explicitness of the goals on technological expertise knowledge. As in the relationship with knowledge acquired, Model 1 shows that mission is positively significant to technological expertise. This implies that the greater the understanding of the mission, the more technological expertise that could be acquired. Model 2 shows a relationship of the same variables excluding years and manufacturing sector. The exclusion of these two variables is statistically valid based on the Wald test in Model 2. When these two variables are excluded, both articulated goals elements: understanding of mission and explicitness of the goals are positively significant to technological expertise. Explicitness of goals was not significant in knowledge acquired. This indicates that the clarity of the goals and understanding them are crucial to acquire more technological expertise from the foreign partner. Acquiring technological expertise seems to be more demanding than general knowledge acquired because goals not only need to be very clear and detailed but also to be well understood. Both factors were essential to boost the organizational members' commitment to the new knowledge and absorb them as well. Joint venture showed a similar effect to the technological expertise as in knowledge acquired as it did not have any influence on acquiring the technology. Therefore, joint ventures or contractual agreements would acquire the same level of knowledge. Firm size was different in knowledge acquisition where larger firms could acquire more knowledge, whereas in technological expertise, both large and small firms have equal opportunities to acquire technological knowledge from the foreign partners.

6.2.3 The Effects of Active Involvement on Technological Expertise

Analysis of the effects of active involvement on technological expertise was conducted using ordered probit. The results for the analysis are summarised in Table 6.6.

Table 6.6 : The Result of Ordered Probit on Active Involvement and Technological Expertise

	Model 1	Model 2	Model 3	Model 4
Constant	-1.313 (-0.951)	-0.721 (-0.589)	-2.642* (-1.700)	-1.628 (-1.212)
Years	0.002 (0.123)		0.005 (0.236)	
Joint venture	0.1555 (0.331)	0.362 (1.058)	-0.081 (-0.143)	0.168 (0.375)
Size	-0.319 (-1.314)	-0.313 (-1.402)	-0.334 (-1.167)	-0.324 (-1.205)
Electronic	-0.598 (-0.863)		0.821 (0.640)	
Electric	0.113 (0.191)		1.551 (1.109)	
Telecommunication	0.407 (0.597)		1.908 (1.393)	
Automotive	0.042 (0.223)		0.019 (0.843)	
Active involvement	1.242** (2.315)	0.942** (2.385)		
Managerial contribution			0.266 (0.601)	0.081 (0.200)
Technical contribution			0.604 (1.308)	0.366 (0.878)
Foreign technology			-0.325 (-0.919)	-0.060 (-0.225)
Foreign training			0.796*** (2.711)	0.768*** (3.123)
Written document			-0.247 (-0.247)	0.154 (0.232)
μ (1)	1.436(3.752)	1.341(4.171)	1.802(3.389)	1.603(4.067)
μ (2)	3.633(7.577)	3.375(8.823)	4.285(5.578)	3.856(8.022)
N	65	65	65	65
Log likelihood	-56.907	-60.438	-49.773	-53.839
Wald test Chi-square – 1 linear restriction (Sig)		0.01 (0.906)		1.30 (0.254)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Model 1 in Table 6.6 shows results for a relationship between years, joint venture, firm size, manufacturing sector and active involvement on technological expertise. Similar to the results on knowledge acquired, active involvement is also positively significant to technological expertise as indicated in Model 1. This means that the more active the foreign partners are in the organization, the more technological expertise that could be acquired by the local firms. Model 2 shows the same relationship excluding years and manufacturing sector, as these two variables are statistically not significant in the relationship. The same result is shown where active involvement remains to be significant while other are not significant to technological expertise.

The results changed somewhat when the elements of active involvement were included. Model 3 shows a relationship between years, joint venture, firm size, manufacturing sector and active involvement elements: managerial contribution, technical contribution, foreign training, and written documents on technological expertise. Model 3 indicates that foreign training is the only element that is positively significant to technological expertise. In a relationship with knowledge acquired, four elements of active involvement i.e. managerial contribution, technical contribution, foreign training, and written documents were significant but foreign technology was not significant. However, in acquiring technological expertise knowledge, only the foreign training element was significant, while the other four elements were not significant. This implies that training provided by the foreign partners was crucial in order for the local firms to acquire technological expertise. Hence, having a foreign partner that has a special knowledge was very important in order for the local firms to absorb the technology. The results also indicate that in order to acquire the technological expertise, managerial, technical, foreign technology and written documents were not critically required. Foreign training is the most important as it provides a basic skill and knowledge to the local employees. Training also allows the local employees to have a hands-on experience with foreign partners where knowledge can be highly absorbed. Similarly to the knowledge acquired results, joint venture and firm size were not significant to technological expertise. This indicates that both joint ventures and contractual agreements, as well as large firms and small firms, will have the same opportunities in acquiring technological expertise knowledge.

6.2.4 The Effects of Accessibility on Technological Expertise

Analysis of the effects of accessibility on technological expertise was conducted using ordered probit. The results for the analysis are summarised in Table 6.7.

Table 6.7 : The Result of Ordered Probit on Accessibility and Technological Expertise

	Model 1	Model 2	Model 3	Model 4
Constant	-0.339 (-0.421)	-0.940 (-1.082)	-0.319 (-0.378)	-0.934 (-0.981)
Years	0.011 (0.522)		0.011 (0.487)	
Joint venture	0.279 (0.686)	0.437 (1.367)	0.279 (0.682)	0.437 (1.367)
Size	-0.147 (-0.649)	-0.160 (-0.809)	-0.145 (-0.638)	-0.160 (-0.808)
Electronic	-1.274* (-1.727)		-1.282* (-1.732)	
Electric	-0.797 (-1.177)		-0.804 (-1.180)	
Telecommunication	-0.980 (-1.264)		-0.996 (-1.264)	
Automotive	-0.075 (-0.686)		-0.076 (-0.687)	
Accessibility	1.006*** (3.101)	0.888*** (3.007)		
Trust			0.489* (1.788)	0.438* (1.666)
Similarity			0.516** (2.030)	0.448** (2.127)
μ (1)	1.576(3.500)	1.537(3.906)	1.577(3.497)	1.537(3.866)
μ (2)	3.721(6.655)	3.588(7.705)	3.721(6.510)	3.588(7.692)
N	65	65	65	65
Log likelihood	-56.270	-58.012	-56.266	-58.011
Wald test Chi-square – 1 linear restriction (Sig)		1.83 (0.175)		1.87 (0.171)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Model 1 in Table 6.7 depicts a relationship between years, joint venture, firm size, manufacturing sector and accessibility on technological expertise. Model 1 indicates that accessibility is positively significant on technological expertise. This means that the greater the accessibility to the foreign partner, the more technological expertise that could be acquired. A similar result was shown on knowledge acquired where accessibility was also significant. Model 2 shows a relationship of the same variables excluding years and manufacturing sector as the Wald test indicates that the exclusion of these two variables is statistically valid. Accessibility remains significant in Model 2 and other variables remain not significant.

Model 3 shows a relationship between years, joint venture, firm size, manufacturing sector and accessibility elements: trust and similarity of knowledge. Trust and similarity of knowledge are positively significant to technological expertise as shown in Model 3. This result is slightly different from knowledge acquired where only trust was significant. As both trust and similarity of knowledge are significant to the technological expertise, this indicates that in acquiring the technological expertise, believing each other and the closeness of the knowledge that the local firms have are both crucial to enhance the learning process. Both are needed concurrently as they would lead to a higher absorption of technological expertise from the foreign partners. Another different effect that accessibility has over the knowledge acquired is in terms of joint venture and firm size. These two variables were significant in knowledge acquired but were not significant in technological expertise. In other words, whatever types of relationship and firm size were not important as both means would allow technological knowledge to be acquired. Model 4 shows a relationship of the same variables excluding years and manufacturing sector as the exclusion of these variables are statistically valid based on the Wald test. Model 4 indicates the same result though the two variables were excluded. Trust and similarity of knowledge remain significant while other variables remain not significant.

In terms of a relationship for all variables, overall experience and mission were significant to the technological expertise, while other variables were not significant. Therefore, the more experience the local firms has and the greater the understanding of mission, the more technological expertise that could be acquired. This result was slightly different from the relationship with knowledge acquired where learning capacity, active involvement, and goals were significant to the relationship.

6.3 Manufacturing Process

6.3.1 The Effects of Learning Capacity on Manufacturing Process

Analysis of the effects of learning capacity on manufacturing process was conducted using ordered probit. The results for the analysis are summarised in Table 6.8.

Table 6.8 : The Result of Ordered Probit on Learning Capacity and Manufacturing Process

	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	-0.799	0.828	0.754	-1.262	-1.763
	(-0.527)	(0.640)	(0.705)	(-0.772)	(-1.182)
Years	0.025	0.001		0.023	
	(0.930)	(0.049)		(0.758)	
Joint venture	0.185	-0.029	-0.0006	0.213	0.346
	(0.558)	(-0.098)	(-0.003)	(0.633)	(1.080)
Size	0.181	0.055	0.051	0.187	0.230
	(1.039)	(0.275)	(0.368)	(0.953)	(1.300)
Electronic	-1.328***	-0.106		-0.923	
	(-2.566)	(-0.122)		(-1.015)	
Electric	-1.088**	-0.021		-0.680	
	(-1.986)	(-0.027)		(-0.711)	
Telecommunication	-1.754***	-0.132		-1.247	
	(-2.891)	(-0.209)		(-1.337)	
Automotive	-1.394	-0.093		-0.925	
	(-1.351)	(-0.094)		(-0.675)	
Learning Capacity	1.042**	0.042	0.042		
	(2.260)	(0.135)	(0.150)		
Research &	0.324			0.303	0.236
Development	(0.779)			(0.661)	(0.600)
Expenditure		0.000	0.000		
		(0.040)	(-0.030)		
Prior knowledge				0.216	0.051
				(0.763)	(0.282)
Flexibility				0.344	0.316
				(1.360)	(1.306)
Determination				0.506*	0.612***
				(1.765)	(2.996)
μ (1)	1.039(2.550)	0.811(2.454)	0.811(2.572)	1.064(2.257)	1.003(2.348)
μ (2)	2.458(5.158)	1.847(4.742)	1.847(5.024)	2.503(4.092)	2.395(4.680)
μ (3)	4.213(7.508)	3.606(5.152)	3.606(8.332)	4.242(6.742)	4.095(6.841)
N	65	56	56	65	65
Log likelihood	-70.764	-84.579	-85.048	-70.439	-72.140
Wald test Chi-square – 1 linear restriction (Sig)	6.28** (0.012)		0.01 (0.908)		0.96 (0.327)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Model 1 in Table 6.8 shows a relationship between years, joint venture, firm size, manufacturing sector, learning capacity and R&D activities on manufacturing process knowledge. Unlike in the relationship with knowledge acquired, learning capacity depicted a different picture in the manufacturing process. Model 1 shows that learning capacity is significant to the manufacturing process while R&D activities is not significant. This indicates that the greater the local partner's learning capacity, the greater the knowledge of manufacturing process that could be acquired. The insignificance of R&D activities on manufacturing process reveals that the R&D activities that are carried out by the Malaysian partner did not add much to a deep understanding of the manufacturing process. In other words, whether the firm has R&D activities or not, it will not add to a greater acquiring and learning of the manufacturing process.

Type of sectors also show a contrasting result on manufacturing process compare with knowledge acquired results. The manufacturing sector was not significant in knowledge acquired, but it is significant in the manufacturing process. Electronic, electrical, and telecommunication sectors are negatively significant to the manufacturing process. This result is confirmed by the Wald exclusion test where the Chi-square result was significant. This implies that these three sectors acquired less knowledge of manufacturing process compared to the base sector and non-significant sectors such as automotive. The base sector encompasses other sectors such as plastics and chemical industry. In other words, learning the manufacturing process was less likely to occur in electronic, electrical, and telecommunication sectors compared to automotive and the base sector. This could be due to the fact that less R&D activities takes place in these three industries, as a result, there were not many platforms or opportunities for the locals to learn the manufacturing process from the foreign partner.

The above result is also supported by the R&D activities themselves where R&D was not significant to the manufacturing process. R&D activities, which was significant to knowledge acquired, product development and technological expertise shows not significant in manufacturing process. Another reason for the low-speed of learning in the above three sectors, could be due to the types of activities carried out in these sectors such as contract manufacturing which involves part of the manufacturing activities instead of the whole process. Compared to the automotive sector, which carries out the whole process from the supplier through to the finished products, the integration of the activities through the supply chain allows more knowledge of the manufacturing process to be absorbed and gained. Unlike in knowledge acquired, joint venture and size of the firms were not significant to the manufacturing process. This indicates that joint venture and contractual agreement have equal possibilities to gain manufacturing process knowledge. Similarly, small firms or large firms also have the same chances to acquire manufacturing process knowledge from the foreign partners. These two findings were in contrast to the result for knowledge acquired where joint venture and large firms would tend to acquire more knowledge than contractual agreement and small firms .

Model 2 shows a relationship between years, joint venture, firm size, manufacturing sector, learning capacity and R&D expenditure on manufacturing process knowledge. None of the variables involved in significant to manufacturing process. Model 3 shows a relationship of the same variables excluding years and manufacturing sector, as these two variables are statistically valid to be excluded based on the Wald test. Similar results are shown in Model 3, none of the variable is significant. The results in both Model 2 and Model 3 are similar to the knowledge acquired in that R&D expenditure is not significant to the manufacturing process.

Model 4 depicts results for a relationship between years, joint venture, firm size, manufacturing sector, R&D activities and learning capacity elements: prior knowledge, flexibility, and determination to learn on manufacturing process. Unlike in knowledge acquired where all three variables were significant, this relationship shows that only determination to learn is significant to the manufacturing process, while the other two are not significant. This implies that the greater the determination to learn by the local firms, the greater the knowledge of manufacturing process that could be acquired. Prior knowledge and flexibility of firms did not have any influence in acquiring the manufacturing process knowledge. Model 5 shows a relationship of similar variables excluding years and manufacturing sector, as these variables are statistically not significant to be included. A similar result is depicted where determination to learn is positively significant while other variables remain not significant to manufacturing process knowledge.

6.3.2 The Effects of Experience on Manufacturing Process

Analysis for the effects of experience on manufacturing process was conducted using ordered probit. The results for the analysis are summarised in Table 6.9.

Table 6.9 : The Result of Ordered Probit on Experience and Manufacturing Process

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	1.569* (1.725)	1.163* (1.763)	2.220*** (2.735)	1.911*** (2.625)	1.373 (1.425)	1.283 (1.590)
Years	0.026 (0.734)		0.017 (0.567)		0.023 (0.649)	
Joint venture	-0.0352 (-0.098)	0.107 (0.352)	0.016 (0.049)	0.148 (0.520)	-0.124 (-0.324)	-0.019 (-0.059)
Size	0.165 (0.961)	0.222 (1.425)	0.206 (1.233)	0.217 (1.421)	0.186 (1.016)	0.214 (1.280)
Electronic	-0.649 (-1.348)		-0.468 (-0.995)		-0.550 (-0.695)	
Electric	-0.411 (-0.743)		-0.113 (-0.211)		-0.280 (-0.333)	
Telecommunication	-0.866* (-1.924)		-0.534 (-1.153)		-0.716 (-1.083)	
Automotive	-0.0489 (-0.608)		-0.030 (-0.329)		-0.044 (-0.476)	
Overall Experience	0.222 (0.898)	0.170 (0.810)				
Previous involvement			-1.862* (-1.675)	-1.862 (-1.599)		
Previous skills & style			0.411 (1.362)	0.394 (1.254)		
Grafting					0.126 (0.955)	0.140 (1.522)
Indirect interaction					0.137 (0.618)	0.040 (0.222)
μ (1) μ (2) μ (3)	0.922(2.464) 2.229(5.088) 3.840(7.528)	0.865(2.571) 2.121(5.579) 3.709(7.917)	1.023(1.739) 2.322(3.351) 3.966(5.472)	0.968(1.743) 2.229(3.481) 3.869(5.431)	0.942(2.436) 2.274(5.117) 3.892(7.509)	0.885(2.629) 2.179(5.689) 3.780(8.149)
N	65	65	65	65	65	65
Log likelihood	-75.523	-77.312	-74.156	-75.352	-74.833	-76.240
Wald test Chi-square – 1 linear restriction (Sig)		1.64 (0.200)		0.55 (0.459)		0.46 (0.496)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Model 1 in Table 6.9 shows the result for a relationship between years, joint venture, firm size, manufacturing sector and overall experience on manufacturing process. The results for this relationship are in sharp contrast to its relationship with knowledge acquired. Model 2 shows the same relationship excluding variables years and manufacturing sector as Wald test indicates that the exclusion of these two variables is statistically valid. Model 1 and Model 2 show that overall experience and other variables are not significant to the manufacturing process.

Another relationship was tested in Model 3 between years, joint, firm size, manufacturing sector and previous experience elements: previous involvement and previous skills & style on manufacturing process. Model 3 shows that previous involvement is negatively significant to manufacturing process while other variables are not. This means that, the less previous involvement that the local firms have, the more knowledge of manufacturing process that could be acquired. Model 4 shows the same relationship between the variables excluding years and manufacturing sector as the Wald test indicates that the exclusion is valid. Model 4 shows that none of the variables is significant including previous involvement to manufacturing process.

Model 5 shows the results of a relationship between years, joint venture, firm size, manufacturing sector and current experience elements: previous involvement and previous skills & style on manufacturing process. Unlike in knowledge acquired, where grafting and indirect interaction were highly significant, Model 5 shows that grafting and indirect interaction are not significant to the manufacturing process. This indicates that these elements are not important in acquiring manufacturing process. This result is contradictory to other results where both of these activities are important in knowledge acquired, product development and technological expertise. This different finding for manufacturing process is probably because grafting and indirect interaction do not heavily occur in the manufacturing process activities. As there was less involvement of expatriates and integration activities and high dependency on capital equipment these activities were regarded as not vital in the manufacturing process.

Joint venture is not significant in both knowledge acquired and manufacturing process. This indicates that whatever types of relationship is chosen, either joint venture or contractual agreements this would not make a difference in terms of manufacturing process. Firm size, which was significant in knowledge acquired, is not significant in manufacturing process. This reveals that both large firms and small firms have equal opportunities to acquire manufacturing process knowledge. Model 6 shows a relationship between the same variables excluding years and manufacturing sector. The exclusion of these variables is valid based on Wald test, the results in Model 6 remain the same where none of the variables is significant to manufacturing process.

6.3.3 The Effects of Goals on Manufacturing Process

Analysis for the effects of goals on manufacturing process was conducted using ordered probit. The results for the analysis are summarised in Table 6.10.

Table 6.10 : The Result of Ordered Probit on Goals and Manufacturing Process

	Model 1
Constant	0.236 (0.167)
Years	0.0374 (1.298)
Joint venture	-0.042 (-0.143)
Size	0.214 (1.229)
Electronic	-1.489** (-2.362)
Electric	-1.420* (-1.888)
Telecommunication	-1.979*** (-2.586)
Automotive	-1.457 (-1.616)
Mission	0.562 (1.434)
Explicit	0.430 (1.397)
μ (1)	1.014(2.523)
μ (2)	2.382(5.163)
μ (3)	4.131(6.781)
N	63
Log likelihood	-69.798
Wald test Chi-square – 1 linear restriction (Sig)	5.49** (0.019)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Model 1 in Table 6.10 shows a relationship between years, joint venture, firm size, manufacturing sector and articulated goals elements: understanding of mission and explicitness of goals on manufacturing process knowledge. The results show that both elements of goals: understanding of mission and explicitness of goals, are not significant to manufacturing process. This is different in knowledge acquired where understanding of mission was significant while explicitness of goals was not significant. Another dissimilarity between manufacturing process and knowledge acquired result lies in terms of the effect of sectors on the manufacturing process. Electronic, electrical, and telecommunication sectors are negatively significant to the manufacturing process, while automotive sector is not significant. This is confirmed through the Wald exclusion test where the result is significant. This means that manufacturing process knowledge is less acquired in these three sectors compared to the automotive and the base sector. This could be because the value added activities such as R&D activities, which brought knowledge to the local firms were undertaken less thus, there were fewer opportunities for the employees to gain the knowledge. As with knowledge acquired, joint venture is also not significant in manufacturing process. This indicates that either joint venture or contractual agreement did not have an advantage over learning the manufacturing process. On the other hand, firm size, which was significant in knowledge acquisition, is not significant in manufacturing process. This implies that both large firms and small firms have same chance to learn manufacturing process.

6.3.4 The Effects of Active Involvement on Manufacturing Process

Analysis for the effects of active involvement on manufacturing process was conducted using ordered probit. The results for the analysis are summarised in Table 6.11.

Table 6.11 : The Result of Ordered Probit on Active Involvement and Manufacturing Process

	Model 1	Model 2	Model 3	Model 4
Constant	0.076 (0.070)	-0.415 (-0.448)	-1.864 (-1.109)	-2.325 (-1.283)
Years	0.021 (0.690)		0.037 (1.312)	
Joint venture	-0.025 (-0.085)	0.125 (0.441)	-0.371 (-0.918)	-0.191 (-0.589)
Size	0.076 (0.437)	0.115 (0.712)	0.040 (0.175)	0.130 (0.560)
Electronic	-0.952* (-1.876)		-1.938* (-1.649)	
Electric	-0.555 (-1.019)		-1.614 (-1.328)	
Telecommunication	-0.915* (-1.868)		-1.909 (-1.607)	
Automotive	-0.482 (-0.581)		-1.527 (-1.117)	
Active involvement	0.862** (2.050)	0.773** (2.154)		
Managerial contribution			-0.151 (-0.589)	-0.148 (-0.607)
Technical contribution			0.946** (2.403)	0.961*** (3.162)
Foreign technology			0.376 (0.901)	0.115 (0.481)
Foreign training			0.129 (0.491)	0.148 (0.657)
Written document			1.378 (1.617)	0.857 (1.370)
μ (1)	1.016(2.529)	0.950(2.754)	1.258(2.522)	1.129(2.812)
μ (2)	2.397(4.691)	2.284(5.444)	3.027(4.589)	2.749(5.943)
μ (3)	4.081(7.611)	3.926(8.227)	4.898(6.583)	4.565(7.758)
N	65	65	65	65
Log likelihood	-72.602	-74.520	-63.173	-66.611
Wald test Chi-square – 1 linear restriction (Sig)		2.22 (0.136)		2.27 (0.132)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Model 1 in Table 6.11 shows a relationship between years, joint venture, firm size, manufacturing sector and active involvement on manufacturing process. As in knowledge acquired, Model 1 shows that active involvement is positively significant to the manufacturing process. Electronic and telecommunication sector are negatively significant to the manufacturing process. In confirming this significance, a Wald test is conducted. The results in Model 2 show that years and manufacturing sector are valid to be excluded based on the Chi-square, thus their significance to the manufacturing process in Model 1 is not valid. However, active involvement remains significant in Model 2 though these two variables are excluded.

Model 3 in Table 6.11 shows a relationship between years, joint venture, firm size, manufacturing sector and active involvement elements: managerial contribution, technical contribution, foreign technology, foreign training and written document on manufacturing process. The result indicates that only technical contribution is significant to the manufacturing process, the other four variables are not significant. This result is dissimilar to the relationship with knowledge acquisition where four of the five elements were significant. This implies that technical contribution was crucial in order to acquire the knowledge of manufacturing process while other elements such as managerial contribution, foreign technology, foreign training, and written document were not important. Hence, to absorb this knowledge, the foreign firms have to be actively involved in technical activities rather than others. As in knowledge acquisition, joint venture and size were not prominent in manufacturing process as the result was not significant. This indicates that both joint venture and contractual agreement could acquire the same level of manufacturing process, similarly with large firms and small firms. The results remain the same despite the exclusion of years and manufacturing sector in Model 4.

6.3.5 The Effects of Accessibility on Manufacturing Process

Analysis for the effects of accessibility on manufacturing process was conducted using ordered probit. The results for the analysis are summarised in Table 6.12.

Table 6.12 : The Result of Ordered Probit on Accessibility and Manufacturing Process

	Model 1	Model 2
Constant	0.876	0.471
	(1.215)	(0.580)
Years	0.027	0.034
	(0.826)	(0.928)
Joint venture	0.043	0.058
	(0.128)	(0.179)
Size	0.198	0.187
	(1.125)	(1.070)
Electronic	-1.414**	-1.308**
	(-2.411)	(-2.161)
Electric	-1.151*	-1.050*
	(-1.914)	(-1.687)

Telecommunication	-1.820*** (-2.988)	-1.523** (-2.425)
Automotive	-1.278 (-1.1397)	-1.086 (-1.080)
Accessibility	0.621*** (2.788)	
Trust		0.634*** (2.997)
Similarity		0.047 (0.8117)
μ (1)	0.990(2.403)	1.085(1.862)
μ (2)	2.329(4.643)	2.445(3.605)
μ (3)	4.047(7.113)	4.223(5.725)
N	65	65
Log likelihood	-72.979	-70.951
Wald test Chi-square – 1 linear restriction (Sig)	6.02** (0.014)	4.10** (0.042)

Notes: t-test results are in brackets
*** is significant at 1%, ** at 5%, * at 10% on a two-tailed test

Model 1 in Table 6.12 shows a relationship between years, joint venture, firm size, manufacturing sector and accessibility on manufacturing process. Similarly to knowledge acquired, Model 1 shows that accessibility is significant to the manufacturing process. This implies that the greater the accessibility, the greater the manufacturing process knowledge can be acquired. Model 2 shows a relationship between years, joint venture, firma size, manufacturing sector and accessibility elements: trust and similarity of knowledge. Trust is significant to the manufacturing process while similarity of knowledge is not significant. These two models display different results compared to knowledge acquired as types of sectors have a significant effect on the manufacturing process. This is confirmed by Wald exclusion test where the result is significant. Electronic, electrical, and telecommunication sectors are negatively significant to the manufacturing process compared to the knowledge acquisition where none of them was significant. This implies that less knowledge of the manufacturing process could be acquired in these three sectors compared to the automotive and base sectors. Hence, learning the manufacturing process in these three sectors was limited compared to the automotive and base sectors. This situation could be due to the fact that access to the foreign manufacturing process in these sectors was difficult and as a result less manufacturing process knowledge can be acquired. Another possible reason could be because the activities conducted in the manufacturing process itself are limited to certain kinds of activity. Therefore, the whole process of manufacturing is not known and learned by the local firms. Dissimilar to knowledge acquisition, joint venture and firm size are not significant in the manufacturing process. This again means that either joint venture or contractual agreement do not matter to the manufacturing process, similarly for large firms and small firms. They would have the same opportunities to learn the manufacturing process.

For a relationship that involved all variables and manufacturing process, the results are different from the relationship with knowledge acquired. Learning capacity is marginally significant to the manufacturing process, the other variables are not significant. As in other relationships with manufacturing process, three sectors, electronic, electrical, and telecommunication, again showed a significant negative effect to the manufacturing process. This means that less knowledge could be acquired in these three sectors compared to the automotive sector.

6.4 Conclusion and Summary of the Results

In summary, the results depicted in the relationship between the independent variables and knowledge acquisition elements (product development, technological expertise and manufacturing process) were different from the knowledge acquisition itself. The differences vary from one dependent variable to another. The relationships that are different were highlighted and shown in a table, while relationships that are quite similar were briefly mentioned. Table 6.13 below summarises the variation of result on the dependent variables.

Table 6.13 Summary of result on Dependent Variables

	Knowledge Acquisition	*Product Development*	*Technological Expertise*	*Manufacturing Process*
Joint venture	√			
Size	√			
Learning capacity	√√	√√	√√	√√
R&D	√	√	√	
R&D Expenditure				
Prior knowledge	√√		√	
Flexibility	√√	√√		
Determination	√√		√	√√
Overall Experience	√√	√√	√√	
Previous involvement				
Previous skills				
Grafting	√√	√	√√	
Indirect experience	√√	√√	√√	
Goals				
Mission	√√	√√	√√	
Explicitness			√	
Active Involvement	√√	√√	√√	√√
Managerial contribution	√√	√√		
Technical contribution	√√			√√
Foreign technology				
Foreign training	√√		√√	
Written documents	√√			
Accessibility	√√	√√	√√	√√
Trust	√√	√√	√	√√
Similarity knowledge			√√	
Sectors				√√

Notes:
√√ : significant at 0.05 and 0.01
√ : significant at 0.1

As shown in Table 6.13, joint venture and size were significant in general knowledge acquisition but were not significant in product development, technological expertise and manufacturing process. The insignificance of joint ventures and size in the three types of knowledge could possibly be due to the fact that both joint ventures/contractual agreement and small/large firms, provide equal opportunities for the firms to learn about product development, technological expertise and manufacturing process. Whether the firms are involved in joint venture or contractual agreement, they have the same chance to learn the above knowledge. Similarly in small or large firms, both would have the same opportunities to acquire the general knowledge. This information indicates that local firms could set up either a joint venture or contractual agreement and do not have to operate on a large scale to acquire the three types of knowledge. As the significance of joint ventures and firm size in knowledge acquired is not influenced by the three types of knowledge analysed, it is believed that other elements of knowledge acquisition such as marketing expertise, foreign culture and managerial techniques might have some influence on the relationship. Even though they are not analysed, statistically there is an influence from these three types of knowledge on the results of joint venture, firm size and general knowledge.

Learning capacity shows a consistent effect and was strongly significant with all dependent variables, general knowledge acquired, product development, technological expertise and manufacturing process. The significance of learning capacity indicates that it is certainly necessary for the local firms to have a capacity to learn in order to acquire the three types of knowledge from the foreign partner. Without the learning capacity, the local firms would not be able to absorb and digest the product development, technological expertise and manufacturing process provided by the foreign partner. As a consequence, this could slow down the learning process and thus, little knowledge could be acquired. However, the elements of learning capacity show a different pattern with these four types of knowledge. R&D activities was significant in general knowledge acquisition, product development and technological expertise, but it was not significant in manufacturing process. In order to acquire manufacturing process, R&D activities are not important because this knowledge is normally provided directly by the foreign partner. Therefore, it does not require much effort from the local firms to gain this knowledge. Furthermore, the nature of manufacturing process knowledge is slightly different from the other two, product development and technological expertise, as these types of knowledge are more complex for local firms to acquire and for foreign partners to provide compared to the manufacturing process. As a result, more proactive efforts such as R&D activities are needed by the local firms to enable their employees to be involved with and exposed to the new knowledge. On the other hand, R&D expenditure was not significant on all four dependent variables. This is because absorbing knowledge is not dependant on the amount spent on these activities. What seems to matter is some threshold level of R&D activities, which allows knowledge from the foreign partner to be absorbed. Additional R&D expenditure does not lead to more knowledge absorption.

Prior knowledge was significant in general knowledge acquisition and technological expertise, but not significant in product development and manufacturing process. As technological expertise is the most complex and complicated knowledge that needs to be acquired by the local firms, it cannot be absorbed straight away without any basic skills or knowledge about it. Hence, prior knowledge is crucial in absorbing technological expertise compared to the product development and manufacturing process, which is quite straightforward.

In contrast to prior knowledge, flexibility was significant in knowledge acquisition and product development, but not in technological expertise and manufacturing process. Flexibility is a different concept from the prior knowledge, it is strongly linked to the level of bureaucracy and hierarchy in the organization. It is significant in product development because in order to produce a new product, a number of bureaucracies and hierarchies are involved, such as approval for the budget and for the design. Product development could mean either a new product to be introduced or process improvement to be made to the existing product. Both of these activities would require the same process where approval from related divisions are needed before the tasks could be executed. Knowledge of product development can only be acquired when these activities are conducted within the firms. The high level of bureaucracy and hierarchy, which indicates that the firm is less flexible, would slow the process of product development and eventually result in a slow progress of knowledge acquired. Hence, it is essential for a firm to be flexible in order to learn this type of knowledge.

Determination to learn, the final element of learning capacity, also shows a different result from the other two, where it is significant in knowledge acquisition, technological expertise and manufacturing process but not in product development. Determination to learn is a concept that looks into the behaviour of the firm towards the knowledge. Its significance in technological expertise signifies that the firm's intention to learn is critical in order to motivate the employees learning the new knowledge. Local firms must have intention to learn as high investments had been made to gain the new technology. Sometimes the new technology is quite complex and could be different from the existing one. Determination to learn has a stronger influence in manufacturing process than technological expertise. Hence, it is vital to have the intention to learn in manufacturing process knowledge as this behaviour is strongly related to the ability of the firm to exploit the learning potential and the extent of the knowledge that can be transferred.

Overall experience depicts a slightly different picture from learning capacity. Even though overall experience was strongly significant in knowledge acquisition, product development and technological expertise, it was not significant in manufacturing process. Manufacturing process does not require a vast experience from the local firms to acquire knowledge as it can be absorbed directly without any background. Instead, a great deal of experience is critically needed in order to acquire product development and technological expertise. Results of overall experience tend to be influenced by the current experience elements, which include grafting and indirect experience rather than previous experience elements, which includes previous involvement and previous skills. Both previous involvement and previous skills were not influential as both were not significant with all the four dependent variables. This situation occurs possibly because of two factors. Firstly, the previous experience is not essential as most of the time the previous experience that the local firms have is different from the one they are seeking from the foreign partner. Hence, the local partners have to adjust and put aside their previous experience in order to learn the new one, otherwise the learning process will be very slow and confusing. Secondly, as manufacturing industry is quite new in Malaysia, not many local firms have a vast previous experience in collaboration. Despite this, most of them were able to work well with foreign partners and acquire knowledge from them without any major obstacles. Therefore, previous experience is not a prerequisite for the local firms to learn the different types of knowledge from the foreign partner.

On the other hand the current experience elements of grafting and indirect interaction were significant in all three dependent variables except manufacturing process. This occurs because knowledge such as product development and technological expertise require thorough attention and detailed understanding of the subject matter. As grafting and indirect interaction allow a socialisation process for organisational members to take place, it is vital for the local firms to be intensively involved in both activities to ensure the learning process takes place smoothly. Learning the manufacturing process would not require as great involvement as is required in product development and technological expertise. This is because the nature of knowledge is different where normally it involves handling a system that has been set up, thus the socialisation process from the organisational members from both firms is not necessary to extract the knowledge. Most of the manufacturing process knowledge can be written and quite straightforward to understand compared to the other two types of knowledge.

Looking at the goals, the two elements of it depict a different pattern. Understanding of mission was significant with three dependent variables but not manufacturing process while explicitness was only significant with technological expertise. Understanding the organisation's mission is crucial in acquiring product development and technological expertise as it would boost the organisational members' motivation and commitment level to absorb these two types of knowledge. Employees need a higher motivation and commitment in order to learn a more complicated knowledge compared to the manufacturing process, which is less complicated. Technological expertise is the most complicated one, therefore, understanding the mission itself is not sufficient, indeed, clear and unambiguous goals have to be explained and understood to increase the motivation and commitment level of the employees. Without a deep and complete understanding of the mission and goals, the motivation and commitment would be low and as a result, the learning and absorption process would be sluggish.

Similar to learning capacity, active involvement was strongly significant with the four dependent variables. However, the influence of the elements of active involvement varies according to the dependent variable. The significance of active involvement in the four types of knowledge indicates that foreign firms have to be proactive in the relationship with local firms to ensure the knowledge provided could be successfully acquired by them. The proactiveness of the local firms alone is insufficient for them to gain the knowledge from the foreign partner as the source of knowledge comes from them. Managerial contribution was significant in knowledge acquisition and product development but not significant in technological expertise and manufacturing process. Managerial contribution, which involves all management aspects within the organisation such as marketing, managerial, and administration, is highly needed in knowledge that requires a range of processes such as product development. Even though product development virtually requires both technical and managerial contribution, the managerial contribution is more prominent as most of the activities involved in product development such as marketing, budgeting and top management approval are managerial activities. On the other hand, technological expertise and manufacturing process knowledge, which is highly technical in nature, do not require much contribution from the managerial side.

In contrast to the managerial contribution, technical contribution was significant in knowledge acquisition and manufacturing process, but not in product development and technological expertise. As technical contribution measures the contribution of manufacturing technology and support in the relationship, obviously this contribution is vital for local firms to learn the manufacturing process. However, technological expertise and product development do not benefit much from the technical contribution because of its limited scope. Indeed, technological expertise is strongly related to the absorptive capacity and socialisation process within the organisation rather than the availability of manufacturing technology and support.

Foreign technology, which looks at the contribution of technology by the foreign partners and contribution of manufacturing capability by the local firms, has no effect on any of the four dependent variables. This indicates that the local firms' contribution was not limited only to the manufacturing capability, but also to other contributions such as human resource, physical resources and technology. The fourth element of active involvement, foreign training, was significant with knowledge acquisition and technological expertise, but not significant with product development and manufacturing process. As a complicated knowledge, technological expertise could not be simply acquired through merely lectures and observations, in fact it requires more proactive efforts to ensure the employees could grasp the knowledge. Training is the best platform for this knowledge to be acquired as it involves both theories and practical learning through formal classes and hands on experience. On-the-job training is the most effective method for this kind of knowledge. Finally, written documentation was significant only with knowledge acquisition but not with product development, technological expertise and manufacturing process. These three types of knowledge do not usually have a detailed manual as the nature of work is quite broad. There might be a document on general job description particularly in manufacturing process, nonetheless it is not a prerequisite for the employees to grasp the technical knowledge. There is a possibility that the significance of the written document is influenced by other knowledge elements such as marketing expertise, foreign culture and managerial techniques, which are more prone to be in a written form rather than the technical knowledge. Apart from a procedure for handling equipment, technical knowledge is rarely compiled in a document as it is a source of competencies for the foreign firms, therefore, they have to be protective in this matter.

Accessibility shows a consistent effect on knowledge where it was strongly significant with the all four dependent variables. This indicates that access to the foreign knowledge is crucial for the local firms to acquire all kind of available knowledge. Elements of accessibility show a different pattern where trust was significant with all four dependent variables whereas similarity of knowledge was significant only with technological expertise. Trust is confirmed to be a major element in order to acquire all sorts of knowledge as it determines the behaviour and attitude of the foreign partners. A high degree of trust would make the foreign partners more open and willing to provide their skills and competencies to the local firms. As the dependency of the local firms on the foreign partner is high, the willingness to provide the knowledge would facilitate and enhance the learning process, as a result more knowledge either product development, technological or manufacturing process could be successfully gained. Conversely, similarity of knowledge, which looked at the extent of knowledge linked between the partners, is not essential in product development and manufacturing process as these two types of knowledge are less complicated than the technological expertise. A knowledge link that the local firms have would act as a fundamental knowledge for them to learn the advanced knowledge. Without the fundamental knowledge, local firms can hardly gain and absorb the new technological expertise provided by the foreign partner. Hence, in acquiring technological expertise, similarity of knowledge is vital as it provides a basis for the employees to learn and understand the new knowledge.

Type of sectors was strongly significant with manufacturing process but not significant with the other dependent variables. The significance of sectors in manufacturing process reveals that there is a strong connection between the types of industry and the manufacturing process that is involved in the industry. Technological expertise and product development can be acquired regardless of the types of sectors because all the sectors studied are critically keen to learn this kind of knowledge. Hence, all sectors would have the same opportunities to learn these two types of knowledge. However, manufacturing process displays a different behaviour as this kind of knowledge is acquired less in several sectors such as electronic, electrical, and telecommunication. This could be due to the fact that the knowledge learnt was very focused and specific. For instance, in the electronics industry, local firms tend to focus only on a single or related product that uses the same process, therefore, the manufacturing process learnt would be limited to the specific product. Should another product be introduced, the local firms would have to learn the new process for the new product which might need a different set of skills and competences from the locals. In other words, the dependency of knowledge is quite high on the foreign firms for the manufacturing process. Another reason for these three sectors to acquire less knowledge compared to other sectors is because of rapid technology changes in these sectors. Changes in technology means that the manufacturing process also has to be changed, therefore, firms have to cope with the fast changes and learn the process as soon as possible before it becomes obsolete. A limited time in acquiring this knowledge might not allow the local firms to vigorously learn the manufacturing process as this requires a longer period of time. The manufacturing process is considered to be learned successfully when the local firms could operate the capital equipment and manufacture the required products. The local firms will always become a beginner whenever technological change takes place as they have to learn the new knowledge. In other words, the previous knowledge would become irrelevant or less useful, particularly if massive changes take place in the technology. For instance, a massive change that takes place in the telecommunication industry would made the local firms uncertain about their future and regard their current knowledge as not relevant. This is because the firms need to possess the new skills and competencies to compete in the sector. The entrance of other players that posses different technologies into the telecommunication sector such as internet companies, digital imaging companies, software companies, hardware companies and broadcasting, have changed the entire structure of the industry, and as a result have created uncertainties among the firms. Hence, this situation has made firms feel that they lack knowledge and crave the new knowledge, particularly in the manufacturing process as this determines their sustainability in the industry.

Technological expertise and product development can be embedded in the organisation and could act as a principal knowledge to advance the local firms. Indeed, these two types of knowledge can be utilized by the local firms as a source of innovation in the future and thus reduce their dependency on the foreign firms. These two types of knowledge also can bring skills and competencies to the local firms, which eventually would allow them to create their competitive advantage in the industry.

In summary, the findings reveal the various effects of the independent variables on knowledge acquisition, product development, technological expertise and manufacturing process. Even though the effects of the other three elements of knowledge acquisition, which are marketing expertise, foreign culture and managerial techniques are not analysed, this does not mean that they have no effect on knowledge acquisition. It is believed that they also have some effect on knowledge acquisition, however, the degree of their influence might not be as great as the three types that have been analysed. For instance, the significance of joint venture and firm size in knowledge acquisition is believed to be related to either marketing expertise, foreign culture, or managerial techniques as these variables had no statistical influence on product development, technological expertise and manufacturing process. The discussion on the independent variables will continue in the next chapter, which covers the findings on knowledge acquisition and firms' performance.

CHAPTER SEVEN : RESULTS OF THE STUDY ON FIRMS' PERFORMANCE AND KNOWLEDGE ACQUISITION

In analysing the effect of knowledge acquisition on performance, two statistical tests were used, Pearson correlation and censored regression. Pearson correlation was conducted in order to examine the correlation between knowledge acquisition and the performance elements, and to identify the extent of the relationship if they are correlated. A censored regression was conducted to analyse two types of relationships. First, a relationship between knowledge acquisition and performance (including moderating variables). Second, a relationship between the determinants of knowledge acquisition and performance. Performance comprises three elements, they are human resource performance, business performance and general performance. Human resource performance represents accumulated competencies and management skills, which are measured through training and management skills improvement. Business performance represents financial and market achievement such as market share, business volume, planned goals and profitability. General performance represents an evaluation of the common performance of the relationship by both local and foreign partners on the relationship. Overall performance represents the average values of the above three types of performance.

7.1 Performance and Knowledge Acquisition (Univariate Analysis)

A reliability test was conducted on types of performance to examine the consistency of the answer provided by the respondents. Pearson correlation was also conducted on types of performance to examine their relationship to knowledge acquisition. The results are summarised in Table 7.1. These results were used to test Hypotheses 8.

Table 7.1 : Results of Reliability and Pearson Correlation for Knowledge Acquired and Performance

	Human resource Performance	Business Performance	General Performance	Overall Performance
Reliability test (Cronbach alpha)	$\alpha = 0.6254$	$\alpha = 0.7906$	$\alpha = 0.8754$	$\alpha = 0.6361$
Knowledge acquisition (Pearson correlation)	R = 0.694*** N=65	R = 0.339*** N=65	R = 0.430*** N=45	R = 0.677*** N=45

Notes: ***significant at 0.1%
** significant at 0.5%
* significant at 1%

Table 7.1 shows a reliability result, which is represented by alpha values (α) for each type of performance and a univariate analysis using Pearson correlation, which is represented by correlation values (R) for knowledge acquisition and types of performance. The number of observation for human resource and business performance is 65, while for general performance the number of observations is only 45. This is because some of the respondents did not answer the general performance section as they thought that it was not relevant to their firms. Overall performance is an average value from the three types of performance, thus it took the smallest value in the calculation. The results depict that all performance elements, human resource performance, business performance, general performance, and the average performance of overall performance, are positively related to knowledge acquisition. This finding confirms that there is a significant correlation between performance including all its elements and knowledge acquisition. It indicates that the greater knowledge that is acquired by the firms the more the firms' performance will increase, including human resource, business and general performance. Overall performance will also be increased as the three types of performance improve. This result serves as a basis to test the hypotheses developed earlier.

Hypothesis 8: The greater the level of knowledge acquired, the higher the alliance/joint venture's overall performance.

The results reveal that knowledge acquisition has a significant effect on the overall performance. The result shows that knowledge acquisition and overall performance is positively correlated and has a strong relationship. This implies that the more knowledge is acquired, the higher the overall performance of the firms. This is because the greater the knowledge acquired, the more value can be added to the products manufactured. The value added activities learnt would not only enhance the employees' skills and competencies, but more importantly, it increases the value of the products and helps to boost the number of products sold in the market. This means higher sales, more market share and higher profitability by the firms. As a result, overall performance of the firms would increase. This finding supports the view that knowledge acquisition is significant to the overall performance.

Hypothesis 8a: The greater the level of knowledge acquired, the higher the human resource performance.

Table 7.1 shows that knowledge acquisition has a significant positive correlation with human resource performance. This means that the more knowledge that is acquired by the local firms, the greater the firms' accumulated competencies, management skills, and organizational capabilities, thus the better the human resource performance would be. This is because when more knowledge is acquired, more new skills, competencies, and capabilities, are learned by the employees. The activities learned would not only increase the employees' tangible skills and competencies, more significantly, it would also increase their morale and commitment to their work. When these two assets, tangible and non-tangible, are embedded among the employees, it will boost the human resource performance of the firms. Hence, this finding supports the view that the greater the knowledge acquired, the higher the human resource performance.

Hypothesis 8b: The greater the level of knowledge acquired, the higher the business performance.

Table 7.1 shows that knowledge acquisition has a significant positive correlation with business performance. This implies that the greater knowledge that is acquired from the foreign partner, the higher the business volume, market share, planned goals, or profitability would be. The greater knowledge acquired will not only improve the technical skills and competencies, but also the managerial and marketing skills of the employees. When the products manufactured are improved, management becomes more efficient, and marketing strategies become more effective, the profitability and sales volume will grow significantly. A high level of sales, market share and profitability would lead to achieving the planned goals, and this signifies a high business performance. This finding supports the view that knowledge acquisition is significant to business performance.

Hypothesis 8c: The greater the level of knowledge acquired, the higher the general performance.

Table 7.1 shows that knowledge acquisition has a significant positive correlation with general performance. This means that the greater the knowledge acquired by the local firms, the higher the general performance. This is because the new knowledge acquired not only enhances the skills and competencies of the employees, at the same time it also enhances the firms' sales and profitability as well. When these activities show an improvement, the general performance will be evaluated as increasing. This is because general performance represents a management assessment of the common performance of the firms in the relationship. This finding supports the view that the greater the knowledge acquired, the higher the general performance.

Out of the three elements of performance, human resource management displays the strongest correlation relationship with knowledge acquisition. This indicates that the new knowledge gained has a strong link to the employees' skills, competencies, and capabilities. Absorbing this intangible or tacit knowledge will not only result in the accumulation of knowledge, but also leads to the creation of firms' competitive advantage. These capabilities and competitiveness are the core elements that will generate a better environment for the firms to compete and differentiate themselves from their rivals. As a result, business performance is nurtured and encouraged to improve. This snowball effect can be seen in the general performance where a growth in human resource and business performance means there is a development in the general performance.

7.2 Performance, Knowledge Acquisition, and Moderating Variables

The relationship between performance and knowledge acquisition further analysed using a multivariate technique to examine the changes in results when more variables are included. Multivariate analysis was used as it includes not only performance and knowledge acquisition, but also other variables such as moderating variables and the determinants of knowledge acquisition itself. Moderating variables include types of relationship, size of the firms, types of sectors, and cultural differences, while determinants of knowledge acquisition include learning capacity, overall experience, goals, active involvement, and accessibility. Tobit analysis, also known as censored regression, is used in analysing the data as the sample comprises of censored data. A sample is censored when observations at a certain threshold are included in the sample, but the exact values are not known. Once again this analysis is estimated using the statistical software Limdep (Version 7.0). Tobit analysis not only allows all variables to be analysed concurrently, but also enables hypotheses 7 and 8 to be tested in detail. The results of the censored regression are shown in Table 7.2.

Table 7.2: Result of Censored Regression on Performance, Knowledge Acquisition and Moderating Variables

	Human resource Performance	Business Performance	General Performance	Overall Performance
Constant	1.044 (1.452)	1.869*** (3.339)	1.0967 (1.317)	1.508** (2.560)
Joint ventures	0.023 (0.153)	-0.145 (-1.197)	-0.122 (-0.668)	-0.138 (-1.065)
Size	0.044 (0.487)	-0.116 (-1.637)	0.030 (0.293)	-0.029 (-0.394)
Electronic	-0.605 (-1.451)	0.248 (0.764)	0.947** (2.449)	0.226 (0.822)
Electrical	-0.767* (-1.827)	0.273 (0.835)	0.867** (2.138)	0.008 (0.031)
Telecommunication	-0.512 (-1.184)	0.190 (0.565)	1.260*** (2.923)	0.209 (0.688)
Automotive	-0.451 (-0.961)	-0.164 (-0.450)	0.595 (1.337)	-0.057 (-0.181)
Culture	-0.235* (-1.814)	0.160 (1.581)	0.016 (0.101)	-0.048 (-0.429)
Knowledge Acquisition	0.904*** (7.444)	0.335*** (3.572)	0.442*** (3.454)	0.551*** (6.212)
Log likelihood	-55.748	-39.425	-34.634	-18.415
N	65	65	45	45

Notes: t results are in brackets
***significant at 0.1%
** significant at 0.5%
* significant at 1%

7.2.1 Results for Cultural Differences on Performance

Cultural differences were analysed using censored regression to see its effect on each type of performance. Cultural differences are measured by looking at both national culture and organizational culture differences between the employees in the organisation. Table 7.2 summarises the results for cultural differences and performance, these results are used as a basis to test the Hypothesis 7. The outcome is as below:

Hypothesis 7 : Cultural differences between the partners tend to negatively affect the level of performance in the relationship.

Table 7.2 shows that cultural difference has a significant negative impact on human resource performance but is not significant with other types of performance. This indicates that the greater the cultural differences between the local and foreign organisations, the lower the human resource performance. This is because the cultural differences that exist between the local and foreign employees will hinder the effectiveness of the organisational members to acquire new skills and competencies as the interaction and integration process between them might be distorted. If the cultural differences between them can be minimised, it might help them to improve the knowledge acquiring process and eventually increase the human resource performance. This finding supports Hypothesis 7 when applied to human resource performance, however, there is no support for business and general performances as cultural differences are not significant in these two types of performance.

As cultural differences are not significant to the business, general, and overall performance, this implies that cultural differences that exist between the employees will not affect these measure of performance. The impact of cultural differences on business and general performance is not obvious because the activities involved in these two types of performances do not require intense interactions between the organisational members to acquire the new knowledge. Furthermore, in aiming for a higher sales and profits, local firms and foreign firms share the same values. However, this situation is unlikely to happen in human resource performance because learning skills and competencies not only require an intense integration and interaction from both local and foreign employees, it also involves sensitivity of culture as it is embedded in their norms and values. The cultural clashes that exist will slow the social effectiveness and reduce the ability to learn and absorb the knowledge as it creates misunderstanding and minimises the flow of information and knowledge.

7.2.2 Results for Knowledge Acquisition on Performance

Table 7.2 shows the results for knowledge acquisition and performance using the censored regression technique, which includes moderating variables (multivariate analysis), while Table 7.1 shows the results for knowledge acquisition and performance using Pearson correlation (univariate analysis). Table 7.2 shows that knowledge acquisition is significant and positive with all performance variables. These findings are consistent with the univariate results where knowledge acquisition is positively correlated with all the performance variables. Both univariate and multivariate analysis support the hypotheses below:

Hypothesis 8: The greater the level of knowledge acquired, the higher the alliance/joint venture's overall performance.

Hypothesis 8a: The greater the level of knowledge acquired, the higher the human resource performance.

Hypothesis 8b: The greater the level of knowledge acquired, the higher the business performance.

Hypothesis 8c: The greater the level of knowledge acquired, the higher the general performance.

The findings signify that the greater the knowledge acquired from the foreign partner, the higher would be the human resource, business, general, and overall performance. The knowledge acquired by the local firms will not only boost the skills and competencies of the employees, but will also enhance their sales, market share and profitability. As these two performances are interrelated, the development of human resource performance will generate a positive impact on the business performance. When human resource and business performance, which are the key elements for performance are significantly improved, the general performance will experience a domino effect and will experience a significant improvement. Hence, a rise in human resource and business performance will increase the firm's general performance as well. As the three major elements of performance are improved, when greater knowledge is acquired, the overall performance will also experience a similar outcome as it represents the average value of the three elements. Thus, performance will improve significantly when greater knowledge is acquired.

7.2.3 The Effects of Moderating Variables on Performance

Table 7.2 also shows the results on performance of moderating variables, which include joint ventures, firm size, and types of industry sectors. Joint ventures and firm size do not show a significant effect on any type of performance. This reveals that either joint venture or contractual agreement, large or small firms have equal opportunities to increase the firms' human resource, business, general and overall performance. Regardless of the mode and firm size selected by the firms in establishing their relationship, they can still attain the skills and competencies provided by the foreign partner, simultaneously improve their sales and profitability, and eventually increase their general performance.

In terms of industrial sectors, the result varies depending on the sector. The electronics and telecommunication sectors show a significant contribution in general performance, while the electrical sector shows a significant contribution in both human resource and general performance. The positive effect that the electronic and telecommunication sectors have on general performance implies that given the amount of knowledge acquired, the effect on general performance is greater in these two sectors compared to the automotive and base sectors. The electrical sector depicts a different pattern compared to the above two sectors as it has a positive influence on the general performance but a negative influence on human resource performance. This positive influence indicates that, given the amount of knowledge acquired, general performance will experience a greater effect in the electrical sector compared to the automotive and base sector, whereas human resource performance will experience less effect in the electrical sector compared to other sectors such as the electronic, telecommunication, automotive and base sector. However, all these sectors do not show any significant impact on business and overall performance.

Looking at performance as a whole, which is represented by overall performance (Table 7.2), apparently performance is strongly affected by knowledge acquisition. This result confirms the correlation results between the two variables, therefore, supporting Hypothesis 8. This implies that given the amount of knowledge acquired, this will have a positive impact on overall performance which will experience an improvement. The elements of performance, which include human resource, business and general performance have a common result in terms of their relationship with knowledge acquisition where all of them show a strong positive relationship. This indicates that all performance elements will improve when knowledge is acquired from the foreign partners.

The elements of performance show some variation in the relationship with other moderating variables. Human resource and general performance display a different picture with respect to the significance of moderating variables: industrial sector and cultural difference while business and overall performance display the same pattern. The electrical sector and cultural difference show a significant negative effect with human resource performance while electronic, electrical and telecommunication sectors shows a significant positive effect with general performance. The result for human resource performance signifies that given the amount of knowledge acquired, the impact of knowledge is less obvious in the electrical sector compared to other sectors and base sector. This could be due to the fact that electrical sector particularly power cable firms require higher skills and competencies from the locals. However, currently the sector is still lacking in both skills and competencies among the locals, which has slowed the learning process, thus affecting the human resource performance. The negative results in cultural differences indicate an inverse relationship between the two variables. The greater the cultural difference between the local firms and foreign firms, the lower the human resource performance. This is because cultural difference can lead to conflictual and unproductive behaviours among organisational members, which eventually reduce the firms' efficiency and effectiveness.

On the other hand, general performance experience some influence from the types of sectors but not from other variables. The impact on general performance is greater compared to other types of performance particularly in electronic, electrical and telecommunication sectors. The impact on general performance in other sectors like automotive and base sector is not obvious. The reason is these three sectors encountered an improvement in their operations and execution of tasks when knowledge is acquired. These improvements might not be as apparent as human resource and business performance, but indeed, it does contribute in enhancing the firms' performance. Hence, the general performance of the firms will increase.

Unlike in human resource performance and general performance where moderating variables showed some effect, business and overall performance did not show any significant effect from moderating variables. This means that the moderating variables such as joint ventures, firm size, types of sectors and cultural differences do not have any influence on business and overall performance. Hence, firms do not have to consider these factors in assessing their business and overall performance. Nonetheless, the effect of these moderating variables tend to change when knowledge acquisition is analysed in detail using its determinant factors which include learning capacity, overall experience, goals, active involvement and accessibility. Further discussion on this is in the next section.

7.3 Results of the Determinants of Knowledge Acquisition on Performance

In identifying the significance of each knowledge acquisition determinant, the relationship between performance and the determinants of knowledge acquisition was examined. A censored regression is once again used to see the effect on performance of the moderating variables and knowledge acquisition determinants. This analysis is similar to that reported in Table 7.2, however the knowledge acquisition variable has been substituted by its determinants, which include learning capacity, overall experience, goals, active involvement, and accessibility. This analysis includes all types of performance, moderating variables and the determinants of knowledge acquisition. When knowledge acquisition is represented by its determinants, the result reveals some changes in the impact of the moderating variables. The results for this analysis are summarised in Table 7.3.

Table 7.3: Results of Censored Regression on Performance and Determinants of Knowledge Acquisition

	Human resource Performance	Business Performance	General Performance	Overall Performance
Constant	1.059 (1.178)	0.844 (1.514)	1.390* (1.810)	1.538** (2.545)
Joint ventures	0.080 (0.472)	-0.281*** (-2.640)	-0.415** (-2.512)	-0.283** (-2.193)
Size	0.017 (0.181)	-0.094 (-1.579)	-0.035 (-0.393)	0.0958 (-1.355)
Electronic	-0.605 (-1.331)	0.085 (0.304)	0.669** (1.978)	0.035 (0.132)
Electrical	-0.677 (-1.491)	0.180 (0.638)	0.853** (2.372)	0.006 (0.021)
Telecommunication	-0.220 (-0.451)	0.151 (0.499)	0.908** (2.278)	0.066 (0.212)
Automotive	-0.354 (-0.689)	-0.278 (-0.875)	0.772** (1.961)	0.053 (0.171)
Culture	-0.346** (-2.479)	0.247*** (2.849)	-0.032 (-0.246)	-0.109 (-1.053)
Learning capacity	0.337* (1.700)	-0.406*** (-3.287)	-0.702*** (-3.319)	-0.293* (-1.779)
Overall experience	0.197 (1.536)	-0.024 (-0.310)	-0.239* (-1.863)	0.059 (-0.595)
Goals	-0.031 (-0.197)	0.430*** (4.393)	0.476*** (3.653)	0.285*** (2.805)
Active involvement	1.048*** (5.067)	0.572*** (4.483)	0.822*** (4.853)	0.804*** (6.060)
Accessibility	-0.327** (-2.080)	0.073 (0.757)	0.181 (1.427)	0.031 (0.316)
Log likelihood	-53.782	-23.883	-22.422	-10.616
N	63	63	43	43

Notes: t-test results are in brackets
***significant at 0.1%
** significant at 0.5%
* significant at 1%

7.3.1 Human Resource Performance

Table 7.3 shows the results for human resource performance. The inclusion of knowledge acquisition determinants in the relationship reveals that human resource performance received some impact from the determinants.

Considering the determinants of knowledge acquisition, learning capacity and active involvement have a significant positive effect on human resource performance, whereas accessibility has a significant negative effect on human resource performance. The positive influence of learning capacity and active involvement signifies that the greater the locals firms' capacity to learn from the foreign partners and the more active the partners are, the greater the effect on human resource performance. When more knowledge is absorbed and foreign partners actively participate in the organisation, dissemination of knowledge is taking place. This situation allows firms to improve their workforce competencies, management skills and organisational capabilities. Hence, the employees' know-how will improve and human resource performance will be enhanced. The negative effect that accessibility has on human resource performance is explained by the major element of accessibility, degree of knowledge protectiveness. A high degree of protection in knowledge by the foreign partner will slow the process of acquiring knowledge, thus reducing the human resource performance. On the other hand, a low degree of knowledge protection means that more knowledge can be acquired from the foreign partner, thus increasing the human resource performance.

As in the previous relationship with knowledge acquisition, human resource performance displays the same result with respect to cultural differences. Human resource performance is negatively affected by cultural differences, which indicates that the human resource performance will decrease with the existence of cultural differences. Cultural differences tend to have a profound effect on human resource performance as the differences affect the personal, interpersonal, group and inter-group dynamics involving employees. These differences are often expressed in the form of conflictual behaviour between the foreign and local partners. The combination of the different environments has caused a culture collision and produces cultural shock. The cultural shock will disrupt the operational performance of the organisation and results in a poor human resource performance.

Other knowledge acquisition determinants like overall experience and goals do not have any influential impact on human resource performance. Therefore, human resource performance will not experience any significant changes compared to other knowledge determinants like learning capacity, active involvement and accessibility. Human resource performance is not affected by joint ventures, size of the firms and types of sectors. This indicates that these moderating variables will not trigger any change in human resource performance even when they take place in the organisation.

7.3.2 Business Performance

The inclusion of knowledge acquisition determinants changes the outcome on business performance compared with Table 7.2. There is now some effect from joint ventures, cultural differences, learning capacity, active involvement and accessibility. Cultural differences, goals and active involvement appear to have a positive effect on business performance, while joint ventures and learning capacity appears to have a negative effect on business performance. The positive influence that cultural differences, goals and active involvement have on business performance imply that the greater the cultural differences, the more understanding of goals and the more active the foreign partners are, the better the business performance. Despite the cultural collision and cultural shock, which negatively affects human resource performance, cultural differences reveal a contrasting effect on business performance. It positively affects business performance by encouraging the sales volume, profits, and employees' productivity to grow. At first sight this appears counterintuitive. In working to achieve the business performance, the cultural differences between the organisations are constructively utilised as the blend of different environments enable firms to improve their business, corporate and marketing strategies. A restructuring in business, corporate and marketing strategies not only will make the strategies more effective, but also result in better performance of sales, profits and productivity. Hence, this will enhance the business performance. Business performance, which involves a lot of financial aspects tends to be quite universal and commonly shared by any culture, thus cultural sensitivity is less obvious within the organisation. In contrast, human resource performance, which involves personal and interpersonal relationships tends to be culturally bounded and sensitive as the relationship varies among the cultures. As a result, cultural differences depict a different effect on different types of performance.

Business performance will also rise when firms have a better understanding of the goals and mission of the relationship. An understanding of goals and mission will allow firms to assess the actions of its members and their output performance, therefore enable them to create their own plans and goals concurrently. This situation can generate the organisational members' freedom and flexibility in the organisation. The achievement of the organisational members' own goals will eventually be reflected in the organisational goals, which will boost the business performance. Active involvement will also significantly affect the business performance through managerial contribution, technical contribution, training, foreign technology and written documents. These key elements allow firms to have a means of conveying the information as it is a substance for knowledge creation. The socialisation and internalisation of knowledge from these factors will contribute to acquiring more knowledge, which eventually leads to higher sales and profits within the firms.

Joint ventures has a negative influence on business performance. This negative influence implies that contractual agreement rather than joint ventures tend to have higher business performance. This situation emerges possibly because contractual agreement involves less cost of investment compared to joint ventures, thus, the return of investment or profits can be gained faster than firms that have a higher investment costs. The profits earned would encourage the business performance to grow significantly. Contractual agreement rather than joint ventures also benefits from the local partner in terms of familiarity with local market conditions such as government policies, local economy and culture (Makino & Delios, 1996). This information not only facilitates the strategy formulation process, but also would make the strategy more precise and effective.

Learning capacity has a negative effect on business performance, which indicates that a high learning capacity will lower the business performance. This is possible as learning capacity will encourage the absorption of knowledge, which directly improves the firms competencies and skills. However, this knowledge need not have an immediate impact on the firm's sales volume, market share and profitability as these factors will be influenced by business and corporate strategies. Firms' might have high skills and competencies in the technology, but if their business and corporate strategies do not match their competencies, business performance cannot be improved (Personal Comm. 1, 2002). The blend of competencies and strategies is essential to create synergy and determine the firms' business performance and competitiveness in the market. For this reason, learning capacity is not expected to have a direct effect on performance. However, the result is quite surprising as it shows a negative effect. Some clues were gained for this result from the details of the interviews on tacit knowledge in the next chapter.

Factors like size of the firms, types of sectors and other knowledge acquisition determinants like overall experience and accessibility, did not reveal significant influence on business performance. Firm size and industrial sectors apparently do not affect the business performance. Similarly, overall experience and accessibility did not show any significant effect on business performance.

7.3.3 General Performance

General performance depicts a different pattern of significance compared to human resource and business performance previously discussed. General performance is affected by most moderating variables and knowledge acquisition determinants. Joint ventures, types of sectors and all knowledge acquisition determinants except accessibility, evidence a significant effect on general performance. Types of sectors, goals and active involvement have a significant positive impact on general performance. Joint ventures, learning capacity and overall experience have a significant negative impact on general performance. The influence of goals and active involvement imply that the greater firms' understanding of goals and the greater the foreign partners' involvement within the firm, the greater the impact on general performance. Similar to business performance, the general performance appears to be greater when goals are explicitly documented and understood by the organisational members. This circumstance will allow them to know what is the mission and expectations from the organisation in order to achieve the ultimate goals. As a result, the assessment of the accomplishment of the goals can be easily conducted, therefore, performance of the desired outcome can be improved. Consequently, there is a tendency that general performance can be encouraged. General performance also appears to be affected when foreign partners are actively involved in the organisation. The effects are derived from the contribution of foreign partners in terms of sales or marketing support, managerial resources, administrative support, product-related technology, manufacturing-related technology, training and documentation. All these factors provide a platform for the local partners to obtain the knowledge and ultimately enhance the general performance.

Four sectors show a strong significant positive effect on general performance: electronic, electrical, telecommunication and automotive, relative to the base sector which involves the plastic and chemical sectors. The inclusion of knowledge acquisition determinants has changed slightly the result compared to the relationship that merely involved knowledge acquisition. Industrial sectors: electronic, electrical and telecommunication but not automotive and base sector, shows a greater effect with respect to general performance. Electronic, electrical, telecommunication and automotive sectors would experience a higher general performance when they acquire knowledge from their partners. In terms of joint ventures, similar to business performance, the effect on general performance is also more significant in contractual firms rather than joint venture firms. General performance is better when firms engaged in contractual agreements as this relationship can reap the benefits from the local partner through their local market knowledge faster than joint ventures. This is because contractual agreement does not have to focus much effort in investing and establishing the operations from the beginning as joint ventures do. Instead, they can straightaway focus on manufacturing the products and market them to the customers using the local market knowledge. Hence, general performance tends to be more significant in contractual firms.

General performance is negatively affected by learning capacity and overall experience. This signifies that the higher the learning capacity and overall experiences, the lower the general performance. The negative impact of learning capacity on general performance is quite unclear at this stage, but clues were gained from the analysis of the influences on tacit knowledge reported in the next chapter. This is because the absorption capability that firms have is directly linked to the tacit knowledge, which influences intrinsic factors like skills and competencies rather than extrinsic factors like sales and profits. The impact of learning capacity is not only negative on general performance, but also on business and overall performance. Similarly with learning capacity, the influence of overall experience also is negative in general performance. The reason for overall experience can be derived from two factors. First, is the difference of previous and present experience that the local firms have which might lead to a confusion and new adjustments. As a result, the effect is not apparent on general performance. The second reason is the grafting and indirect interactions (elements of overall experience) is tacit in nature, therefore, the output is very difficult to be seen and measured explicitly. Hence, the influence of the overall experience is negative on general performance.

Moderating variables like size and cultural differences did not show any effect on general performance. Hence, small or large firms and the existence of cultural differences between local and foreign partners will not have much influence on general performance. Looking at the knowledge acquisition determinants, accessibility is the only factor that did not show any impact on general performance. Other factors like learning capacity, overall experience, goals and active involvement depicts an effect on general performance but with different signs on the coefficients. This implies that given the amount of accessibility the local firms have, the general performance will not experience much changes.

7.3.4 Overall Performance

The results in Table 7.3 show that overall performance is affected by three knowledge acquisition determinants and moderating variables, but the pattern of impact is distinct. Goals and active involvement have a positive effect on overall performance, while joint ventures and learning capacity have a negative effect on overall performance. The pattern of significance in overall performance is similar to the business performance. The significant positive relationships indicate that an understanding of goals and foreign partners' active involvement contribute to an improvement in overall performance of the firms. The understanding of goals will boost the organisational members' freedom by setting their own target to achieve the organisational goals, as a consequence, the overall performance will be positively affected. The active involvement of the partners will encourage high interaction between the organisational members, thus increasing the internalisation of knowledge. The internalisation of knowledge is proved when firms are able to improve their productivity or other kind of output, thus encouraging the growth of overall performance.

The negative effect of joint ventures on overall performance indicates that overall performance is most likely to be improved in contractual arrangements rather than joint venture firms. The reason is due to high investment costs that joint venture firms have to incur, which reduce the benefits gained from the relationship. Contractual relationships require less investment cost, therefore, they enjoy the benefits faster than joint ventures and this is depicted in overall performance. Similar to business and general performance, given the amount of knowledge acquired, the influence of learning capacity is less obvious in overall performance. The reason is the knowledge acquired through absorptive capacity leads to the acquisition of tacit rather explicit knowledge. Tacit knowledge cannot be measured and seen explicitly, a transformation process is required in order to utilize the benefits derived from this knowledge. This tacit knowledge is not portrayed in overall performance, thus the influence of this factor is not apparent in this performance.

Moderating factors like size, types of sectors and cultural differences did not show any significant effect on the overall performance. This means that given the size, sectors and amount of cultural difference that exists in the organisation, the overall performance will not be significantly affected. Similarly, knowledge acquisition determinants, overall experience and accessibility do not significantly affect the overall performance.

7.4 Conclusion

By and large, knowledge acquisition has a positive effect on performance and its three elements: human resource, business and general performance. Results from univariate and multivariate analysis support the view that knowledge acquisition positively contributes to improved performance. With performance as the dependent variable, moderating variables, knowledge acquisition and determinants of knowledge acquisition show a different impact on the performance elements, namely human resource performance, business performance and general performance. Human resource performance is positively affected by learning capacity and active involvement but negatively affected by cultural differences and accessibility. In contrast, business performance is positively affected by cultural differences, goals and active involvement while negatively affected by joint ventures and learning capacity.

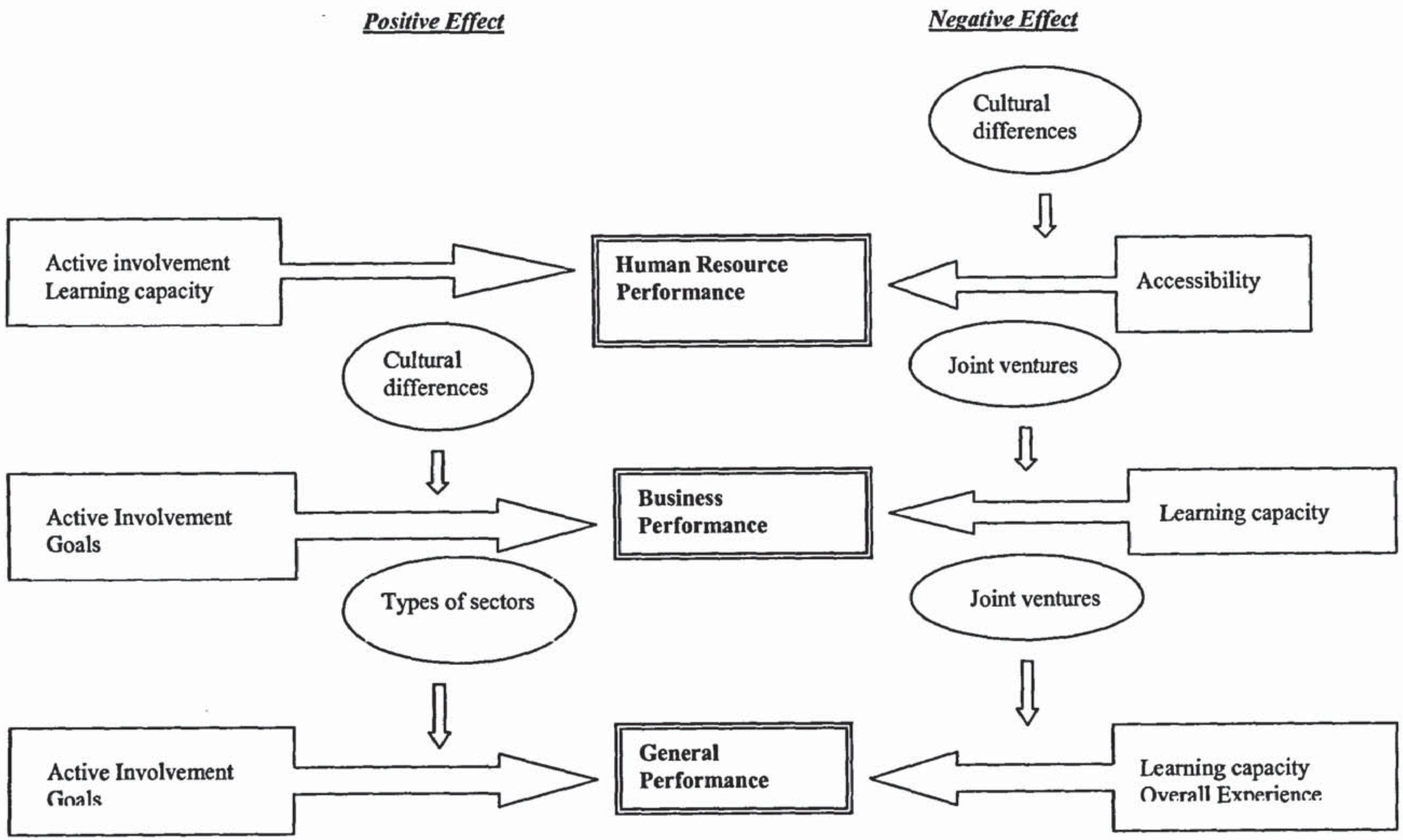
Almost all moderating variables and knowledge acquisition determinants showed a significant effect on general performance. Type of sectors, goals and active involvement have a positive impact on general performance whereas joint ventures, learning capacity and overall experience have a negative impact on general performance. Goals and active involvement have a positive influence on overall performance, while joint ventures and learning capacity have a negative influence on overall performance. The effect of the variables on the three types of performance is summarised in Table 7.4 and Figure 7.1.

Table 7.4 : Impact of Variables on Types of Performances

Types of performance	Positive impact	Negative impact
Human Resource Performance	Learning capacity Active involvement	Cultural differences Accessibility
Business Performance	Cultural differences Goals Active involvement	Joint ventures Learning capacity
General Performance	Types of sectors Goals Active involvement	Joint ventures Learning capacity Overall experience

The findings contribute to the refinement of the conceptual framework, which was developed earlier. The findings tend to show that goals and especially active involvement of partners are the key elements in improving performance. Interestingly, learning capacity only has a positive effect on human resource performance. So learning capacity is vital in acquiring knowledge from the foreign partner (knowledge acquisition result), but not in transforming the knowledge into better performance. Initially, only cultural differences were predicted to have effects on performance but not other moderating variables such as joint ventures and types of sectors. However, the results reveal that not only are cultural differences significant to the performance, but also type of relationship established and types of sectors also have effects on performance. Size, on the other hand, has no impact on performance. The discussion of the findings will continue in the next chapter but the emphasis is on the tacit knowledge. This discussion will support some of the empirical findings that have been examined in the previous chapters.

Figure 7.1 : The Effect of Knowledge Acquisition Determinants and Moderating Variables on Performance



CHAPTER EIGHT: RESULTS OF THE STUDY ON TACIT KNOWLEDGE

8.1 Analysis on Tacit Knowledge

In elaborating about knowledge, all aspects that comprise this subject need to be evaluated. As Polanyi (1966) classified knowledge into two types, explicit and tacit knowledge, it is essential for this study to assess knowledge acquisition in terms of both aspects. Polanyi (1966) states that individuals appear to know more than they can explain and this unexplained knowledge is tacit. Tacit knowledge is embedded in individuals and the only way to learn is through experience. The explicit part of knowledge has been discussed thoroughly in the previous chapters and statistical analysis was presented based on explicit knowledge questionnaire (first questionnaire). This section will cover the second part of knowledge (second questionnaire), which is tacit knowledge and it will be analysed differently from the explicit knowledge. Further explanation on tacit knowledge literature and its relation to knowledge acquisition process was carried out in chapter two.

Since tacit knowledge is harder to acquire, and individuals can only obtain it from direct experience (Polanyi, 1966), this type of knowledge requires a different form of analysis compared to the explicit knowledge. In gathering the required data, personal interviews were conducted with the local firms' key managers who have direct involvement with foreign partners. The interview questionnaire was set to be semi-structured for two reasons. First, is to ensure that the interview covers tacitness issues of involved independent variables such as learning capacity and accessibility. Second, it provides an opportunity for the researcher to explore other possible elements that might not be yet known from literature. The interview was recorded by dictation machine and was also written down at the same time to ensure information gathered is not missed out. In analysing the information, two type of findings is presented. First type of findings comes from the structured data, which allows findings to be analysed descriptively. Second type of data, which is unstructured data was qualitatively analysed. Unstructured data was analysed systematically using four major steps suggested by the literature (Hawe et al. 1990; Creswell, 1998). Firstly, data was organised where the data was put into an easy format to work with. This step allows the researcher to have an overall picture of the complete data set.

Secondly, the data was shaped into information where the researcher assessed what are the types of themes coming through. This analysis was done by sorting the information. The different categories or types of responses found were noted down and they were separated into groups that share similar characteristics. The third step involved interpreting and reorganising the categories. Sometimes it was necessary to summarise the information at this step. The fourth step involved explaining the information, which is discussed at length in this chapter. Because the qualitative information is to support the quantitative results, the qualitative information is also compared with the empirical quantitative findings before the conclusions and assumptions on the tacitness of knowledge are reached.

8.2 Tacit Knowledge Variables

As both explicit and tacit knowledge are equally important in knowledge creation (Inkpen,1996), both types of knowledge have to go hand in hand. While the first questionnaire covered the explicit elements, the second questionnaire covers the tacit ones. Even though both questionnaires focus on the determinants of knowledge acquisition, elements that are purely tacit and cannot be made explicit were covered in the second questionnaire.

Since the nature of tacit knowledge is very different from explicit knowledge, the elements used to evaluate it are also dissimilar. Tacit knowledge, which can only be obtained by internal individual processes like experience, reflection and individual talents, cannot be managed and taught in the same manner as explicit knowledge (Haldin-Herrgard 2000). Different types of questions were posed to understand the transfer of tacit knowledge. Zander & Kogut (1995) argue that know-how of the organization is tacit and difficult to be transferred and imitated. However, the transfer can be made possible if the know-how can be simplified and communicated to others (Winter, 1987; Rogers, 1983). They proposed a construct for tacit knowledge includes codifiability, teachability and system dependence. Codifiability refers to that knowledge which can be encoded, teachability refers to the extent of training, and system dependence refers to the extent of dependency in terms of capabilities on experienced people. Based on this argument, questions regarding them were designed and reconstructed to suit the Malaysian context and environment.

In simplifying the terminology to help respondents understand the variables, these three variables were renamed as "manufacturing control", "learning methods" and "dependency". Codifiability is named as manufacturing control in this study. This question was designed to identify the encoding process involved in simplifying the tacit knowledge to the local firms. Teachability is named as learning methods and is designed to identify the techniques adopted to acquire the knowledge. Finally, system dependence is named as degree of dependency and is constructed to discover the level that local firms depend on foreign partners. The degree of dependency (system dependence) is used for evaluating dependency, while manufacturing control (codifiability) and learning methods (teachability) are used for evaluating accessibility.

Other tacit elements that are needed to evaluate tacit knowledge have also been proposed by Inkpen (1998). Elements such as the usefulness of capabilities, extent of access, extent of trust, and organizational changes in organizational systems and process are also used to evaluate the tacit variables (Inkpen, 1998). Usefulness of capabilities helped to evaluate the foreign capabilities, extent of access and trust helped to evaluate accessibility and organizational changes in organizational systems and processes helped to evaluate organizational effects. These elements together with elements proposed by Zander & Kogut (1995) are used to develop the construct for tacit knowledge in the present study.

In summary, the elements in tacit knowledge are classified into four major constructs; dependency, usefulness of capabilities, accessibility and organizational effects. Details of the elements used in evaluating tacit knowledge are summarised in the Table 8.1.

Table 8.1: Tacit Knowledge Variables

Types of Variables	Elements	Additional questions
Dependency	Extents of dependency Areas of dependency	Reason for dependency Actions to counter dependency
Usefulness of capabilities	Extent of usefulness	How it becomes useful

Accessibility	Extent of access Extent of trust	How it becomes useful How it is accessed What knowledge can be accessed Actions to counter the problem
Manufacturing control	Manuals Standard software Specific sotware	Other forms of control
Learning methods	Communicating Training	How the method was conducted Other methods
Organizational effects	Extent of changes in organizational systems Extent of changes in organizational process	How significant are the changes to the firms

8.2.1 Dependency and Capabilities

On the whole, the second questionnaire attempts to cover all relevant tacit elements. Therefore, it was divided into three sections; dependency, accessibility and organizational effects. Dependency includes questions on degree of dependency to the foreign partner, areas of dependency and usefulness of foreign partners' capability (Zander & Kogut, 1995; Rogers, 1983; Winter, 1987). Degree of dependency describes the extent of dependency on the foreign partner, reasons for the dependency, areas that firms depend on and actions that have been taken by local firms to counter the dependency. In addition to Kogut & Zander (1995), Inkpen (1998) argues that firms that use alliances for knowledge they cannot generate on their own may continue to depend on the partner and acquire less knowledge. Hence, it is crucial to analyse dependency in order to know the level of knowledge acquisition. Usefulness of the capability describes the significance of the foreign capabilities to the local firms and the extent of its utilization. The usefulness of partners' capabilities is important in creating a successful learning environment (Inkpen, 1998). This learning environment is a fundamental ingredient in facilitating the transfer of knowledge (Huber, 1991). Knowledge or capabilities can only be acquired when partners learn from each other, otherwise knowledge is impossible to be transferred. Harrigan (1988) stressed that acquisition of knowledge or capabilities can only be done through organizational learning. Huber (1991) points out that when a firm obtains knowledge and recognises it as useful, the process or organizational learning has occurred within the firm.

8.2.2 Accessibility

Inkpen (1998) argues that accessibility is a vital factor in knowledge acquisition. In order for knowledge to be acquired, it has to be accessed. However, accessibility to the foreign knowledge is not a guarantee that knowledge has been acquired. The acquisition of knowledge will depend on the firm's learning efforts and the extent that it internalises the knowledge in its operations (Inkpen 1998). Questions regarding accessibility include the degree of trust in the foreign partner (Inkpen 1998) , easiness of knowledge accessed (Inkpen 1996, 1998), types of manufacturing control (Zander & Kogut, 1995) and methods of learning adopted from the foreign partner (Harrigan, 1998; Huber, 1991; Fiol & Lyles, 1985; Lyles, 1988, Lawson & Lorenz, 1999). Trust is a central element in accessibility, low trust would increase the partners' protectiveness while high trust would reduce the partners' knowledge protectiveness (Inkpen, 1998), thus knowledge is more accessible. Even though trust was included in the first questionnaire, this element reappears in the second questionnaire as the first questionnaire did not cover the reasons for developing trust and how firms rectify the trust related problems. Easiness of knowledge accessed attempts to describe the extent of easiness of access, how the knowledge is being accessed and what kind of knowledge can be accessed. This question is asked in order to identify the extent of protectiveness from the foreign partner and the potential of competitive overlap between the partners (Inkpen 1998). This question is designed to support the trust question. Meanwhile, manufacturing control attempts to identify what form of control is adopted in the manufacturing process, this reflects the extent of knowledge that has been encoded and communicated to the partner (Zander & Kogut, 1995). The easier the knowledge can be prepared, the faster it can be communicated and accessed. Methods of learning attempt to identify which techniques are commonly adopted and which techniques would ease the access process. Zander & Kogut (1995) refer to this as teachability, while Richter & Vettel (1995) refer to this as learning modes.

8.2.3 Learning Methods and Organizational Effects

Argyris & Schon (1978) emphasize that individual learning is necessary for organizations to learn. In fact, Senge (1996) asserts that organizations learn through individuals and it can occur at three levels, individual, team and organizational. Inkpen (1996) claims that among the key methods to successful learning and effective knowledge acquisition are meetings, regular visits by parent employees, tour to the parent company, local-foreign partner interactions, and personnel movement. However, Marquadts (1994) cautions that team learning differs radically from team training. High level team learning permits collective thinking, communication, creative and constructive working to develop. The final section was posed based on Nonaka (1994) and Hedlund & Nonaka (1993) on knowledge acquisition. They argue that knowledge acquisition is an organizational process and can only be acquired when it is internalised at various organizational levels (Von Krogh, Roos & Slocum 1994). This organizational process would initiate more learning opportunities and enhance the learning effectiveness. A few changes in the organizational systems and process would reflect a low knowledge acquisition by the local partners, while if many changes occur this would reflect a high knowledge acquisition.

The closed-ended section in the second questionnaire permits data to be statistically analysed. It was analysed using the statistical package known as SPSS Version 11.0. The answers were recoded before it was coded into the program in order for it to be analysed. Using the SPSS, a reliability test for the questions was conducted for the closed-ended questions to identify its level of consistency. The result reported as the Cronbach alpha value, shows that alpha is 0.7055, which is acceptable. This indicates that respondents tend to have a good understanding of the questions that were posed, thus the answers provided could be considered as reliable. The open-ended section permits descriptive analysis and is discussed in the following sections.

8.3 Results for Dependency

Table 8.2 summarises the results for dependency of local firms on foreign firms in their relationship, it covers issues related to dependency such as degree of dependency, areas of dependency and methods to reduce the dependency.

Table 8.2: Result of Frequencies on Firms' Dependency

Variables	Items	Frequency (%)	Cumulative
Degree of dependency	Highly dependence	31.0	31.0
	Dependent	50.0	81.0
	Some dependence	14.3	95.2
	Little dependence	4.8	100.0
Areas of dependency	Core activities	66.7	66.7
	Marketing activities	2.4	69.0
	Technical activities	28.6	97.6
	Others	2.4	100.0
Usefulness of foreign Capabilities	Highly useful	42.9	42.9
	Useful	42.9	85.7
	Some useful	11.9	97.6
	Little useful	2.4	100.0

8.3.1 Local Firms' Dependency

Table 8.2 shows that 81% of the sample firms depend on their foreign counterparts and only 4.8% do not rely much on their foreign partner. These figures indicate that most of the local firms are heavily dependent on the foreign partner for some aspect of knowledge. Inkpen (1998) claimed that even though firms involved in strategic alliances seek knowledge, not all of them are determined and proactive to acquire knowledge. They often fail to initiate learning efforts and aggressively seek the partners' knowledge. The high dependency that was depicted by the local firms could possibly be related to this phenomenon. Despite having opportunities to access the resources and efforts of foreign partners, they did not fully capitalize on them, leading to slow learning. When firms use the relationship (joint venture or contractual agreement) to acquire knowledge, this means that the firms place low value on knowledge acquisition (Inkpen, 1998), and the firms tend to remain dependent. In this circumstance, if the relationship is terminated, the knowledge of the dependent firms most likely will be eroded (Inkpen,1998). Based on the results, Malaysian high technology manufacturing firms might experience the above situation, which leads to high dependency on the foreign partner. This dependency and poor learning are regarded by Senge (1990) as firms 'learning disabilities'. He recognised that many organizations experienced this phenomenon and suggested that the only way for firms to overcome this problem is by being a learning organization. In order for local firms to acquire the knowledge, it has to be created. Nonaka &Takeuchi (1995) stress that knowledge can only be created when there is an interaction between two kinds of learning, obtaining know-how in order to solve a specific problem and establishing new premises in order to override the existing one. These two kinds of learning are known as single-loop learning and double-loop learning (Argyris & Schon 1978; Bateson 1973). The interaction of these two types of learning is quite unclear in the alliances between the local firms and foreign partners. Lacking concentration in these two specific learning steps might contribute to poor learning and high dependency phenomenon. Malaysian firms have to find ways to improve their learning and lowering their dependency, thus boosting the level of knowledge acquired.

8.3.2 Areas of Dependency

From the feedback received, locals firms are prone to depend on core and technical activities rather than other activities. As Table 8.2 also shows, 66.7% of local firms depend on core activities and 28.6% depend on technical activities. From the personal interviews conducted, local firms have an understanding that core activities are similar to the technical activities, however, for the purpose of assessing them into categories, they are keep separated. The above understanding exists because technical activities are considered a major element in the firms' business operations and are always treated as core activity.

From the interviews, it can be concluded that there are three reasons for the local firms to rely on their foreign partners, of which the first two, are the most important. Firstly, local firms depend on their foreign counterpart when none of the local firms in the country can provide the kind of knowledge that they require. The technical knowledge is the most required knowledge from the foreign partner because the knowledge cannot be obtained from other local firms. For instance, all fourteen Malaysian firms that were interviewed and involved in the power cable sector such as supplying electric power, producing fibre optics, producing switch gear and cable design have to seek knowledge from the foreign firms because no local firms have such knowledge. The partners are mostly Japanese and German who are among the major world players in this industry. When no other local firms have such knowledge, the only alternative to learn about this industry is by finding a foreign partner that possesses such technology.

Secondly, the locals depend on their foreign counterpart because of unavailability of certain production sources in the country. In this situation, local firms do not have any other alternative except by relying on foreign partners. For instance, ten companies from the power cable sector alone mentioned that they have to rely on a foreign partner for certain sources of production such as machines, raw materials and manufacturing components (physical capital), it is impossible for them to manufacture such products.

Thirdly, the local firms depend on foreign counterparts because of lower costs. Despite choosing foreigners as partners for the unobtainable knowledge and materials in the country, these firms select foreigners as their partners because of cost effectiveness. For instance, two firms that were interviewed chose partners from Uzbekhistan and Turkey because of lower costs. They mentioned that it is possible for them to get the technology with other local firms but it would be less expensive for them when engaged with the foreign firms. Nonetheless, the products that they produced are not high technological products that have to compete in a turbulent market, both of them are involved in producing electrical goods and competing in a stable market. Hence, it is possible to find the knowledge locally, however, because of high cost, they preferred to engage with foreign partners. The first two reasons would create a high value in local firms if they manage the dependency effectively and eventually posses the knowledge. However, the last reason is less valuable for the local firms because it is subjected to various effects. For instance, if the currency of the country appreciates or their manufacturing costs increase, the cost benefit would disappear.

Regardless of their reasons for dependency, the critical knowledge that the local firms are seeking is technical knowledge. There are various definitions of technical knowledge provided by the firms depending on their types of relationships. Among the definitions or terms used are: technology producing the product, technical expertise, technical know-how, technical assistance, technical knowledge or skills and technology of handling and maintaining machinery. All these are known or referred to as technical knowledge. Some local firms rely on the technical expertise only while others depend on physical capital only. However, quite a number of them depend on both skills and physical capital, this situation leads to a higher dependency among the local firms. From the response, it can be inferred that companies which rely on foreign sources of production will at the same time rely on their technical expertise as well, however, not all companies that rely on technical expertise sought the sources of production from their partners.

Other areas that the local firms seek for and depend on foreign partners are: new product development, and research and development (R&D) (Personal Comm. 2, 2002). Even though these two areas sound different from the technical area, it is essentially closely related with the technical knowledge. These two activities are significant for local firms that have learned from the previous partners and are capable of manufacturing the current products, but still unable to plan their future direction and upcoming manufacturing activities. Hence, they tend to remain dependent on foreign firms. For instance, one of the firms interviewed established a joint venture with an American partner and was involved in manufacturing quality Liquid Crystal Display(LCD) and Liquid Crystal Module (LCM), claimed that the company is capable of manufacturing the current products by itself, but they still lack design and engineering skills to enable them to develop their own new products and further research. Therefore, the company depends on the foreign partner for R&D and new product development activities.

Table 8.2 shows that apart from technical activities, local firms also tend to engage in other managerial areas such as marketing. However, unlike the technical area, the dependency on marketing activities is quite low, with only 2.4% of the respondents relying on foreign firms for marketing activities. This implies that the dependency on managerial knowledge is rather low compared to technical knowledge.

8.3.3 Methods to reduce dependency and its effect on knowledge acquired

From the personal interviews, the local firms acknowledged that they are relying on the foreign firms for their business activities and realized that this situation is potentially risky. Hence, in order to counter the dependency related problems, several methods were undertaken and planned to reduce the dependency and speed up the knowledge transfer process. Among the primary methods adopted by the local firms to reduce their dependency were:

a) place foreign experts to work in Malaysia as expatriates
b) place local employees to work together with the expatriates
c) increase the number of local employees in the R&D department, which is a key source of new knowledge
d) send the local employees for training either within the organization or to the headquarters of the foreign partner
e) ensure that local employees participate in the key tasks
f) localise the skills and components

Looking at the activities proposed and conducted by the local firms, they are in line with the activities suggested by other researchers for firms to acquire knowledge (Argyris & Schon, 1978; Kogut & Zander, 1992; Marquadts, 1994; Zander & Kogut, 1995; Inkpen, 1998). The activities conducted are activities that are needed in acquiring knowledge as agreed by previous studies. In addition to that, the usefulness of foreign capabilities, which indicates how local firms regard the foreign knowledge, shows that they put a high value on the partners' knowledge. This is shown by the result in Table 8.2 where 85.7% of local firms regard their partners' capabilities as useful and this implies that local firms put a high value on the foreign knowledge. Based on the above findings, and some statistical output from the performance, it is possible to conclude that Malaysian firms have acquired knowledge from their foreign partners. However, despite conducting the necessary activities for seeking knowledge and putting a high value on it, the curiosity lies on why firms remain dependent on their foreign partners. This situation requires detailed assessment on the process involved in knowledge acquisition.

When firms value their alliance partners' knowledge but do not actively seek to acquire that knowledge, this situation will create dependency on the foreign firms (Inkpen, 1998). This dependency is harmful because not only would the local firms' knowledge become eroded when the relationship terminated, it also indicates a low learning potential within the organization (Inkpen, 1998). As the key to acquiring knowledge is through learning (Harrigan, 1988; Huber, 1991), the effectiveness in learning is crucial (Inkpen, 1998). Even though firms implement essential learning methods and value highly the foreign partners' knowledge, these two factors cannot confirm that knowledge can be acquired without the presence of learning opportunities and effective learning. Learning opportunities and effective learning can only be created when firms aggressively seek to acquire it. From this argument, it can be inferred that Malaysian firms might not experience plenty of learning opportunities and effective learning in those methods adopted. Hence, it is crucial for the local firms to assess and evaluate the implementation and effectiveness of the learning methods conducted. When learning opportunities are not abundant and learning methods are not effective, knowledge is difficult to be acquired. It might be valuable if these two issues are also viewed in terms of other issues such as accessibility as they are closely related. The accessibility issue will be discussed in the following section.

In spite of this, efforts need to be continuously made by firms to reduce the dependency in all aspects, as eventually local firms would find it hard to manage and develop their own strategies in the long run. The effect of dependency on the local firms is not only dissatisfying in terms of learning and acquiring knowledge, it might also have some influence on firms' performance. If this situation continues for a long period of time, the efficiency of being involved in an alliance and having a foreign partner would diminish. This can be seen when looking at the previous statistical results (as depicted in Table 7.3) of censored regression on knowledge acquisition and performance. The statistical output shows that business and general performance has a negative relationship with learning capacity. The dependency phenomenon might provide some explanation as to why learning capacity is negative towards business and general performance. As firms depend on foreign expatriates for their knowledge and production materials for the manufacturing process, they have to bear a large amount of financial burden, such as expatriates' salaries, which are obviously much higher than the local salaries, sending the employees abroad for training, conducting training locally, loss of production due to training of the employees, and importing of machinery and production materials from abroad. These kinds of expenses are relatively high particularly when it involves currency exchange. Currency exchange is very volatile as it depends on the supply and demand of all currencies in the foreign exchange market and the exchange rates for the home country currency is often much higher than the Malaysian Ringgit. This condition would add to increase both the fixed costs and variable costs, as the cost of volatility has to be absorbed by the local firms. The situation is worse if the expatriates are paid in their home country currency as more volatility cost has to be absorbed due to the foreign exchange fluctuation. As business and general performance is measured based on factors like volume growth, employees' productivity and overhead costs, the high expenses incurred in running these activities could outweigh the quantitative benefits gained. Hence, it is difficult for the local firms to come out with an excess of financial inflow especially during the initial stage of the relationship. These financial difficulties would make the local firms more likely to experience a deficit because of the high expenses incurred. Thus, business and general performance appears to be negative. This scenario is acceptable if it occurs temporarily during the transition period of learning, however, if the learning process takes longer than expected, the cost to acquire the knowledge is higher and might lower the benefits gained from the alliance.

8.4 Accessibility

Table 8.3 summarises the results for issues related to accessibility such as ease of access, constraints of accessibility.

Table 8.3: Frequencies of Accessibility, Manufacturing Control and Learning Methods

Variables	Items	Frequency (%)	Cumulative
Knowledge accessed	Easy access	64.3	64.3
	Some access	26.2	90.5
	Little access	9.5	100.0
Degree of trust	High trust	19.0	19.0
	Trust	54.8	73.8
	Limited trust	26.2	100.0
Form of manufacturing control	More than one form	42.9	42.9
	Manual only	31.0	73.8
	Standard software only	7.1	81.0
	Modified software only	4.8	85.7
	Developed software only	2.4	88.1
	Not in a software	4.8	92.9
	Not available	7.1	100.0
Combination form of manufacturing control	One method only	50.0	50.0
	Manuals + standard software	33.3	83.3
	Standard + Modified software	4.8	88.1
	Manual + Developed software	4.8	92.9
	Not available	7.1	100.0

Methods of learning	More than one method	85.7	85.7
	Communicating	4.8	90.5
	Blueprint	2.4	92.9
	Do together	4.8	97.6
	Training	2.4	100.0
Combination of methods	One methods	16.7	16.7
	Two methods	42.9	59.5
	Three methods	23.8	83.3
	Four methods	16.7	100.0

Accessibility is an essential feature in knowledge acquisition as it is a basic step to capitalize the foreign partners' knowledge (Inkpen, 1998). Accessibility is not a guarantee that knowledge will be acquired, it simply means that the learning opportunities are available for the locals to grasp the knowledge. As Inkpen (1998) points out, knowledge can only be acquired when the learning process is effective. This condition signifies that even though the firms recognise that they can access the partners' knowledge, it does not imply that knowledge has been acquired. Therefore, when firms have limited access to the partners' knowledge, they have to deal with more obstacles and constraints in acquiring knowledge from the foreign partners.

8.4.1 Ease of access

Table 8.3 shows that 64.3% of the sample indicated that knowledge from the foreign partners can be easily accessed, while 35.7% said that they have some or little access to the knowledge of the foreign partner. From the interviews, it could be inferred that there are two main reasons why foreign partners allow easy access for the local firms.

Firstly, because the foreign partners want to ensure that the product manufactured satisfies their required specification and is at the quality as produced in other parts of the world. This achievement is imperative for the foreign partners in order to maintain their product standard and firms' reputation. In these circumstances, knowledge is permitted to be accessed by the locals. For instance, almost all firms involved in contract manufacturing (one type of contractual agreement) in the electronic manufacturing services sector, reported that they received a satisfactory access to knowledge from their foreign counterparts. This is essential, as the quality of products produced by the Malaysian firms have to satisfy their customers' requirements and specification.

The second reason for easy access is when the local firms represent the foreign company itself. For instance, firms involved in licensing (another type of contractual agreement) found that the foreign partners allowed relatively easy access to their knowledge. Similar to the contractual manufacturing, the access to the licensors' knowledge is crucial to enable the locals to learn and understand about their products knowledge. This is important to ensure that the products manufactured are at the same standard produced by the headquarters. The difference in the quality of products produced that might occur if the local did not acquire the knowledge would jeopardise the licensor's image and good will.

8.4.2 Constraints on accessibility and its effect on knowledge acquired

From the interviews, it was found that the local firms have to face eight major constraints in dealing with accessibility issues. These issues arose from the open-ended parts of the questionnaire, and so do not appear in Table 8.3 above. These constraints at the same time clarify why the access to the knowledge is limited or being made difficult by foreign partners in certain alliances. They are:

a) <u>Limited qualified local employees</u>

First is the constraint caused by lack of educated or skilled local employees that worked in the Malaysian companies. The short supply of engineers or highly skilled-workers among Malaysians is one of the reasons that limits knowledge accessibility. When there are not enough skilled-employees to learn about the new knowledge, the possibility for the companies to acquire the knowledge is smaller. Even though the foreign partner might be willing to give the knowledge, because of the limited number of learners, knowledge might not be fully accessed and acquired. This scenario is made worse when the small number of skilled employees would rather work for foreign firms rather than local firms because of the higher salaries offered by foreign firms. This lack of qualified trainees has forced the local firms to rely on foreign firms. For instance, the respondent in a German-Malaysian joint venture mentioned that the expatriates are keen to provide the knowledge to the locals but unfortunately there are insufficient highly skilled locals to take the knowledge. Cohen and Levinthal (1990) claimed that a firm's absorptive capacity will depend on the absorptive capacities of its individual members. The absence of an individual with a relevant prior knowledge means that the level of the firm's absorptive capacity is low and this circumstance would limit the knowledge acquisition process. The respondent claimed that it is very difficult for them to recruit locals that have skills in lighting engineering and train them to gain the knowledge from the expatriates. As a result, the expatriates remain to carrying out the tasks even though the alliance has been established for nearly fifteen years. In simple words, this situation reflects the fact that Malaysian tertiary education lacks a focus on technical aspects, thus the number of technical graduates is limited and this has some impact on the local employment pattern. This explains why local firms still have to depend on expatriates for certain highly skilled tasks.

b) Employee turnover

For the firms interviewed, a major problem in knowledge accessibility and acquisition occurs when the responsible employees left the company. Most were skilled employees who had been trained for a period of time and left the company after acquiring certain knowledge. They left the company for various reasons, some claimed that the pay was inappropriate, the benefits provided were not attractive, they received good offers from other companies and some because of personal problems. Argote (1999) refers to this turnover phenomenon as *knowledge depreciation* and regards it as harmful to the firms as the organizational members who left the organization might take their knowledge with them. High levels of turnover would also make it difficult for firms to retain knowledge in the organization. In such circumstances, all the efforts that have been conducted seemed to be meaningless and it retards the process of disseminating knowledge to the whole organization. The same process of learning needs to be repeated when another employee is employed and this would be time consuming and costly for the firms. This clarifies why local firms remain dependent on foreign partners and less effective in their learning process.

c) <u>Expatriates' behaviour and period of service</u>

The third reason that limits the knowledge accessibility is the behaviour of individual expatriates. As expatriates are human beings, they differ from one another though they share the same national and organizational cultures. Some expatriates are willing to teach more than other expatriates and some teach better than others (Personal Comm. 3, 2002). In addition, the limited period that they stay with the local partners also further limits the learning process that occurs. Before government interference, the expatriates normally stayed for 1-3 years and other expatriates would be replaced, sometimes the term being less than a year. This short- term service by expatriates has caused problems for the locals trying to learn from them. In the early 1990s, the government realized these problems and stipulated that under Malaysian investment policies the minimum period for an expatriate to work in the country is two years. At present, the usual period for expatriates to work in the country is 2-5 years. This policy is not only intended to avoid frequent changes of expatriates that would affect the knowledge transfer process and learning process from them (Malaysian International Trade and Industries, 1990), but also to encourage a long-term relationship between them. The differences of attitudes and behaviour among expatriates is recognised by the local firms as it is a fact of organizational behaviour, however, they claimed that this problem could be minimised by the foreign partner if they select the most appropriate candidate for the position. The expatriates' ability to communicate and explain things to the locals and their willingness to join the locals in other activities would significantly aid in transferring knowledge to them. This would allow more knowledge to be accessed and acquired compared to expatriates who are less able to communicate and like to work on their own. This situation reveals that the expatriates' attitude and individual behaviour tend to affect the extent of accessibility and thus influence the intensity of knowledge provided to the locals.

d) Cultural differences

Related to an individual behaviour is the expatriates' culture and this seems to have some impact on the accessibility of knowledge. In comparing expatriates from different countries, some nations tend to be more cooperative than others (Personal Comm. 4, 2002). The interviews revealed that local firms consider culture as one of the factors that influence knowledge accessibility. Accessibility to the knowledge of foreign partners can be made easier when the locals have a better understanding on the expatriates' cultures. For instance, a Malaysian joint venture with a Japanese car manufacturer claimed that the local employees did not have any problems working with the Japanese because most of them understand the Japanese culture through their experience of having either had worked in Japan before or working in other Japanese firms in Malaysia. Therefore, they fully understand the Japanese culture and some of them are able to speak Japanese. They acknowledged that this understanding had eased their learning process and knowledge is more accessible. An understanding of the expatriates' cultures especially their work ethics and language, reduces the barriers that act as a stumbling block for the locals in gaining the knowledge from them. These barriers would eventually lead to conflicts and cultural collision if no efforts are taken to minimise them (Fiol & Lyles, 1985; Lane & Beamish, 1990; Parkhe, 1993; Salk, 1992; Lyles & Salk, 1996). In relation to this phenomenon, this finding is supported by an empirical result from previous statistical analysis. In Table 7.3 for censored regression results on knowledge acquisition and performance, cultural differences were found to have a negative effect on human resource performance. This means that high cultural differences would create high barriers for the locals to learn and assimilate the knowledge, consequently this would lower the employees' competencies building and accumulated skills. If firms are able to keep the cultural differences at a minimum, more knowledge could be accessed and acquired by the locals.

e) Documentation

The fifth constraint that local firms are facing which limits the knowledge accessibility is documentation. As documents are one of the means for knowledge to be transferred (Hall & Johnson 1970) and disseminated to the whole organization, keeping them as guidelines and records are necessary for future direction. However, the interviews revealed that not many foreign partners provide written manuals and not many tasks are well documented. Most of the key tasks especially those that are highly skilled are not available in any form of document but are learned verbally. Besides that, only the few local employees that are involved directly with the expatriates can gain access to the knowledge. The difficulty in accessing this tacit knowledge implies that the local firms are having problems in turning the tacit knowledge into an explicit knowledge. If the knowledge can be codified in the form that it can be communicated and easily understood, more tacit knowledge can be accessed and learned from the foreign partners. The failure to codify the tacit knowledge would further restrict accessibility and would reduce the learning potential by the locals as not all knowledge that had been taught could be gained, some of the knowledge might be lost before it is understood and written down. This situation would result in a low potential learning as the real knowledge that can be absorbed is much less than can be learned.

f) Limited involvement by local partner

Limited involvement by the local partners in the daily operations also makes the knowledge hard to be accessed. Foreign firms are expected to convey the knowledge to the locals because they are perceived as possessing the technology, administrative and management know-how (Child & Markoczy 1993). However, when their involvement is limited, it would retard the knowledge transfer process. Limited involvement occurs when local firms are only involved in certain types of operations, thus merely certain types of skills can be accessed. It was discovered that in most alliances, critical knowledge or key tasks of the manufacturing technologies are difficult to be accessed. As a matter of fact, certain knowledge desired is considered as secretive and only available in the headquarters. This situation is worse when regulations are made to restrict the access of locals to such knowledge. An example of this situation is from a Malaysian-Japanese joint venture vehicle manufacturer. This company has to send samples of the finished product to the headquarters for quality tests before the products can be approved and distributed. Even though there were quality measures along the manufacturing of the components, the final products need to be tested by the Japanese and in the Japanese headquarters only. Local employees are not allowed to experience them at all though the relationship has been established for more than ten years. The foreign partner considers that the locals should not learn yet about that knowledge and access has to be restricted. However, the local partner claimed that they should not be denied access to the foreign knowledge because it was stated in the agreement that all knowledge related to the manufacture of the products should be taught. This is among the dilemmas that the Malaysian alliances are facing.

Similar to joint ventures, contractual agreement firms also experienced low accessibility when they were involved in certain types of operations. Local firms in particular that are involved in technical assistance, contractual manufacturing of components and buyer-supplier relationship, have limited access to the foreign knowledge as it is restricted merely to the job that they perform and machines that they use. Apart from that, they have no access at all to other kinds of knowledge. This is among the limitations of having non-equity alliance, as the knowledge accessed is more limited than joint ventures. This limited knowledge would create dependency on the foreign partner, as they do not learn the overall technical know-how. Thus, any changes pertaining to the products manufactured have to be taught by the foreign partners. An example of this case is a contract-manufacturing firm, which supplies various components for American and Japanese firms. The firm claimed that the knowledge it acquired is limited to the components specified for them to produce and the tasks are quite limited. They believe that if more knowledge were given to them, they could learn and acquire even more knowledge (Personal Comm. 5, 2002). The limited involvement not only means that knowledge is limited to be accessed, it also indicates that fewer interactions and routines would take place in the organization (Abernathy, 1978; Rosenberg, 1982) subsequently the learning process is slowed.

g) Negative Perception of Foreign Partner Towards Local Firms

Another factor that limits access to the foreign knowledge is the perception of foreign partners towards the local firms. Perception is defined as a process by which individuals organize and interpret their sensory impressions in order to give meaning to their environment (Robbins, 2001). Individuals behave in a given manner based not on the way their external environment actually is, but rather on what they see or believe it to be (Robbins, 2001). Based on Argyris & Schon (1978), Richter & Vettel (1995) developed a learning modes model which comprises of three steps, perception, internalisation and abstraction. Perception is considered as the first step in the learning mode, which helps to turn the environmental knowledge to internal knowledge, then through abstraction knowledge is transferred across the organizational boundaries (Richter & Vettel 1995). The model showed the importance of perception before knowledge can be internalised into the organization. Hence, a negative perception of the local firms would distort the learning sequence and limit the inflow of knowledge within the organization. From the interviews, some firms that are involved in highly technological products believed that their accessibility is being restricted because foreign partners look down on their capabilities in learning the new knowledge. They claimed that the partners only provide simple and straightforward knowledge that they already knew and core knowledge was not provided. When the real knowledge is not given, it is impossible for the locals to process such knowledge and internalise it within the organization. The locals believed that if they were given more opportunities to learn about the knowledge, they would be able to acquire it. For example, a Malaysian-Japanese joint venture mentioned that the foreign partner is not confident about the locals' capabilities, thus the core skills, processes and technologies that may help the firm's competitiveness were not provided. This circumstance would make the knowledge desired more difficult to be accessed.

h) <u>Threat of Potential competitor</u>

Another reason that restricts the access of knowledge by the locals is the threat of potential competitors. This situation occurs because despite having a relationship with the local firms, foreign firms at the same time also operate independently in the same industry in the country. Even if the foreign partners are not operating locally, the risk of creating potential competitors has to be seen as an alliance drawback. The local firms would be a potential competitor to the foreign partners and would pose a new threat for them, therefore they need to be protective in providing their knowledge. Inkpen (1998) regards this phenomenon as competitive overlap. This limited access can be seen when only general product knowledge is provided whereas the core knowledge of the products is not. One Malaysian-Japanese joint venture in the telecommunication industry revealed that even though they had worked together for nearly twenty years, the reliance on the Japanese partner is still high because the core knowledge remains with them. Though it cannot be denied that they learned a lot during that period, the locals remain dependent on the expatriates.

Linking accessibility to the performance, the above findings support the empirical evidence that has been found in previous statistical analysis. Table 7.3 (Censored Regression results on Knowledge Acquisition and Performance) showed that accessibility has a negative effect on human resource performance. The above constraints that firms are dealing with could help to clarify the negative impact that accessibility has on human resource performance. The constraints would create disappointments and irritations among the local firms and this would influence the firms' struggle to acquire knowledge. As a consequence, it diminishes the firms' competencies and capabilities building, which in the end lower the employees' motivation and morale to attain the new skills. Ultimately, human resource performance would experience a decline.

8.4.3 Trust

Trust is one of the important elements in accessibility (Inkpen 1998) and the alliance itself. Even though this element was asked about in the first questionnaire, it appears again in the second questionnaire because several issues regarding trust cannot be covered through statistical analysis. This section will further clarify this matter. Table 8.2 (p. 191) shows that 73.8% of respondents considered they had a high degree of trust in their foreign counterparts, while 26.2% had a limited trust.

Based on the interviews, firms considered there is trust in the relationship when the foreign partners are willing to explain the technology and know-how to the locals and cooperate well. Trust is also presumed to develop when the foreign partner is the co-owner of the firm such as a joint venture. This is because as a co-owner who had made an investment in the firm, the foreign firm is expected to have the same interest as the local partners. However, despite their ownership, which encourages the local firms to trust the foreign partner, some local firms still consider that most of the available technologies were not transferred to them. Quite the opposite, for local firms that are involved in contract manufacturing, the foreign partners were quite cooperative as the technical knowledge was provided to the locals in order to ensure that they grasp the knowledge. This is because the foreign partners believed that the success of the locals is important for them, not only because it will determine the success of their products, but also to reduce their costs.

As the above finding indicates a lower trust towards the foreign partners among one quarter of the sample, it is worth identifying the reasons for it. Firstly, this situation is developed when foreign partners are reluctant to provide their knowledge and unwilling to explain the difficulties and problems that arise for the locals, even when the locals keep on asking about such matters. Secondly, it exists when new and challenging tasks were not given to the locals, but instead only simple and straightforward tasks were assigned to them. Thirdly, some foreign partners do not even share certain skills and technology with the locals and exposure for the locals in terms of technical capabilities is kept at a minimum. In the worst situation, some foreign firms do not even provide the critical knowledge of the product to the locals, instead it is reserved in the headquarters of the home country. In some cases, the foreign partners did not provide the technical know-how that they have agreed and did not perform tasks that they had promised as stated in the alliance contract. They tended to control all the major tasks and merely unskilled duties are given to the locals. Basically, the reasons for a low trust are closely related to the reasons for limited access as trust itself is part of accessibility.

The issue of trust is quite complex and ambiguous as it is relative and subjective. Even though by and large, the locals tend to trust their foreign partner, there are some issues that are hidden but significant to the knowledge acquisition process. For instance, in a joint venture which involves a set up of a single company by Malaysian firms and foreign firms with a common objective, trust sometimes is not obvious. As a joint venture, literally there should be trust between them as both have common interests, yet it is not always the case. Though trust might exist, the extent of it is uncertain and cannot be specified. The empirical finding in the previous statistical output supports the view that trust is a critical element in acquiring the technical know-how. Tables 6.7 and 6.12, which reports results of ordered probit on trust and knowledge acquired elements, show that in acquiring knowledge, in particular for technical knowledge such as technological expertise knowledge and manufacturing process knowledge, trust is significantly needed to facilitate the transfer process. Hence, this issue is critical in knowledge acquisition and local firms have to manage the matter efficiently. One of the ways to rectify the trust problem is through having a thorough selection process of the potential foreign partner. Local firms need to recognize the partners that are less protective and keen to teach the locals pertaining to their knowledge.

8.5 Manufacturing Control

Manufacturing control is reviewed because it helps to discover the extent of foreign partners' willingness to codify the knowledge from tacit to explicit (Zander & Kogut, 1995). Zander & Kogut (1995) claimed that knowledge needs to be codified before it is communicated and manufacturing control is one element of the codified knowledge. The codification of knowledge is vital as it would generate the learning potential and learning opportunities within the organization. If the knowledge is not codified, the chances for it to be acquired might not be possible, as learning potential and opportunities are not available. Manufacturing control embodied by firms can be codified either through manuals, standard software, modified software, and developed software. These various forms would indicate the foreign firms' willingness to cooperate and commitment towards their local partners' pertaining to their knowledge. Indirectly it could reflect the level of learning incurred via the manufacturing control activities. Table 8.3 shows that 50% of the firms adopt only one method of manufacturing control while 42.9% adopt more than one method of manufacturing control. When a single method is adopted, a manual is the most common form but when two methods are adopted, manual and standard software are the most common forms. Some firms did not adopt any manufacturing control methods at all either manually or software.

As manuals are the most common form embodied by the firms, the definition of a manual by the firms interviewed is essential. From the interviews, it is understood that a manual type of manufacturing control has two meanings, one is a written manual like a document, and another one is a non-written manual and controlled by a professional employee. Written manuals provided by the foreign firms are claimed to be not effective in assisting local firms in acquiring the new knowledge. The information provided is normally general guidelines in conducting the tasks and tends to be superficial, thus it is not very useful in adding to the know-how of the locals. Written manuals are available only when it involves routine work and simple tasks. Nonetheless, in some firms written manuals are not available at all. In such a situation, the local firms developed the manuals themselves by compiling and writing all the necessary guidelines and tasks involved for their own future reference.

However, when the tasks are not routine and involve highly-skilled work, the knowledge is embedded in expatriates themselves and a written manual is not available. Hodgkinson (2000) regards this as personal mastery and believes that this high ability in knowledge, attitude and skills could only be achieved through practice, self-analysis, reviewing, improving and coaching. In order for this to be realized, an honest, open and stretching working environment is needed in providing support. For this kind of task, the only way to control the manufacturing is through an individual who possesses such skills. When this is the only method of manufacturing control adopted, especially in terms of the quality control, few problems tend to arise.

Expatriates, who normally act as a manufacturing controller in terms of the quality of the products, particularly when the product is custom-made (the product is specifically designed for a specific customer), knowledge is very difficult to be accessed.

From the interviews, the local employees, who were involved in this kind of task claimed that they had a hard time in learning the knowledge and skills because most of the expatriates were not supportive and did not provide opportunities for them to conduct the work by themselves. They merely showed them how to do it and they were assigned simple tasks in assisting them to complete the tasks. Until now they said they were not able to carry out the tasks themselves and this created dependency on the expatriates. Some of the manufacturing control techniques are not even available in the country, they are only available in the home country of the foreign partner. Therefore, the products have to be sent back to the home country to ensure the quality reaches the required standard. This situation implies that knowledge is not really being made easy for the local partner, this would lower the learning potential and learning opportunities for the locals, thus they would remain dependent on the foreigners.

Looking at the software, not all firms embodied it in their manufacturing systems. For firms that embodied such systems, standard software is commonly used rather than modified and developed software. Standard software means that the local firms adopt directly the software without making any changes in it while modified software means that some changes have been made on the system to suit the local manufacturing needs. Developed software is a system that is specifically designed for the local needs and no other firms can adopt the system. When standard software is commonly adopted, it implies that minimum efforts are needed in designing the manufacturing control system within the firms. It is economical for both local and foreign firms to apply this as the locals can adopt directly while the foreign partners do not have to work on the system with the locals. Nonetheless, this situation effectively limits the learning opportunities, which are abundant if the manufacturing control system is modified or developed together. The early stage of setting up the system is critical if it is to be understood and learned by the locals in order for them to learn another related knowledge. Most of the firms claimed that the only way they could learn is during maintenance and repair of the machines, as these two tasks helped them to understand better the technology of manufacturing such products. Though such tasks did not create as much learning opportunities as during the set up period, it facilitates the understanding process. The learning opportunities are further restricted in some firms when the duty of maintenance is carried out by existing expatriates or foreign employees from the headquarters (Personal Comm. 6, 2002). Sometimes local employees are not allowed to be involved in these tasks. This circumstance indicates that the manufacturing control system contributes to limiting the learning opportunities and accessing the knowledge from the relationship.

8.6 Learning Methods

As knowledge can only be acquired through learning, understanding the extent of learning methods adopted by the Malaysian firms is significant. Learning methods not only assist in assessing the level of learning opportunities, they also assist in terms of evaluating the learning effectiveness. Based on previous studies, five common learning methods that are adopted by firms are communicating, blueprints, observing, doing together and training. From the interviews, Table 8.3 shows that 85.7% of the sample used more than one method to learn from the expatriates and skilled employees while 16.7% used only one method to learn. The firms claimed that they combined several learning methods in order to hasten the learning process and increase the learning effectiveness. The most commonly applied methods are communicating, doing together, training and blueprints. Communicating involves several ways like face-to-face communication within the organization, telephone, electronic mail, and frequent visits from the headquarters. Communication such as personal meetings and conferences are considered among the most effective ways of transferring knowledge as they contain rich information compared to written documents such as correspondence, papers and publications (Daft & Lengel 1984). Indeed, Dutton & Starbuck (1979) found that face-to-face meetings and conferences were more effective in diffusing the technology than the written media as it provides opportunities to transfer a richer set of information including tacit knowledge. Personal interactions such as personal contacts and face-to-face communication are likely to be the most effective technique during the early stage of the knowledge transfer process (Dutton & Starbuck 1979) where desired knowledge needs to identified and well understood (Daft & Lengel 1984). Face-to-face meetings and conferences can be fruitfully supplemented by electronic means once a relationship is established. Electronic means, such as electronic mail and video conferencing, are generally more effective at augmenting existing relationships than establishing new means (Kraut, Egido & Galegher, 1990).

Doing together involves group work and the most common technique is teamwork, which permits integration from the diverse background of locals and expatriates. Marquardt (1994) points out that team learning is important as it would encourage a flow of ideas and creativity, thus enabling the members to work creatively and constructively. The local firms claimed that teamwork allows the four common methods of communicating, doing together, blue printing and training to be applied simultaneously. Moreover, teamwork not only enables the expatriate to design, discuss and explain the technical knowledge to the locals, it also promotes the interactions and sharing of experiences among the team members. From the interviews, in can be inferred that the local partners believe the foreign knowledge can be easily accessed when the locals and expatriates work together. The interactions between them facilitate the knowledge transfer process as problems, curiosities, and difficulties can be explained directly to the locals. This is confirmed by research done by Liang, Moreland & Argote (1995) and Baron & Kenny (1986) who revealed that members who were trained together recalled more about the tasks and made fewer errors than members who were trained apart. They exhibited greater memory and they were better coordinated.

Teamwork can be conducted in several ways and one of them is through training. Firms revealed that training is often organised when certain skills need to be acquired by the organization. For instance, it is intensively conducted at the early stage of the alliance as there is a great deal of new knowledge that has to be learned. It is carried out either locally or abroad depending on where the knowledge is being kept. Training is also frequently conducted when a new product is to be launched or when there is a change pertaining to the core technology. Local firms stated that most of the time these kinds of training are conducted at the headquarters in the home country of the foreign partner. Training can also be carried out in several ways, the most common way adopted by the interviewed firms is on-the-job training as it combines all the above four methods concurrently.

Blueprints refer to the written documents or manuals that are available in hardcopy form. Even though it is adopted as a method of learning, it is less popular as a single method as its efficiency is quite ambiguous. Instead, it is commonly adopted together with other methods like communicating, doing together and training. Similar to blueprints, observing is less likely to be adopted alone, rather it is combined with other methods to increase its effectiveness. Some knowledge is more effectively acquired through observation, thus some firms adopt this method along with other methods primarily in the R&D department. Observant locals would learn more than non-observant locals in carrying out their tasks specifically when it involves tacit knowledge. Other ways of learning that are stated by the interviewed local firms but rarely discussed in the literature are controlling and supervising. Controlling and supervising is helpful when there is an involvement and commitment from both the expatriates and locals, otherwise it would not be beneficial. When the expatriates have direct control and supervise the locals, learning opportunities could be created and available for the locals, thus encouraging more knowledge to be acquired.

8.7 Effect on Organizational System

Knowledge can only be acquired when it can be internalised and when various organizational levels share their observations and experiences (Von Krogh, Roos & Slocum, 1994). As participation of all organizational levels is essential, the acquisition of knowledge can be reflected in their organizational systems and processes. Hence, the organizational systems and processes have to adapt with the knowledge acquisition process. An attempt to identify the changes in the organizational systems and processes is described as the effect on the organizational system, which refers to the impact that the local firms experience in these two aspects when knowledge has been acquired from the alliances. Organizational system refers to the structures, techniques and procedures that are embedded within the firm whereas organizational process refers to how these structures, techniques and procedures are being managed. As pointed out by Hedlund & Nonaka (1993) and Nonaka (1994), knowledge acquisition is an organizational process that can be managed by the partners. This process of acquiring knowledge is essentially the process of creating organizational knowledge (Nonaka 1994). Indeed, Nonaka & Takeuchi (1995) emphasize that creating organizational knowledge is not just about learning from others or acquiring knowledge from outside, instead it is a complicated organizational process involving various levels and players. This process enables specific knowledge to be amplified throughout the organization. To describe the movement of knowledge across various organizational levels, Nonaka (1994) developed the concept of a 'spiral' of knowledge creation. In the spiral, knowledge moves upward in an organization; it begins at the individual level, moves to the group level and finally moves to the firm level. As the knowledge spirals upward in the organization, individuals interact with each other and with their organizations. The movement of knowledge can be depicted in the organizational structures.

Table 8.4 shows the frequencies on organizational system and process. Only 7.1% of the local firms stated that they experienced major changes in their organizational system and organizational process, while the majority of them (61.9%) experienced few changes in their organizational systems and organizational process. The respondent claimed that having an alliance did not bring major changes in the organizational system and process because they only focus on technical know-how. Only technical employees, such as engineers, and a few supporting employees would be involved in the learning process and interactions tend to be centred among them. This implies that not all organizational levels are involved in learning and acquiring knowledge from the foreign partner. Relating Nonaka's (1994) knowledge creation concept to the above situation, the knowledge tends to be less likely to be created and acquired when the knowledge is not moved to various levels in the organization. This is because the socialization between individuals within the organization, which would expand the interaction of explicit and tacit knowledge, is limited and not widely spread throughout the organization (Nonaka 1990).

Table 8.4: Results of Frequencies on Effect of Knowledge Acquired

Variables	Items	Frequency (%)	Cumulative
Changes in Organizational system	Many changes	7.1	7.1
	Some changes	16.7	23.8
	Few changes	61.9	85.7
	Very few changes	14.3	100.0
Changes in Organizational process	Many changes	7.1	7.1
	Some changes	16.7	23.8
	Few changes	61.9	85.7
	Very few changes	14.3	100.0

8.8 Analysis of Joint Venture and Contractual Agreement

The number of joint venture and contractual firms involved in this study is equal. Forty-two firms participated, twenty-one are joint ventures, while another twenty-one are contractual agreements. This equal number enables further analysis to be conducted in order to identify any differences between the two types of relationship. T-tests were conducted on these two groups and the results are summarised in Table 8.5. Due to the way the questions were coded, a low mean value indicates a high score for the variables concerned.

Table 8.5 : Result of T-test on Joint Venture and Contractual Firms

Types of factors	Types of alliances (Mean value)	T-value	Sig
Degree of dependency	Contractual (1.24) Joint venture (0.62)	2.659	0.011
Foreign capabilities	Contractual (0.95) Joint venture (0.52)	1.865	0.070
Trust	Contractual (1.10) Joint venture (1.05)	0.225	0.823
Ease of access	Contractual (1.48) Joint venture (1.43)	0.228	0.821
Organizational system	Contractual (3.10) Joint venture (2.57)	2.345	0.024
Organizational process	Contractual (3.10) Joint venture (2.57)	2.345	0.024

Table 8.5 shows that joint ventures and contractual agreements experience statistically significant differences in degree of dependency, usefulness of foreign capabilities, organizational system and organizational process. The results indicate that joint ventures tend to depend more on the foreign partners than the contractual agreements.

This circumstance appears because most of the local firms that engaged in joint ventures have limited knowledge of the desired technology and the knowledge is more tacit in nature, which means it is harder to be acquired. Furthermore, the products manufactured in joint ventures are typically high-technology products that require special highly skilled employees to produce. They also tend to be custom-made products, which differ every time they are produced, thus the manufacturing control has to be carried out by individual expatriates. This means that more obstacles have to be dealt with before knowledge can be accessed. The learning opportunities and potential is more limited and knowledge is more difficult to acquire. Hence, not only would the learning period be longer, the dependency on them is also higher because of the above barriers. But with the contractual agreements, most of the firms involved have some prior knowledge on the products and most of the products that are manufactured are standard products, thus the knowledge is less difficult to be accessed and acquired. In addition, firms involved in agreements like contract manufacturing and licensing were guaranteed access to knowledge to ensure products manufactured fulfil the standard required by the foreign partner. Therefore, the dependency on the foreign partner is less apparent.

In terms of usefulness of foreign capabilities, respondents from joint ventures considered foreign capabilities as more valuable than contractual firms. This is because without the foreign partner's cooperation, it is impossible for them to manufacture their products. Apart from investing in the local firm, the foreign partner in a joint venture relationship also provides learning opportunities for the local firms. The type of technologies that are normally sought by the locals through joint ventures are technologies that involve specialized skills and non-standard products. This kind of knowledge is not possible to be acquired through non-equity alliances as the knowledge requires a thorough understanding on the whole process, from scratch to the finished products. The knowledge desired is embedded in the skills of expatriates, thus the learning process has to be very thorough and painstakingly carried out. Without the foreign partners' assistance, it is impossible for the locals to manufacture such products by themselves. Hence, the joint ventures regard foreign capabilities as more valuable than contractual agreements. Unlike joint ventures, contractual agreements normally involve producing standard products, which are widely used by many companies. Foreign capabilities are not regarded as highly valuable by contractual firms compared with joint ventures since the technologies sought are standard and can be gained from other competing firms through contract manufacturing and licensing. These two methods would enable them to learn quickly and gain the capabilities from the foreign partners.

Finally, in terms of organizational system and process, joint ventures tend to experience more changes in their organizational system and organizational process compared to joint ventures. As joint ventures involve the setting up of a new firm, the firms tend to focus on both technical and managerial aspects. This is because the ownership through the investment made, provides them with authority to manage and control the whole organization. Unlike joint ventures, contractual agreements tend to focus merely on technical assistance and very slightly or not at all on managerial aspects. This is because the foreign partner does not have a legal right to be involved in other aspects apart from the ones they have agreed. Hence, the effect of organizational system and process are more likely to take place in joint ventures rather than contractual firms. Table 8.5 also depicts that contractual agreements and joint ventures did not experience any differences in terms of degree of trust and easiness of accessibility. This signifies that both types of relationship might experience similar situations when dealing with these two issues.

8.9 Conclusion

As both types of knowledge, tacit and explicit are significant in knowledge acquisition, both have to be analysed thoroughly. The discussion of explicit knowledge was provided in previous chapters, thus this chapter focuses on tacit knowledge and the insight provided by the alliances in Malaysia. Generally, the issues that were covered in this section are degree of dependency, areas of dependency, usefulness of foreign capabilities, accessibility, trust, manufacturing control and effect on organizational system. Differences of impact on joint ventures and contractual agreements based on the above issues were also highlighted.

From the interviews conducted, it can be concluded that Malaysian firms tend to depend on foreign firms for their technical knowledge and are often incapable of manufacturing the products without the foreign partners' assistance. Despite the many efforts that had been made to reduce the reliance as suggested by previous researchers, the phenomenon seems not to be improving significantly. Sometimes the costs of relying on foreign partners could outweigh the benefits gained from the relationship. When this occurs, it is better for the local firms to terminate the alliance and look for another partner. The dependency is contributed by factors that researchers refer to as learning opportunities and effective learning. Local firms have to be a learning organization (Senge 1990; Marquardt 1994) and engage in organizational learning (Argryis & Schon, 1978; Dodgson, 1993; Richter & Vettel, 1995; Lawson & Lorenz, 1999) simultaneously. They have to manage the knowledge desired effectively, or else learning opportunities will not emerge and firms become incapable of learning. Senge (1990) argues that to resolve these learning disabilities and to enhance the organization's capacity to learn, firms need to be a learning organization.

There are two major reasons why Malaysian firms are relying on foreign partners; first is the unavailability of the technical know-how and secondly, the unavailability of the capital equipment and certain manufacturing components within the country. These two reasons have created a dependency problem, however, it could be resolved if the local firms handle the matter effectively and efficiently. These dependency problems seem to be worse when other problems and constraints related to accessibility and trust are incorporated.

From the interviews conducted, eight major problems that the locals face and, which restrict the knowledge accessibility were identified. They are: limited qualified local employees, employee turnover, expatriates' behaviour and period of services, cultural differences, documentation, limited involvement by foreign partner, negative perception of foreign partner, and threats as potential competitor. These problems not only limit the access to the knowledge of foreign partners, they also enhance the dependency on them. It is vital for the local firms to take these problems as fundamental and critically get to the bottom of them in order to benefits from the alliance relationship.

The way manufacturing control is carried out and the changes that take place in the organizational systems also reflect the level of learning potential and opportunities available. The findings from these two indicators did not show a positive result, thus more effort needs to be aggressively planned and carried out to ensure the locals learn from their partners. Joint ventures and contractual agreements showed different behaviours in three aspects. Joint ventures tend to be more dependent on the foreign partners than contractual agreements, joint ventures regard foreign capabilities as more valuable than contractual agreements, and finally joint ventures experience more changes in organizational systems and process than contractual agreements. However, in terms of accessibility and trust, both types of alliances did not show any differences. Overall, this discussion provides some insight into the knowledge acquisition process that the Malaysian firms have undergone. This discussion is helpful in enhancing the understanding of the knowledge acquisition process as it illustrates different views from the empirical quantitative findings of the earlier chapters. As both empirical quantitative and qualitative findings were described, the next chapter will emphasize the major findings of this study and its contribution to the related discipline.

CHAPTER NINE : SUMMARY OF KEY RESULTS

Strategic alliances have recently become a strategic tool for firms either to learn new technology or expand into the markets in sustaining their competitiveness. As the strategic alliance's roles are becoming increasingly significant in this decade, this study attempts to contribute some major findings in this area. The most important objective of this study is to assess the determinants and effects of knowledge acquisition among international alliance firms in Malaysia. This objective is achieved by evaluating the factors that influence the knowledge acquisition process, and appraising the firms' performance through knowledge acquisition. Some interesting findings were captured in this study. This chapter summarises the key results of the study.

9.1 Knowledge Acquisition and Determinant Factors

The literature on knowledge-based theory and organizational learning showed that knowledge acquisition is a process that can be influenced by other factors. These factors could either facilitate or hinder the acquiring process, therefore it is essential for the organization to understand them in order to ensure knowledge can be acquired effectively and successfully. From the literature, this study has identified that there are five factors considered to be influential in the knowledge acquisition process, they are: learning capacity, experience, goals, active involvement and accessibility. Hence, this study has used these factors to assess and further understand the knowledge acquisition process by identifying their influence on this process. Some of the findings confirmed their influence as in other studies, but some of the results indicate a different impact from previous studies.

9.1.1 Learning Capacity

The literature emphasized that learning capabilities are essential for firms to learn and acquire new knowledge. In doing so, firms need learning capacity or absorptive capacity (Cohen & Levinthal, 1990) to acquire the new knowledge, which acts as a basis for firms' learning capabilities. Consistent with Cohen and Levinthal (1990), the findings of this study indicate that learning capacity was the most influential factor in acquiring knowledge from the foreign partner. Learning capacity not only enables firms to absorb the capabilities from the foreign partner and accumulate knowledge, it also helps to speed up the learning process. Learning capacity has been studied by Lyles and Salk (1996), who analysed it by examining only absorptive capacity and firms' flexibility. This study, however, looked deeper into the elements of absorptive capacity by considering the firms' prior related knowledge and enhanced the scope of learning capacity by including two additional elements, the determination to learn and Research and Development (R&D) activities.

This study found that learning capacity could be developed and enhanced through four elements, the firm's prior related knowledge, flexibility, determination to learn and Research and Development (R&D) activities. The findings revealed that prior related knowledge is significant to enhance the learning capacity (Cohen & Levinthal, 1990). It is a vital determinant for absorbing knowledge and a crucial element that enhances the firm's ability to acquire capabilities through strategic alliances. The findings also showed that firm's flexibility is significant in enhancing the learning capacity (Dodgson, 1993; Lyles & Baird, 1994). The firm's flexibility is essential in developing learning capacity as it encourages cooperation and information exchange among members, increases the receptiveness among members, and thus boosts the capacity to absorb knowledge.

Another contributing factor to enhanced learning capacity, which has not been covered and tested by other studies is determination to learn. This study found that it is a critical factor in enhancing the learning capacity as it facilitates the transfer of valuable competences (Hamel, 1991; Inkpen 1998). Determination to learn not only represents the intensity of learning efforts by the local firms, it also reflects the degree of firms' efforts in internalising the skills and capabilities of their partners. Research and Development (R&D) activities, in particular the expenditure on R&D, was believed to have an influence on learning capacity (Cohen & Levinthal, 1990). However, the findings of this study showed that R&D activities do not influence the learning capacity. This result might be peculiar to Malaysia, as the number of R&D activities conducted through strategic alliances in the country is quite limited.

9.1.2 Experience

The literature on experience and knowledge acquisition has shown that these two factors are closely connected to each other. Experience is vital to boost learning, thus more knowledge can be acquired (Prahalad & Betties, 1986; Lyles & Schwenk, 1992; Von Krogh, Roos & Slocum, 1994). Consistent with previous research, generally this study found that experience plays a major role in knowledge acquisition as firms learn through their experience. While, previous studies tend to integrate experiences regarding the product knowledge experience and the experience of the strategic alliances, this study attempts to analyse them separately and to highlight their impact on the knowledge acquired. Experience of the product knowledge is considered as knowledge-based experience, and experience of the strategic alliances is considered as relationship-based experience. Though previous studies agree that knowledge acquisition can be developed from the firm's experience, there is no clear evidence that experience, either knowledge-based or relationship-based experience, influences the knowledge acquisition process. Hence, this study provides some empirical evidence on experience and its connection to knowledge acquisition.

The findings present the results of the two types of experiences on knowledge acquisition. Firstly, knowledge-based experience showed a significant influence on the knowledge acquisition. This kind of experience helps to boost learning and enhance the absorption of knowledge. Knowledge-based experience is more crucial in acquiring knowledge, particularly tacit knowledge, since it is embedded in routines and organizational culture. As tacit knowledge can only be acquired through internalisation and routinisation within the organization, knowledge-based experience becomes significant in facilitating the knowledge acquiring process. Previous studies proposed several methods that would enhance the internalisation of knowledge through experience, this study tested two of them, grafting and interactions. Consistent with Huber (1991), this study found that grafting and interactions between the organizational members and foreign employees, in particular expatriates, are the best method to acquire knowledge from the foreign partner. These activities demonstrate effective knowledge acquisition as they provide avenues for the organizational members themselves to experience working in the new environment and internalise the new knowledge. This kind of experience is very beneficial for the local firms as it enhances the knowledge acquisition process.

By contrast, relationship-based experience showed a different impact on knowledge acquisition and this effect is depicted in the firms' performance. There is a lack of evidence from previous studies that can explain this impact. Though Makino and Delios (1996) look at the impact of experience on performance, their focus is on the host country experience by the foreign partner rather than home country experience by the local partner. The findings of the present study revealed that previous alliance relationships of the local firms tend to have a negative effect on their current relationship. This negative impact can be considered as an 'unsupportive' influence on the current alliance as firms have to unlearn from their previous relationship before learning new knowledge from the current relationship. Though this unsupportive influence tends to affect more managerial matters rather than technical matters, local firms faced some difficulties in adapting to the new partner, therefore, some disruptions in the knowledge acquiring process are expected. These disruptions were reflected in the firms' performance particularly in the early years of the relationship.

9.1.3 Articulated Goals

There is literature supporting the importance of goals in acquiring knowledge (Hill & Hellriegel, 1994; Nonaka & Takeuchi, 1995; Lyles & Salk, 1996). Nonetheless, there is still a lack of evidence that shows a direct influence of articulated goals on knowledge acquisition. Lyles and Salk (1996) provide some evidence on this relationship but only focused upon the existence of written documents related to the goals. The present study attempts to further understand this phenomenon by analysing not only the existence of documentation, but also the extent of understanding about the goals among the organizational members and its links with knowledge acquisition. The understanding of the mission by the members of an organization is critical as it promotes commitment and enthusiasm among them. Consistent with Lyles and Salk (1996), this study found that articulated goals are significant in knowledge acquisition. This study also provides additional findings, which shows that understanding mission of the goals is important and encourages more knowledge to be acquired. The results also revealed that the understanding about the mission of the goals is more important in influencing the knowledge acquisition process rather than the existence of goals' documentation.

9.1.4 Active Involvement

The socialization and internalisation literature indicates that active involvement of partners in the strategic alliances provides valuable avenues for knowledge to be acquired. Active involvement by the foreign partner has been studied by Lyles and Salk (1996) who focused on four factors: managerial, technical, contribution of foreign partner on technology and contribution of foreign partner on training. The present study acknowledges the importance of the four factors, thus these factors are adopted as active involvement elements. Nonetheless, this study argues that there is another area that also needs active involvement from the foreign partner, that of documentation. Documentation played a major role in contributing knowledge to the local partners, thus this study includes documentation as an additional factor in active involvement. The findings of this study revealed some differences from Lyles and Salk (1996). It was found that managerial, technical, training by foreign partners and documentation were significant in acquiring knowledge from the foreign partner. Lyles and Salk (1996) confirm the four factors' contributions; managerial, technical foreign technology and foreign training. However, the present study found that foreign technology provided by the partner was not a significant determinant of knowledge acquisition. This result implies that locals are not involved in merely providing manufacturing capabilities, they do make some mutual contribution in terms of providing certain technology together with the foreign partner. This phenomenon is true in particular for the contractual agreement alliances such as contract manufacturing. Local firms, which have acquired some knowledge do work together with the foreign partners and contribute some product knowledge from their experience in developing the new products. Joint ventures showed that local firms were dependent on the foreign partner's technology and the details about the dependency is discussed in chapter eight.

9.1.5 Accessibility

There are few prior studies that consider accessibility though the concept is accepted in knowledge acquisition. Even though accessibility is highlighted by Inkpen (1998), he did not provide any empirical evidence on accessibility and knowledge acquisition. Instead, he provided stories and some clarification on certain related issues for further understanding via case studies. There is no empirical evidence that shows an influence of accessibility on knowledge acquisition. Hence, this study attempts to provide some empirical evidence for further insights on accessibility and knowledge acquisition. Based on Inkpen (1998), a measurement of accessibility was developed and tested. Although Lyles and Salk (1996) looked at knowledge acquisition and its influencing factors, they did not include accessibility in their model. The findings of the present study show that accessibility is a crucial element in knowledge acquisition and trust is the core component. By having trust between the partners, foreign partners would be less protective in providing their knowledge, thus encouraging more knowledge to be accessed by the locals. The importance of accessibility seemed to be more obvious in acquiring tacit knowledge rather than explicit knowledge.

9.2 Knowledge Elements and Determinant Factors

Apart from evaluating the factors influencing the overall knowledge acquisition process, this study also endeavours to look at the elements of knowledge itself, which include new technological expertise, product development, and manufacturing process. The role of the factors influencing or determinants are reviewed according to each of these elements. The link between the elements of knowledge and determinants could help firms to identify the necessary conditions in facilitating the acquisition of knowledge. Though there are actually six elements of knowledge, only the above three were selected as they represent technical knowledge. The other three elements of knowledge that were not further evaluated and known as managerial knowledge are new marketing expertise, managerial techniques, and foreign culture. The three selected elements are considered as core elements or technical knowledge because most of the local firms seek this kind of knowledge in pursuing strategic alliances. There is no evidence from the previous studies that provides a link between the determinants and elements of knowledge. Even though Lyles and Salk (1996) used the same six elements for knowledge acquired, they did not analyse any of the elements further. Therefore, this element of the thesis represents additional understanding on previous research.

The findings of this study show that these three elements are strongly influenced by the determinants, nonetheless each element received different impacts from the determinants. The description of each element is conducted individually in the following section.

9.2.1 Product Development Knowledge

By and large, in acquiring product development knowledge, all the five determinants (learning capacity, experience, goals, active involvement, and accessibility) have a strong influence. This means that the existence of the above factors would increase the acquisition of knowledge. R&D activities (Cohen & Levinthal, 1990) and flexibility (Dodgson, 1993; Lyles & Baird, 1994) are the most significant elements that could boost the capacity of individuals in learning about product development. By conducting research with a foreign counterpart, many opportunities are available for the locals to explore and understand about the process of product development. Local firms have to be open and try to accommodate the new situation in order to encourage the participation of locals in the research activities. Working together with expatriates and being exposed to the real work would be more effective for product development knowledge to be acquired. Product development knowledge can also be attained when the mission of the relationship is well understood and accepted by the employees. This understanding is crucial as it enhances the employees' commitment and determination towards learning the new knowledge. Foreign partners also have to be actively involved (Lyles & Salk, 1996) in managing the organization, this would allow them to make decisions that are parallel with the firms' goals and objectives. Foreign partners that are highly participative in management, marketing, and administration would enhance the local firms ability to acquire product development knowledge. Finally, to acquire this knowledge, trust (Inkpen, 1998) among partners is necessary to enable knowledge to be accessed. Without accessibility to the new knowledge, it is impossible for the locals to acquire such knowledge.

9.2.2 New Technological Expertise

In acquiring technological expertise, generally all five determinants were important. However, the influence of each element was different from product development knowledge. Technological expertise can be made easily acquired when local firms are involved in R&D activities (Cohen & Levinthal, 1990), have a prior knowledge about the products (Cohen & Levinthal, 1990), and the locals are thoroughly determined to learn from the foreign partner (Hamel, 1991). Through R&D activities, the technical expertise can be diffused and thus, enhance the ability to learn. When firms have a prior knowledge, more technological expertise can be acquired as it enhances the firms' absorptive capacity to absorb the new knowledge. The firms' intention to learn is needed to transfer the valuable competencies like new technological expertise as intense efforts are made to acquire such knowledge. This knowledge also requires the locals to work together with expatriates and have direct interactions with them. Understanding of the goals is a must and goals need to be spelt out clearly to the organizational members (Lyles & Salk, 1996), otherwise it is difficult to acquire the new technological expertise. Training provided by the foreign partner is crucial and they have to actively participate in the process to ensure that the technological expertise knowledge has been transferred (Ounjian & Carne, 1987). Finally, not only is trust needed in acquiring the technological expertise, but also the similarity of knowledge (Inkpen, 1998) is required in facilitating the acquisition of such knowledge.

9.2.3 Manufacturing Process Knowledge

Acquiring manufacturing process knowledge requires fewer factors. In doing so, only three determinants seemed to be influential and they are learning capacity, active involvement and accessibility. Determination to learn is needed as the firms would make a greater effort to learn from the relationship (Hamel, Doz & Prahalad, 1989), thus more knowledge could be acquired. An active participation from the foreign partner in particular in terms of providing product-related technology, manufacturing-related technology and manufacturing support were also fundamental in ensuring the manufacturing process could be acquired (Lyles & Salk, 1996). Finally, trust is required as it enables local firms to access such knowledge from the foreign partner (Inkpen, 1998).

These findings provide some insights for the local firms to understand the knowledge acquisition process and the conditions that facilitate achieving them. In maximising the knowledge acquired from the foreign partners, it is imperative for the local firms to know the kind of knowledge desired and to try to establish the necessary conditions in order to smooth the progress of learning and acquiring them. Having the necessary conditions would not only facilitate and expedite the process of learning and acquiring knowledge from their partners, but also increase the level of knowledge acquired.

9.3 Performance and Knowledge Acquisition

Many previous studies have been conducted on performance (Killing, 1983; Beamish, 1984; Hamel, Doz & Prahalad, 1989; Geringer & Herbert, 1991; Hill & Hellriegel, 1994; Lyles & Salk, 1996), however, there are few specific studies that link performance and knowledge acquisition. Hence, the understanding pertaining to this relationship remains ambiguous. As knowledge acquisition concerns acquiring the knowledge, capabilities and skills of a foreign partner, this can enhance the competitive advantage and performance of the firms. As firms' competitiveness is closely linked with performance and performance is less complicated to be measured than competitiveness and knowledge acquisition itself, performance acts as an indicator for competitiveness and knowledge acquisition.

In assessing the level of knowledge acquisition, performance is used to indicate the effectiveness of the knowledge acquiring process. There is little point in acquiring knowledge from a partner unless it enhances the firm's performance. Performance is analysed in three aspects, human resource performance, business performance, and general performance. In general, the results showed that when knowledge is acquired from the partner, all three types of performance showed a significant increase. However, the outcome of the three performance types tends to change slightly when the determinant factors are taken into account. This signifies that the determinant factors have some influence on the three types of performance. Each of these three types of performance are discussed separately in the following sections.

9.3.1 Human Resource Performance

Human resource performance looks in terms of accumulated competencies to indicate the firm's performance (Hamel, Doz & Prahalad, 1989; Kogut & Zander, 1992; Szulanski, 1993; Lyles & Salk, 1996). Questions about assessments of training and improving management skills were asked with managers required to evaluate the performance. The findings showed that human resource performance experienced an increase when firms have learning capabilities and foreign partners are actively involved in the relationship. This indicates that the firms have acquired certain competencies from the alliances. However, human resource performance experienced a decrease when there is a great cultural difference between the local firms and foreign partners and when accessibility of knowledge is concerned. The cultural difference represents the lack of fit between the partners, which disrupts the learning and knowledge acquiring processes, therefore poor performance in terms of accumulating competencies was depicted. These findings are consistent with previous studies, which showed that cultural differences resulted in instability and poor performance of firms in the alliances (Biven & Lorell, 1983; Killing, 1983; Lane & Beamish, 1990; Lyles & Salk, 1996). Accessibility, which played a major role in ensuring knowledge especially tacit knowledge, also has a significant impact on human resource performance. Knowledge that is highly protected and less accessible leads to a lower human resource performance. Highly protected knowledge imposed by the foreign partner on the local firms means that knowledge is difficult to be accessed and thus resulted in poor human resource performance.

9.3.2 Business Performance

Business performance evaluates volume growth, market share, planned goals and profitability of the alliance firms (Geringer & Herbert, 1991; Parkhe, 1993; Hill & Hellriegel, 1994, Harrigan, 1996; Lyles & Salk, 1996). This information was provided by the local firms' managers based on their assessment of the firms. Unlike human resource performance, business performance demonstrates a different reaction towards knowledge acquisition and the determinants. Business performance showed an improvement when goals are clearly understood and firms actively participate in the relationship. As culture has a significant impact on organizations (Bhagat & MacQuaid, 1982; Denison, 1990; Cullen et. al, 1991), cultural differences also affect the business performance. However, unlike in human resource performance, cultural difference showed a positive influence on business performance and this implies that the greater the cultural differences, the better the business performance. The increase in business performance despite the cultural conflicts signifies that there are close interactions and common goals that the partners have in terms of financial achievements. High profits and growth are common aspirations and shared by organizations regardless of their nationalities or cultural background.

Another determinant that affects business performance is learning capacity. Learning capacity also showed a contrary effect on business performance compared to human resource performance. When firms started to develop learning capabilities, business performance would experience a declining trend. This is because in achieving learning capabilities, more human aspects are concerned such as competencies building and skills development rather than financial aspects. As human aspects are closely related with human resource performance and less related to financial aspects like volume growth, profits and overhead costs, the impact on business performance is also different. The financial achievements of growth and profits would be disrupted as learning capabilities did not focus on its development, instead learning capabilities require a financial commitment in order to smooth the learning process.

9.3.3 General Performance

Finally, general performance measures the local partner's evaluation of the overall alliance's performance (Killing, 1983; Beamish 1984; Lyles & Salk, 1996). General performance experienced an improvement when goals are well understood and partners are committed and enthusiastic in the relationship. In addition, four sectors, the electronic, electrical, telecommunication and automotive, encountered a stronger effect on their general performance compared to other sectors. This means that these four sectors would have a higher general performance than other sectors. However, general performance declined with learning capabilities and overall experience. This might be due to the fact that general performance is closely related to business performance rather than human resource performance, and general performance is assumed to be seen explicitly, whereas learning capabilities and overall experience are implicit and difficult to measure quantitatively. Furthermore, these two elements also require some financial contributions to make them more efficient and effective, hence it would give a reverse effect to the firm's profits and growth.

9.4 Effects of Moderating Variables on Knowledge Acquisition

The literatures has shown that both national and organizational cultural differences tend to have some influence on firms' performance (Killing 1983; Lane & Beamish, 1990; Pierre-Xavier & Alain, 1994; Lyles & Salk, 1996; Hickson 1996). However, there is still a lack of evidence that cultural differences affect knowledge acquisition. The present study not only attempts to provide some information on culture and knowledge acquisition, it also endeavours to present some insights on factors that could help firms to maximise the knowledge acquired. Therefore, this study incorporates cultural differences as a moderating variable. As discussed in the performance section, the findings confirmed that cultural differences have an effect on the level of knowledge acquired and firms' performance. Lyles & Salk (1996) find that cultural differences negatively affect performance, however, the present study found that this is not true for all aspects of performance. It is true for human resource performance but not for business performance. The greater the cultural differences between the local firms and the foreign partners, the lower the human resource performance. On the other hand for business performance, the greater the cultural differences the better the business performance. Cultural differences affect the ability of locals to learn and acquire knowledge from the foreign partner and sometimes lead to misunderstanding between them.

The findings also discovered that there are two other factors that moderate the knowledge acquisition process. They are size of the firms and types of sectors that the alliances are involved in. Firm size moderates the effect of the determinants on the level of knowledge acquired where large firms would acquire more knowledge than smaller firms. Size is significant when learning capacity and experience are concerned. Finally, large firms also acquire more knowledge when knowledge is accessible. Another variable that is not considered in the literature before, but showed a delicate effect on knowledge acquisition is types of sectors. Types of sectors in high technology industries like electronic, electrical, telecommunication and automotive were found to have a greater effect on general performance compared to other sectors. This signifies that these sectors would experience a better performance than other sectors when knowledge has been acquired.

9.5 Acquiring Tacit Knowledge

The literature highlighted that between tacit and explicit knowledge, tacit is more important as it represents more strategic assets and is the hardest to be transferred and imitated (Polanyi, 1966; Johnson-Lairds, 1983; Nonaka & Takeuchi, 1995; Haldin-Herrgard, 2000; Jacob & Ebrahimpur, 2001). It is embedded in routines and individuals and cannot be managed and taught in the same manner as explicit knowledge. There are quite a number of studies that focus on tacit knowledge, however, none of them focus on both tacit and explicit knowledge at the same time. This study examines both explicit and tacit knowledge concurrently and identifies the differences that might occur in acquiring them. This is because both types of knowledge are significant to the firms and they tend to complement rather than substitute for each other. Hence, it is imperative for firms to understand and compare the differences between them before integrating them in the same knowledge acquisition process.

The empirical findings presented in previous chapters represent an overview of the knowledge acquisition process and its achievement through performance. Yet, the above findings did not elaborate much on tacit knowledge. An understanding of acquiring tacit knowledge is certainly vital as it represents the real knowledge acquired and the learning process involved. As empirical findings did not provide further information of how knowledge is acquired and learned, this section presents some clarification about the process involved in acquiring the desired knowledge from the foreign partners. There is a lack of literature regarding the acquisition of tacit knowledge in strategic management as the knowledge management field seems to dominate the tacit knowledge discussion. The understanding of tacit knowledge in knowledge management is rather different from the strategic management view, particularly when international strategic alliances are engaged. Inkpen (1998) focuses on tacit knowledge in strategic management and found relevant factors that are closely linked to acquiring tacit knowledge. However, he does not describe further those factors and thus an understanding of the acquisition of tacit knowledge remains unclear. The present study attempts to clarify further his findings and provide a framework for the tacit knowledge acquisition process. From the literature, this study identifies six key factors that are crucial in acquiring tacit knowledge which indicate the level of tacit knowledge acquired. They are dependency on foreign partner, accessibility of knowledge, trust, manufacturing control, learning methods, and organizational system.

Dependency (Inkpen, 1998) is an indicator for tacit knowledge acquisition where high dependency represents low tacit knowledge acquired while low dependency represents high tacit knowledge acquired. The findings of the present study showed that most of the local firms tend to rely heavily on foreign firms in particular for technical activities and certain production sources. Other reliance activities include new product development and Research and Development activities. The reliance on other matters like costs and marketing activities is minimal.

Accessibility is another key contributing factor that determines the level of tacit knowledge acquired (Inkpen, 1998). The present study found that generally knowledge, in particular explicit knowledge, is quite easy to access. However, tacit knowledge was less easily accessible than explicit knowledge. There are quite a number of obstacles that hinder the flow of knowledge and thus increase the protectiveness of tacit knowledge. Among them are limited qualified local employees, high employee turnover, poor supportive behaviours among expatriates, cultural differences, lack of documentation, limited involvement by the foreign partner, negative perception on local partner, and finally the threat of local partner as potential competitor.

Closely linked to accessibility is the concept of trust, which is also vital in knowledge acquisition. This study found that in general there is trust between the partners. Nonetheless, one third of respondents report poor trust in their relationship and this number cannot be ignored. Trust was poor between the partners when the foreign partner was reluctant to explain problem solving to the locals, when difficult tasks were not assigned to the locals, exposure for learning is at minimum and core knowledge about the product is kept at the headquarters.

Manufacturing control (Zander & Kogut, 1995) is also evaluated as it helps to identify the foreign partner's willingness to codify tacit knowledge and turn it into explicit knowledge. This study has found that tacit knowledge was not widely codified into explicit knowledge and this has made the process of acquiring tacit knowledge more difficult. This is indicated by the lack of supporting methods adopted in the management system. Not only are tasks mostly in manuals and not in software but the manuals themselves are not extensive and comprehensive. This would make it harder for the local firms to learn and acquire desired knowledge.

As tacit knowledge can only be acquired through learning, it is important to evaluate the learning methods adopted by the local firms. The common methods adopted are communicating, doing together, training, blueprints and observing. The findings of this study revealed that local firms used more than one method to learn from their foreign counterparts. Communicating, doing together, training and blueprints are the most common and are conducted concurrently. The blend of these four methods facilitate learning from the foreign partners. Though the local firms have acquired some knowledge, the dependency and accessibility indicate a contrasting condition whereby they did not satisfactorily acquire the tacit knowledge. The literature shows that these learning methods are among the most effective learning methods in organizational learning (Marquadt, 1994; Luthans, Rubach & Marsnik, 1995; Locke & Jain, 1995; Romme & Dillon, 1997). Poor implementation of the learning methods leads to ineffective and inefficient learning, which eventually results in low acquisition of tacit knowledge. This phenomenon is closely link to organizational learning and levels of learning, which will be discussed in the next paragraph.

The final factor that indicates the tacit knowledge acquisition is the effect of organizational system and organizational process (Inkpen, 1998). The effect of learning that takes place within the organization and the changes that might occur in the organizational structures and procedures were also analysed. As organizational system and process is related to learning, they could provide some indication of the effectiveness and efficiency of learning through the level of knowledge acquired.

Poor knowledge acquired indicates poor learning and this can be evaluated by examining the organizational learning process and the levels involved in the process. As organizational learning involves two general levels, lower level or single loop learning and higher level or double loop learning (Fiol & Lyles, 1985), the findings of this study can be understood easily by linking to these levels. The present study found that organizational system and organizational process experienced minimal changes after knowledge has been acquired. This means that the organizational structure, rules and procedures, norms and behaviours did not significantly change after the foreign partner joined in the alliance relationship. This finding indicates that local firms tend to be involved in lower level learning rather than higher level learning. Lower level learning means that the learning that takes place is related to adjusting to the environment and repetitive behaviours rather than a more cognitive process, which uses skills development and insights.

9.6 Equity vs Non-equity Alliances

The strategic management literature suggests that strategic alliances are significantly important and can be analysed in two broad cases: equity and non-equity. There is a large literature that examines these two types of alliances, nonetheless the prior studies tend to focus only on either equity alliances or non-equity alliances. Very few studies focus on both types of alliances concurrently. Though Mowery, Oxley & Silverman (1996) look at both types of alliances, they only measured changes in the pattern of alliances and draw the effect on knowledge transfer between the firms. The present study attempts to bring more understanding to these two types of alliances by using some reliable measurements on knowledge acquisition in the specific context of a developing country.

In this study joint ventures represent equity alliances while contractual agreements represent non-equity alliances. Both depict a different behaviour in acquiring knowledge from the foreign partner. In general, joint ventures tend to acquire more knowledge from the foreign partners than the contractual agreements. This is because joint venture firms, which are jointly owned and managed by the two partners, are able to develop a better learning capacity within the firms and knowledge can be accessed from the beginning of the process up to the end as finished products. These kinds of opportunities are not available in the contractual agreements, which are limited to certain kinds of processes. In other words, joint ventures are a superior means of gaining access to technological and other complex capabilities. These findings are consistent with Kogut & Zander (1988) and Mowery, Oxley & Silverman (1996), which confirms that joint ventures are more effective in acquiring knowledge rather than contractual agreements. Mowery et al. (1996) argue that formal joint ventures experience more impact than non-equity alliances. This means that successful knowledge transfer is more likely to take place in formal alliances rather than informal networks or contractual agreements. The finding of joint ventures as a better means for knowledge acquisition is also supported by other studies. Polanyi (1967) states that the joint venture tends to be more effective at transferring knowledge particularly tacit knowledge, as it is more conducive to organizational learning. Joint ventures also tend to be more conducive to the transfer of organizational routines and skills (Nelson & Winter, 1982), as well as to experiences, reputation and goodwill (Berg & Friedman 1981; Duncan 1982).

Killing (1983) and Lyles & Salk (1996) identify that types of ownership in international joint ventures influence the effectiveness of knowledge acquisition. The present study also supports these findings. However, unlike Lyles and Salk (1996) who found that shared management where partners have equal participation in equity resulted in greater knowledge acquisition, the present study discovered that majority ownership, where the foreign partner holds more equity than the local firms, resulted in greater knowledge acquisition. By having a larger equity, the foreign involvement in both managerial and technical aspects in the organization is higher. This active involvement as confirmed before, opens more opportunities for interactions with the foreigners and therefore encourages more knowledge to be acquired by the locals.

In terms of performance of equity and non-equity alliances, there is no study that compares directly both types of alliances. Mowery et. al (1996) did not look at performance but focused on technological capabilities while Lyles & Salk (1996) looked at performance but focused only on joint ventures. Hence, the present study provides some comparison between equity and non-equity alliances particularly in terms of performance. The findings of this study depicts that joint ventures demonstrate a distinctive behaviour in terms of performance. Joint ventures tend to have a lower business and general performance compared to contractual agreements when knowledge has been acquired. This is apparent as the joint venture mode requires high investment compared to the contractual agreements, thus the financial return can be gained faster in non-equity alliances. In addition to that, joint venture firms tend to be highly dependent on the foreign firms in particular for expatriates' skills and capital assets such as machinery and raw materials. This dependency contributes to additional costs on the local firms' financial liabilities. However, the trend of these two performance results could be temporary in nature. The high costs incurred by the local firms might be reduced if the local firms have reached a certain level of knowledge acquisition. This level of knowledge acquisition would allow the local firms to be independent and able to create their own knowledge. The low reliance on foreign firms would naturally lower the firms' financial obligation and thus would promote the business and general performance to grow rapidly.

9.7 Conclusions

This study aimed to evaluate the knowledge acquisition among international strategic alliance firms in Malaysia. In realizing this aim as well as renewing the strategic management literature, other related disciplines and theories are also reviewed. The review of this literature has triggered this study to explore deeper the subject matter as there remains a lack of understanding about some issues. Though there are related studies that have been conducted regarding knowledge acquisition, international strategic alliances and performance, most of them are conducted separately and did not integrate these three major elements. There are a few studies conducted on knowledge acquisition and international collaborations, but they tend to focus on acquiring local knowledge by the foreign partner. This study attempts to consider the converse by focusing on firms in the developing country of Malaysia acquiring the foreign knowledge from partner firms from developed countries. The understanding of foreign knowledge acquisition and international strategic alliances are the keys to attaining competencies and sustaining the firms' competitiveness in the global market.

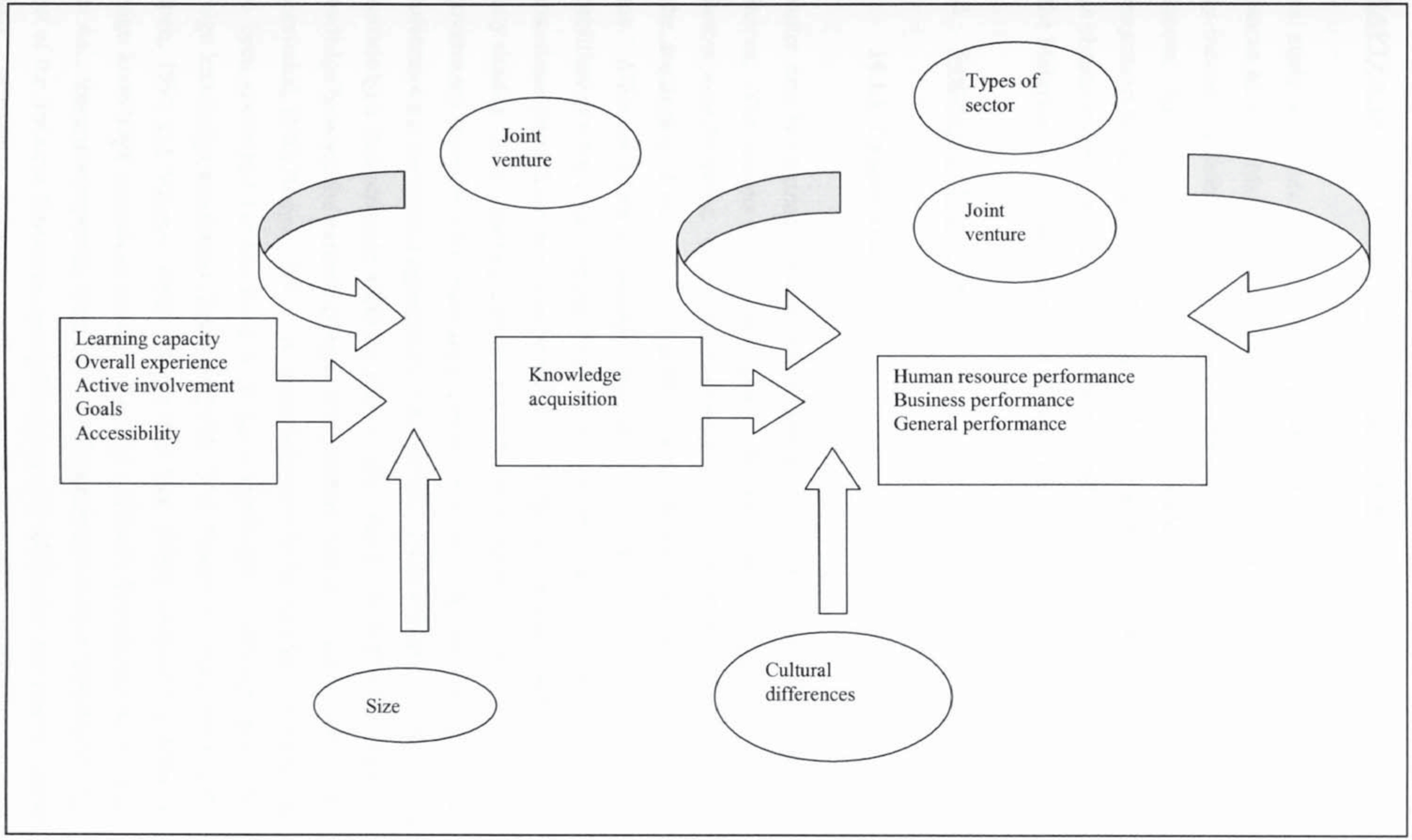
The results of this study have confirmed the conceptual framework that was developed as shown in Figure 3.2 (p.76). Figure 9.1 depicts the new framework based on the results of the study. The findings of the present study suggest that types of alliances have effects on both processes, knowledge acquisition and performance. There is also some effect from firm size and types of sector on the knowledge acquisition process, two factors previously neglected in the literature.

In conclusion, the key findings from the present study are:

a) Knowledge acquisition in international strategic alliances is influenced by five determinant factors: learning capacity, experience, articulated goals, active involvement and accessibility.
b) New technological knowledge, product development knowledge and manufacturing process knowledge will be influenced differently by the determinant factors.
c) Knowledge acquisition and its determinant factors have a significant impact on firm performance.
d) Cultural differences tend to moderate the effect on firm performance.
e) Acquiring tacit knowledge is not only influenced by the five determinant factors, but also by other factors like dependency, accessibility, trust, manufacturing control, learning methods and organizational system.
f) Malaysian firms involved in joint ventures tend to acquire more knowledge than those firms involved in contractual agreements.
g) The presence of R&D activity in the Malaysian partner encourages knowledge acquisition, but the amount of R&D expenditure has no effect on knowledge acquisition.

After analysing the major findings and considering the contribution of the results to the discipline, the next chapter reviews the whole thesis presentation and highlights several recommendations, limitation of the study and possible extension from this study.

Figure 9.1 : Framework on Knowledge Acquisition and Performance



CHAPTER TEN : CONCLUSIONS and RECOMMENDATIONS

This study evaluates the knowledge acquisition determinants through strategic alliances between Malaysian and foreign firms. The main findings of the study not only increase understanding of the knowledge acquisition in international strategic alliances, but also provide some additional understanding for the strategic management discipline as a whole. Generally, this study has achieved its objectives. This chapter recapitulates the previous chapters and provides some recommendations to the Malaysian firms and government based on the major findings.

10.1 Summaries of Chapters

10.1.1 Chapter One

Chapter one highlighted the background information about international strategic alliances. The reasons for the rapid growth and motives of engaging in strategic alliances were discussed. One of the most widely cited motives for strategic alliances is the acquisition of new technical skills or technological capabilities from partner firms. Alliances create knowledge links and give firms access to the skills and capabilities of other organizations. As there is a variety of alliance forms adopted by firms, these forms have been classified in two categories, equity sharing and non-equity sharing. Equity sharing includes firms that have equity involvement and have a governance structure while non-equity sharing includes firms that have no equity involvement but contractual agreements. The literature on knowledge acquisition has acknowledged that strategic alliances play a vital role in facilitating the flow of knowledge between the partners (Kogut, 1988; Hamel, Doz & Prahald, 1989; Cohen & Levinthal, 1990; Hamel, 1991). The role of alliances for knowledge acquisition has also been researched but the focus is on local knowledge acquisition rather than foreign knowledge acquisition (Beamish, 1984, 1988; Gomes-Casseres, 1989, 1990; Inkpen, 1992 and Makino, 1995). Lyles and Salk (1996) conducted a study on foreign knowledge acquisition through alliances in Eastern Europe, however, South East Asia remains unexplored. Hence, this study endeavours to seek such knowledge. Most of the literature focuses on equity sharing modes rather than non-equity sharing modes. In addition, the prior studies tend to focus on a single mode rather than comparing the two directly. Though Mowery, Oxley and Silverman (1996) did give special attention to knowledge transfer in both equity and non-equity sharing modes, the study did not cover developing countries as it centred on developed countries. The limited prior study and ambiguous understanding of the determinants of knowledge acquisition through international strategic alliances triggered the motives for this study.

10.1.2 Chapter Two

Chapter two discussed the related theories in knowledge acquisition. Two major theories were highlighted, they are knowledge-based theory and organizational learning theory. Currently, the role of knowledge is seen as essential and more important than hard assets. Various definitions were spelled out, among them the following; Nonaka (1994) defines knowledge as justified true belief; Sveiby (1997) defines knowledge as a capacity to act; Bhatt (2000) defines knowledge as combination of ideas, procedures and information; and Bebby & Booth (2000) define knowledge as a resource on which firms based their competitive strategies. Though knowledge lacks a general accepted definition and measurement standard, scholars agree that it is the key to achieving competitiveness. Knowledge was classified into two types, explicit and tacit knowledge. Explicit knowledge is knowledge that can be articulated formally and easily expressed and communicated while tacit knowledge is hard to formalize and is deeply rooted in action and involves intangible factors embedded in the individual. The only way to acquire knowledge is through the process of learning among firms and this is referred to as organizational learning. Organizational learning not only enables firms to utilize, change and develop corporate knowledge, it is also essential as it creates and develops shared knowledge among alliance firms. It is imperative for an organization to improve its knowledge through organizational learning as this allows organizations to move effectively respond to the changing environment. Further discussion on organizational learning includes the level of learning, organizational learning process and knowledge creation process.

10.1.3 Chapter Three

This chapter concentrates on strategic alliances and the process of knowledge acquisition. Determinants of the knowledge acquisition process, in other words factors that influence the level of knowledge acquisitions were discussed. All the variables involved namely independent variables, dependent variables and moderating variables were elucidated. Strategic management theory is presently developing more knowledge pertaining to strategic alliances, which are interchangeably referred to as inter-organizational relationships, cooperative strategies, collaborations and joint ventures. The understanding about strategic alliances has moved from explanations of competitive success based on creating and sustaining successful market positions ,towards a view of strategic success based on the resources and capabilities of the organization. Here, the importance and role of knowledge is becoming crucial. The importance of knowledge acquisition through strategic alliances was specifically addressed and attention was given to both equity and non-equity alliances. Determinants of knowledge acquisition were examined and hypotheses were developed. The determinant factors include learning capacity, experiences, articulated goals, active involvement and accessibility. Culture and performance were also highlighted as they are indicators for knowledge acquisition and hypotheses were also developed. Performance covered three aspects, human resource performance, business performance and general performance.

10.1.4 Chapter Four

Chapter four covers issues related to the research methods used in conducting this study. A questionnaire survey was used to collect data. Two questionnaire were used, the first to gather data on explicit or codified knowledge, its determinants, and on performance issues; and the second to gather data on tacit knowledge. The population of this study is Malaysian high-technology manufacturing firms involved in collaborations with foreign firms. Sectors involved include electronic, electrical, telecommunication and automotive. The sample was drawn from four major sources; the Federation of Malaysian Manufacturers (FMM), Foreign Companies in Malaysia: Yearbook 2001, Malaysian Industrial Development Authority (MIDA) database and Malaysian Trade Development Corporation (MATRADE) database. These sampling frames complement each other. The sampling design was multistage, firstly companies were grouped in the high-tech sectors and information about them was gathered. Then local companies were identified and differentiated from the foreign companies that operate locally in those sectors. Following this, telephone calls were made to confirm the local firms' participation with foreign partners. Local firms that did not have any foreign participation were excluded while those that had foreign participation were further contacted for their consent to participate in this study. The sample was further stratified as joint ventures and contractual agreement firms were identified. Letters were then sent to the potential respondents who hold positions such as Managing Director, Chief Executive Officers, and General Manager requesting a date for an interview. In order to increase the response rate, apart from conducting face-to-face interviews, a postal questionnaire was also administered. The total number of companies that responded was 65.

10.1.5 Chapter Five

Chapter five reports the results of the examination of the data. The analysis was divided into two stages, univariate analysis and multivariate analysis. Univariate analysis was conducted to evaluate the variables and the results support the hypotheses. Two statistical tests were used in univariate analysis, they are t-test and Pearson correlation. The hypotheses were reconfirmed through multivariate analysis where relevant variables were included concurrently. Censored regression was used to analyse the data and the analysis was clustered based on the determinant factors. Learning capacity was shown to have a significant effect on knowledge acquisition. The learning elements, which include prior related knowledge, flexibility of firms and determination to learn were significant to knowledge acquisition. Hence, Hypothesis 2 that the greater the ability to learn and absorb the knowledge, the greater the knowledge acquired was supported. Experience also depicted a significant effect on knowledge acquisition and elements like grafting and indirect interaction were critical in acquiring knowledge. Though previous relationship experience did not greatly help the local firms to work well with the new partner, the results is still significant. Hence, Hypothesis 3 that the greater the local firms' experience, the greater the knowledge acquired was supported. Articulated goals also showed a positive effect on knowledge acquisition, thus Hypothesis 4 that the higher the understanding of goals, the greater the knowledge acquired was supported. Active involvement is another determinants that also showed a significant effect on knowledge acquisition. Therefore, Hypothesis 5, the greater the active involvement, the greater the knowledge acquired was supported. Finally, the ultimate determinant is accessibility, which also had a significant effect on knowledge acquisition. Therefore, Hypothesis 6, the higher the accessibility to the foreign partner's knowledge, the greater the knowledge acquired was supported. These determinants were tested together with other moderating variables such as types of relationship, size of the firms, and types of sectors that the firms involved.

10.1.6 Chapter Six

Chapter six further investigated the data by considering the knowledge components. Three out of six components were examined which represent the most crucial knowledge sought by the local firms. Ordered probit analysis was carried out on the independent variables to see the effect of each component. They are product development, new technological expertise, and manufacturing process. Product development was shown to have an impact on the determinants of knowledge acquisition. Learning capacity, experience, goals, active involvement and accessibility were found to have an impact on product development and new technological expertise, however, the elements that influence the manufacturing process varies. Product development is enhanced when the following elements exist: learning capacity in terms of Research & Development (R&D) and flexibility; experience in terms of grafting and indirect experience; goals in terms of mission; active involvement in terms of managerial contribution; and accessibility in terms of trust. New technological expertise on the other hand, would also be enhanced with the presence of the following elements: learning capacity in terms of R&D, prior knowledge and determination to learn; experience in terms of grafting and indirect experience; goals in terms of mission and explicitness; active involvement in terms of foreign training; and accessibility in terms of trust and similarity of knowledge. The final components of knowledge is manufacturing process, which is influenced by fewer determinants such as learning capacity, active involvement and accessibility. In order for local firms to enhance their manufacturing process knowledge, they need to have determination to learn, a foreign partner that contributes in terms of technical input and trust between the partners. All the above elements are significant for the local firms to acquire more knowledge from the foreign partners.

10.1.7 Chapter Seven

Chapter seven shifted the discussion from knowledge components to performance. Data was analysed using censored regression and hypotheses were supported based on the findings. Performance not only revealed the level of knowledge acquired, it also indicated the significant implications of the determinants.

Hypothesis 7 that is cultural differences between the partners negatively affects the level of knowledge acquired was supported. Hypothesis 8, that is the greater the level of knowledge acquired, the greater the overall performance was supported. As performance is analysed in terms of three different aspects, detailed explanation of determinant effects on the three aspects was presented. Performance was identified as human resource performance, business performance and general performance. Learning capacity and active involvement showed a positive effect on human resource performance but cultural difference and accessibility showed a negative effect. In contrast, cultural difference, goals and active involvement showed a positive effect on business performance but learning capacity showed a negative effect. Goals and active involvement showed a positive effect on general performance but learning capacity and overall experience showed a negative effect.

10.1.8 Chapter Eight

Chapter eight analysed the data in a different way due to the qualitative nature of data. Based on personal interviews, information about tacit knowledge was obtained. Qualitative issues like the local firms' dependency and accessibility were analysed. This study found that local firms are heavily dependent on foreign partners for technical activities and certain production components or materials. Though several ways to reduce the dependency have been conducted by the local firms, the reliance remains high. Local firms regard foreign capabilities as useful and valuable for them, however, they did not actively seek the capabilities, which has created the dependency phenomenon. Accessibility is crucial in capitalizing foreign knowledge, yet it is not a guarantee that knowledge can be acquired. Despite the fact that knowledge can be accessed, there are eight major constraints that local firms have to deal with. As trust is one of the important elements in accessibility, low trust would lead to a high degree of protectiveness of the foreign partners' knowledge. Manufacturing control was also analysed to indicate the extent of the foreign partners' willingness to codify the knowledge from tacit to explicit. Learning methods adopted by local firms were also examined to assess the learning effectiveness. Other qualitative indicators for knowledge acquisition are changes that take place in the organizational system and organizational process. Finally, the differences in terms of qualitative factors between joint ventures and contractual agreements were highlighted.

10.1.9 Chapter Nine

Chapter nine specifically addressed the major findings of this study and emphasized the contributions that this study provides to the strategic management area. The main literature and findings were reviewed and the discussion was centred on the additional understanding contributed by this study. The discussion of the major findings was organized into six major topics: knowledge acquisition and determinant factors; knowledge elements and determinant factors; performance and knowledge acquisition; effects of moderating variables on knowledge acquisition; acquiring tacit knowledge; and an assessment of equity and non-equity alliances. The findings of this study were compared with previous studies to assess the contribution of this study. Overall, the results were consistent with previous studies, however, some findings do show some differences from the previous studies.

10.1.10 Summary of the Hypotheses Findings

Eight major hypotheses were tested in this study and the findings of the hypotheses are summarised in Table 10.1.

Table 10.1: Summary of the Hypotheses

Hypotheses	**Findings of the study**
H1: Equity alliances generate a higher level of knowledge acquisition than non-equity alliances	Support the hypothesis *
H2: The greater the ability of firms to learn, absorb and utilize the knowledge from the foreign partner, the greater the amount of knowledge acquired by the local partner	Strong support for the hypothesis
H3: The greater the experience that the local firm has, the greater the knowledge acquired from the foreign partner	Strong support for the hypothesis
H4: The more explicit the articulated goals, the greater the knowledge acquired by the local firms	Strong support for the hypothesis
H5: The greater the active involvement of the foreign firms, the greater the knowledge acquired by the local firm	Strong support for the hypothesis
H6: The higher the accessibility to knowledge of foreign partner, the higher the knowledge acquired	Strong support for the hypothesis
H7: Cultural differences between the partners tend to negatively affect the level of performance	Support the hypothesis
H8: The greater the level of knowledge acquired, the higher the alliance/joint venture's overall performance	Strong support for the hypothesis

- * Although the t-test does not support this hypothesis, the censored regression showed support for this hypothesis.
- Notes : Strong support means the significant level is less than 1%
  Support means the significant level is at 5% or less than 10%

10.2 Recommendations

The findings of this study offer strategy recommendations for Malaysian firms and government to assess their current plans and policies. Several strategies can be designed and considered in order to strengthen their current plans and policies. The following sections propose some recommendations for the local firms and government to consider to help them to formulate future strategies. These recommendations tend to focus on acquiring tacit knowledge as it is the most important and hardest to be learned. The tacit knowledge is also highlighted because the problems faced in acquiring it have major implications for the whole knowledge acquisition process. The effects on determinants are quite straight forward and easily understood by the local firms and Malaysian government, thus not many suggestions are provided in connection with these findings. The recommendations are designed to aid the local firms and government and to provide some input to improve the current knowledge acquisition conditions.

10.2.1 Learning Opportunities and its Effectiveness

As discussed in chapter eight, local firms claimed that they were given limited opportunities to learn from the foreign partner. The limited and specific tasks assigned to them did not permit the locals to explore further the foreign knowledge. Examples can be seen in joint ventures and contractual agreements where tasks performed were restricted to certain boundaries. Licensing firms also have to deal with the same problems and they expect more product or technological transfer and a longer relationship. This is the most crucial issue that local firms have to deal with. One way to deal with this problem is by negotiating with the foreign partner and having an open discussion on how to proceed. Foreign partners have to provide more opportunities to the locals, nonetheless at the same time, the locals also have be proactive and actively seek the desired knowledge. Opportunities that are currently available must be fully utilized by the locals. Any learning barriers such as turnover of the employees, and lack of prior knowledge among the employees have to be resolved before more opportunities are to be requested. The capability of the locals to absorb such opportunities must be reviewed and factors that could facilitate the absorptive capacity such as flexibility and determination to learn have to be implemented within the organization.

The learning process has to be assessed in order to identify its effectiveness and efficiency before further actions on foreign partners could be taken. One of the means to assess the effectiveness and efficiency of learning is by evaluating the learning methods adopted. Teamwork, which comprises foreign and local employees, is a common method adopted and it can be further specified to cross-functional teams and problem-solving teams. They would be given specific tasks to be carried out, which would quicken the learning process. These teams need to be evaluated regularly to identify their achievements and performance, this assessment would provide an indicator to the organization on the progress of their learning. Constant efforts have to be performed and close monitoring of the achievement has to be implemented. Learning would be more effective when allocation of resources, either capital assets or human assets, can be made efficient, therefore it is vital for the local firms to allocate the resources accordingly. Distribution of resources on efforts that are geared towards learning such as increased number of employees, invest more on necessary equipment for learning, frequent training, teamwork, and R&D activities need to be emphasized. These kinds of efforts need strong support both from the local partners and the foreign partners. The findings also suggest that local firms need to be culturally sensitive and to learn more about the work ethic of the foreign partners. This lesson will not only prevent the cultural conflict between them, it would also enhance the competencies building and eventually increase human resource performance.

In the perspective of foreign partner, they might not willing to provide more knowledge than they have agreed based on the terms of the relationship. This is because of there is a risk of a 'spill-over' effect where the local firms might be a potential competitor in the future. This is the major drawback in establishing strategic alliance relationship. Foreign partners are aware of this matter, they know the limit of the knowledge that should be given. The most important issue in the relationship is the cooperation from foreign partner to fulfil their obligation as stated in the terms and conditions agreed. Foreign partners are not expected to seek more efficiency in transferring the knowledge because that is beyond their motives. Thus, the duty to acquire the knowledge lies more on the local firms. If the methods of acquiring the desired knowledge is more effective, local firms will acquire more knowledge than they are today without any additional commitment from the foreign partners.

10.2.2 Flexibility

Local firms also claimed that foreign partners tend to have a high degree of control on all activities conducted within the firms and did not provide a clear direction to the local partners. This means that the foreign partners are not flexible in the approach to organizational structure and management. This phenomenon has been shown in the findings where flexibility is important as it affect the firms' learning capacities. Local firms believed that if more authority were given to them, in other words for the foreign partners to be more flexible and less bureaucratic, more learning opportunities would be available. This would help the local firms in learning the managerial techniques and provide direction in making decisions. Authoritarian and autocratic foreign partners would not only narrow the learning opportunities, but might also block the possible opportunities available. Partners that control most of the decisions, including the supply chain, would prevent learning from taking place and would result in inefficient learning. This high degree of control would not only hinder the learning opportunities, it would also discourage and demotivate the participating employees in the learning process. This would interrupt the knowledge acquiring process. In solving this problem, local firms have to openly discuss with foreign partners the constraints they face and how to work the problems out together. At the same time, local firms have to examine the reasons for such actions as well. The authoritarian and high control of foreign partners could be due to the differences of managerial style and cultural problems. Hence, an open discussion with the foreign partners is vital to increase an understanding between the partners.

In the perspective of foreign partner, providing flexibility means that their degree of control is less on local firms. For some foreign partners, their management styles require high degree of control while for other partners their management style require less degree of control. A negotiation in terms of flexibility might be influenced by the management style of the foreign partners. Therefore, local firms have to understand the nature of the foreign partners' management style before negotiation on flexibility is requested. Foreign partners that have high degree of control might not be able to provide higher flexibility to local firms compared to the partners that have less degree of control. Generally, foreign firms that have lower degree of control which can be referred to as decentralised management style, might allow greater flexibility to local firms compared to foreign firms that have higher degree of control which can be referred to as centralised management style.

10.2.3 Dependency

Dependency on the foreign partner is another matter that needs to be addressed though it might take a longer period of time. Strategic planning on how to deal with these specific problems has to be designed. Dependency issues like technical know-how and production materials have to be controlled cautiously to ensure that knowledge can continue to be gained and that required materials can still be accessed. Knowledge remains to be gained when the learning methods adopted in the organizational learning are effective and efficient. This can be identified when the locals are given more tasks and independent work that is similar to that which has been learnt. Job enrichment and job enlargement are two managerial tools that can be applied to provide opportunities for local firms to prove that knowledge has been acquired. The evaluation of the new skills and competencies should be constantly undertaken in order to recognise their learning achievements.

In implementing any procedures to reduce the dependency, motivation should be given to the local employees either via extrinsic factors such as higher pay, and more fringe benefits or intrinsic factors such as recognition by the top management, and need for achievement. An intention to learn, which proves to be essential in enhancing the firm's learning capacity, is an example of intrinsic factors that can motivate the employees and promotes learning. Motivation would not only enhance learning and knowledge acquisition, it would also increase the employees' commitment and loyalty to the organization. As learning requires an organizational memory, one way to ascertain that knowledge is accumulated via learning is by retaining the particular employees. The knowledgeable employees would act as an organizational memory to the local firms and acts as a basis for the organization to collect and employ knowledge through experience. This process is vital for enhancing and accelerating learning. If these employees are not retained and moved to other organizations, knowledge will be drained out from the organization and cause knowledge depreciation. This means that the accumulation of the knowledge is disrupted and as a result learning will be slowed. This would affect the knowledge acquisition process and therefore the aim to reduce dependency would fail to be accomplished.

From the foreign partner point of view, dependency is expected and is wished to remain for a certain period of time. Although the obligation is to make the local firms independent within the agreed period, the dependency of the local firms after the agreed period might not harm them either. The local firm is a party that have much to lose compared to foreign partner if the dependency is long-lasting. It is beyond the foreign firms concern to shorten the dependency period as dependency means 'a business' to them. Therefore, the local firms have to put more effort to shorten the dependency period. One way to motivate the foreign partner to accelerate the knowledge acquisition process is by establishing a milestone for each stage of knowledge acquisition development. For instance, when one stage of knowledge is acquired, the foreign firms are given money and when the next stage of stage of knowledge is acquired, they are provided with access to the local market. By establishing those incentives in stages as a return for the knowledge provided, it is hoped that the foreign partners are willing to speed up the knowledge acquisition process to the local firms.

10.2.4 Training

As has been highlighted in the findings, training, which provides technical knowledge to the locals, is undeniably essential in acquiring knowledge from the foreign partners. Nonetheless, the most important issue is not the frequency of the training but its efficiency and effectiveness. This is because training is costly as it requires high financial commitment and consumes a long period of time, which local firms could not afford to bear in the long run. Most of the time training is conducted in the home country of the foreign partner, thus employees have to be sent there, however, the local firms claimed that this is costly to them. This situation cannot be avoided if the core knowledge is located abroad, however, it could be reduced over a period of time and training can be conducted locally. Apart from having expatriates participate in the training, other foreign experts could be brought into the country for the purpose of training. In order to make training more effective, foreign partners should emphasize more the training of technical skills to the locals, be flexible in making decisions pertaining to production materials, be considerate about the local firms' financial constraints and be supportive in terms of business conditions for the local firms to sustain their profitability. By having such circumstances, the relationship between the partners would become longer. On the local firms' side, they need to be aggressive in knowledge seeking by focusing more efforts on training and personnel development. Training has to be evaluated consistently and a specific purpose must be established, as this is significant to achieve the goals and objectives of the relationship. Local firms have to be certain that the knowledge desired is viable and truly necessary in order to remain competitive in the market. Training methods also can be in various form, for instance secondment or work with the headquarters for a certain period of time would also help to expedite the process of transferring knowledge. Though, as argued before it might be costly, the efficiency and effectiveness needs to be measured and the cost-benefits analysis should be conducted.

In providing a training foreign firms have to be involved as they are the knowledge provider, thus negotiation about the training has to be done with them prior to the training. In the perspective of foreign partner, training is a cost to them, thus it has to be minimised. Foreign partners might not look forward to provide more training as it requires high financial involvement and time consuming. In addition, there is no guarantee that the local firms would acquire all the necessary knowledge from the training. Therefore, local firms have to make sure the training provided is fully utilised by the local employees and learn as much knowledge as possible. Nonetheless, negotiation with the foreign firms can still be carried out if there is a high need for certain knowledge or skills although there is no guarantee.

10.2.5 Cultural Differences

Cultural difference plays a major role in international strategic alliances as it affects human resource performance and business performance. In daily activities the cultural difference is more significant as it also affects communication between the partners and can be harmful to the relationship. It is crucial for international strategic alliances to have good communications between the partners since they work closely together. Different cultural backgrounds are prone to generate miscommunication that eventually leads to conflict and misunderstanding. Communication is crucial in maintaining a good relationship with the foreign partners and plays a vital role in acquiring knowledge from them. Therefore, any barriers that are related to communication have to be resolved before they become worse and turn to misunderstanding and conflict. An open discussion between the two partners should be regularly conducted in order to reduce the tendency of miscommunication. One of the possible barriers in cultural difference generally and communication specifically is the language barrier. From the interviews conducted, the local firms claimed that they could understand better their foreign partners and work more closely with them if they speak their languages. Hence, the local firms need to provide some training on understanding foreign partners' cultures, which includes work ethic, values and foreign languages.

Another issue related to communication and cultural barriers is communicating the goals and objectives. As the findings revealed, goals and objectives are important in acquiring knowledge from the foreign partner. Therefore, these goals and objectives have to be well communicated and clearly spelled out. This is significant as it has other implications on the management. When goals and objectives are not properly communicated, the roles and responsibilities between the partners become vague and unclear. This might lead to either redundancy of tasks or avoidance of tasks. Failure in effective communication in the relationship would finally delay the process of acquiring knowledge from the foreign partner.

10.2.6 Government Policies

As government played a key role in expanding the involvement of local firms in international strategic alliances, policies adopted have to be in line with the needs of the participating firms. Currently, the government is very supportive in providing incentives and tax breaks to attract foreign firms coming to Malaysia and engaging in strategic alliances with the local firms for technology transfers. Nonetheless, interviews with the participating firms revealed some limitations that should be overcome with the government involvement. Four main issues should be addressed by the government and in particular a government agency, the Malaysian International and Trade Industry (MITI), as this could help to boost the local firms learning process in knowledge acquisition. The first issue concerns costs, which is a significant issue in acquiring knowledge as it involves high costs especially for R&D activities and training. Local firms claimed that they are keen to carry out the knowledge acquiring activities but they are constrained by the costs incurred. If grants for knowledge acquisition or learning activities was provided by the government, local firms believed that more valuable plans could be designed and implemented to speed up the learning process. At the moment, no such grants are available in the market particularly for R&D activities. Grants would be more critical for small and medium size firms as they have to compete with the large multinational corporations (MNCs). Small and medium size firms represent a large number of local firms compared with the large firms which are mostly foreign firms. Hence, their capabilities in acquiring knowledge are far behind those of the large firms. Secondly, the local firms believed that if the government provides a longer period for tax incentive, it would allow them to focus on acquiring knowledge rather than making profit to disburse their tax. The local firms believed that if the government prolong the pioneer status up to ten years or Investment Tax Allowance (ITA) for up to fifteen years, it would enable them to learn more and be more competitive by that time. Currently they enjoy these benefits up to 5 years for pioneer status and 5 years for ITA. Thirdly, the government should encourage large local firms that have engaged in international strategic alliances to assist the small and medium sized local firms. The types of assistance could be in various forms, one of which is through outsourcing. The outsourcing of the manufacturing processes should be given to the small and medium sized firms. Among the activities that can be outsourced are the designing of new products, making changes to current products and manufacturing certain core components. This would not only enable knowledge to be acquired by the local firms, it also ensures that the components used can be obtained locally. This would reduce the dependency on the foreign partners.

Finally, the government should provide equal benefits to the operating local firms regardless of their location. This is important to boost their capabilities in acquiring new knowledge. At present, only firms that are located in the Free Trade Zone (FTZ) are entitled to the benefits provided, while those that are not located in the FTZ area are not qualified to receive such benefits, even though they operate in a similar sector. As firms that are located in non-FTZ area are not eligible to enjoy the benefits such as tax incentives and physical infrastructures that are enjoyed by other local firms in a similar sector, this situation adds more barriers for them to acquire more knowledge. They certainly have to strive to learn from the foreign partners and at the same time struggle to remain their competitiveness without any support from the government, as the benefits provided cannot be utilized. Hence, the government ought to investigate this matter and consider providing other incentives to compensate for their unqualified benefits.

10.3 Limitations of the study

This study is not without limitations. The first and most significant is the sample size, which is relatively small for the results to be generalised. The fact that there is no single authoritative data source and the reluctance of the firms to participate in this study have contributed to this condition. It also restricts the number of variables that could be reasonably analysed. Second limitation is that the responses that have contributed to this data may differ from non-respondent firms. There is a possibility that the sample is biased towards better performing firms, whose management may be willing to share information with the researcher. Thirdly, the methodology used to measure performance presents some limitations. The qualitative nature of the measures can make them subject to bias. Fourthly, the findings that are derived from correlation result does not establish any causation, it merely explains the existence of the relationship not the cause-effect relationship. Fifthly, these findings can be generalised only to the countries that go through a similar stage of development like Malaysia and to the countries that are in need of foreign technology. Finally, the findings of this study represent a starting point for the examination of international strategic alliances in the developing economies of South East Asia. Additional studies with larger sample sizes and more comprehensive examination of all variables are recommended.

10.4 Future Research

There are other variables that might need further investigation in understanding knowledge acquisition in international strategic alliances. Some of the variables have been covered in this study but need additional examination such as culture and R&D activities. The study on these variables can help to improve the efficiency and effectiveness of knowledge acquisition. Although this study covered cultural difference issue, it did not analyse culture by itself in depth. Culture, in particular national culture, might also have an effect on the extent of knowledge acquired. National culture can be further understood by examining the dimension proposed by Hofstede (1991) such as power distance, uncertainty avoidance, individualism and masculinity. It is captivating to explore how these dimensions affect the process of knowledge acquisition from the foreign partners.

Another issue that has been covered in this study but need additional examination is the role of Research and Development (R&D) activities in the international strategic alliances. Although some alliances have an R&D department, its role is different from one alliance to the other. An investigation of the R&D roles will provide further understanding on how knowledge can be effectively acquired as most of the required knowledge departs from this activity.

Another variable that is not covered in this study but is believed to have some influence on knowledge acquisition process is the country origin of the foreign partner. Country origin of the foreign partner can be studied by assessing how one nation differs from another nation in providing knowledge to the local firms. It is interesting to know that countries like United States, United Kingdom, Germany, France, Japan, Sweden and Australia, might show a different effect on the extent of knowledge acquired.

10.5 Conclusions

This chapter summarises all of the previous chapters of the thesis. A brief summary for each chapter was provided to give an overview of the whole thesis. As this study presents findings regarding knowledge acquisition and international strategic alliances, the findings reveal implications for two major participants, Malaysian firms that are involved in international strategic alliances and Malaysian government agencies. The implications are basically related to the problems and difficulties that they are dealing with. Among them are, learning opportunities and its ineffectiveness, flexibility of the foreign firms, dependency on foreign partners, training and its inefficiency, cultural differences, and government policies. Hence, some recommendations to reduce or resolve these problems and difficulties are proposed. This chapter also highlights a few limitations of this study and suggests some potential variables for further examination.

REFERENCES

Abernathy, W. J (1978) *The productivity dilemma*, Baltimore: John Hopkins University Press.

Adler, N. J (1986) *International Dimensions of Organizational Behaviour,* Kent Publishing Company, Boston.

Aldrich, J.H. & Forrest, D. N. (1984) *Linear Probability, Logit and Probit Models*, Sage University Paper Series on Quantitative Applications in the Social Sciences, series np. 07-045. Sage. Newbury Park, California

Anderson, Erin (1990) Two firms, one frontier: An assessing joint venture performance, *Sloan Management Review*, Vol 31(2), pp.19-30.

Argote, Linda (1999) *Organizational Learning: Creating, Retaining and Transferring Knowledge*, Kluwer Academic Publishers, Mass.

Argyris, C. (1982) *Reasoning, Learning and Action*, San Francisco, CA: Jossey-Bass.

Argyris, C & Schon, D.A (1978), *Organizational Learning*, Addison-Wesley, Reading, MA.

Argyris, C & Schon, D. A. (1996), *Organizational Learning 2: Theory, Method and Practice*, Addison-Wesley, Reading, MA.

Astley, W,G (1984) Toward an appreciation of collective strategies, *Academy of Management Review*, Vol 9, pp.526-535.

Augier, M. & Vendelo, M.T. (1999) Networks, cognition and Management of Tacit Knowledge, *Journal of Knowledge Management*, Vol: 3, Iss: 4, pp.252.

Badaracco, J.L. (1991), *The knowledge link,* Cambridge: Harvard Business School Press.

Barkema, H; Bell, J; & Pennings, J (1996), 'Foreign Entry, Cultural Barriers and Learning, *Strategic Management Journal*, Vol: 17, pp.151-166.

Barkema, Harry, G.; Shenkar, Oded; Vermeulen, Fred & Bell, John, H.J. (1997) Working abroad, working with others: How firms learn to operate international joint venture, *Academy of Management Journal*, Vol: 40 (2), pp.426-442.

Barney, J.B. (1991) Firm Resources and Sustained Competitive Advantage, *Journal of Management*, Vol: 17 (March), pp.99-120.

Baron, R.M., & Kenny, D.A. (1986), The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations, *Journal of Personality and Social Psychology,* Vol: 51, pp.1173-1182.

Bartlett, C. & Ghoshal, S. (1987), Managing Across Borders: New Strategic Requirements, *Sloan Management Review*, Vol: 29, pp.7-17 .

Bateson, G. (1973), *Steps to an Ecology of Mind*, London: Paladin.

Beamish, Paul, W. (1984) *Joint venture performance in developing countries.* Unpublished doctoral dissertation, University of western Ontario.

Beamish, Paul, W. (1988) *Multinational joint ventures in developing countries,* London: Routledge.

Beamish, Paul, W. & Lane, H. (1990) Cross-cultural cooperative Behaviour in Joint-ventures in Less Developing Countries, *Management International Review*, Vol:30 (Special Issue), pp.87-102.

Beeby, Mick & Booth, Charles (2000), Networks and Inter Organizational learning: a critical review, *The Learning Organization*, Vol:7(2),pp.75-88.

Beeby, M. & Simpson, P. (1998), Barriers, Boundaries and Leaks in an Development Dimension, *The Leadership and Organization Development Journal,* Vol: 19, pp.353-361.

Bell, M. (1984) 'Learning and the accumulation of industrial technological capability in developing countries', in Fransman, M. & King, K. (Eds), *Technological Capability in The Third World*, St. Martin, New York, NY, pp.187-209.

Benson, J. (1975) The Inter-organizational Network as a Political Economy, *Administrative Science Quarterly*, Vol: 20, pp.229-249.

Berg, P. (1985) 'Organizational Change as a symbolic transformation process'. In *Organizational Culture,* P.J. Frost; L.F. Moore; M.R.Louis; C.C. Lundberg & J. Martin (Eds), pp. 281-301, London: Sage Publications.

Berg, S. & Friedman, P. (1981) Impacts of domestic joint ventures on industrial rates of return: A pooled cross-section analysis, *Review of Economics and Statistics,* Vol:63, pp.293-298.

Bhagat, R. & Macquaid, S. (1982) Role of subjective culture in organizations: A review and directions for future research, *Journal of Applied Psychology Monograph,* Vol:67,pp.653-685.

Bhatt, Ganesh, D. (2000) Information dynamics, learning and knowledge creation in organizations, *The Learning Organization,* Vol: 7(2) pp. 89-98.

Bierly, Paul, E.; Wessler, Eric, H. & Christensen, Edward, W. (2000), Organizational learning, knowledge and wisdom, *Journal of Organizational Change Management,* Vol 13 (6), pp. 595-618.

Bivens, K.K. & Lovell, E.B. (1966) *Joint Ventures With Foreign Partners*, New York: The Conference Board

Bland, J.M. & Altman, D.G. (1997), Statistics Notes: Cronbach's Alpha, *British Medical Journal*, Vol: 310 pp.170.

Bland, J.M. & Altman, D.G. (1986) Statistical Methods for Assessing Agreement between two Methods of Clinical Measurement, *The Lancet*, (1),pp.307-310.

Bleek, Joel & Ernst, David (1993) *Collaborating to compete: Using strategic alliances and acquisitions in the global marketplace,* John Wiley, California.

Blodgett, L.L. (1992) Factors in the Instability of International Joint Ventures: AN Event History Analysis, *Strategic Management Journal*, Vol: 13, No.6,pp.475-481.

Bloom, B.S. (1956) *Taxonomy of Educational Objectives*, Handbook I: Cognitive domain, Longman, New York, NY.

Borooah, V.K. (2002) *Logit and Probit : Ordered and Multinomial Models Linear*, Sage University Paper Series on Quantitative Applications in the Social Sciences, series np. 138. Sage. University of Ulster

Borys, B. & Jemison, D. (1989) Hybrid Arrangements as Strategic Alliances: Theoretical Issues in Organization Combinations, *Academy of Management Review*, Vol: 14, pp.234-329.

Bowditch, J.L & Buono, E (1989) *Human side of mergers and acquisitions,* Jossey-Bass, San Francisco.

Bowen, D. (1996) Tobit Analysis. In B. Jackson (Ed), *Sociological Methodology*, Blackwell Publication.

Bresmen, Henrik; Birkinshaw, Julian & Nobel, Robert (1999) Knowledge transfer in international acquisition, *Journal of International Business Studies,* Vol 30 (3), pp.439-462.

Bresser, R. (1988) Matching Collective and Competitive Strategies, *Strategic Management Journal,* Vol: 2, pp.375-385.

Bresser, R. K. & Hall, J.E (1986) Collective Strategy: Vice or virtue, *Academy of Management Review*, Vol 11, pp. 408-427.

Brown, J.S & Duguid, P (1991), Organizational learning and communities of practice: Towards a unified view of working, learning and organization, *Organization Science*, Vol:2 (10), pp. 40-57.

Buckley, P.J & Casson, M (1976) *The future of the multinational enterprise,* London: MacMillan.

Chang, Sea Jin (1995) International expansion strategy of Japanese firms: Capability building through sequestial entry, *Academy of Management Journal*, Vol: 38(2), pp.383-407.

Chay, K.Y. & Powell, J.L. (2001) Semi-parametric Censored Regression Models, *Journal of Human Resource*, July, pp.1-12.

Chesbrough, H. & Teece, D. J (1996) When is Virtual Virtuos? Organizing for Innovation, *Harvard Business Review*, Vol: 74, No.1, pp.65-73.

Child, J. (1994) On Organizational Learning, *The Journal of Management Studies*, Vol: 31, Iss: 3, pp.448-462.

Child, John & Markoczy, L. (1993) Host country managerial behaviour and learning in Chinese and Hungarian joint venture, *Journal of Management Studies,* Vol: 30, pp.38-63.

Child, J. & Rodrigue, S. (1996) The Role of Social Identity in International Transfer of Knowledge through Joint Ventures. In S. Clegg & G. Palmer, *The Politics of Management Knowledge,* London: Sage Publications.

Coghlan, D. (1997) Organizational Learning as a Dynamic Inter-level Process. In R.A. Rahim, R. Golembiewski, & L.E. Pate (Eds), *Current Topics in Management*, Greenwich, CT, JAI.

Cohen, M. D & Bacdayan, P (1994), Organizational routines are stored as procedural memory: Evidence from laboratory study. *Organization Science*, Vol :5 pp. 554-568.

Cohen, Wesley, & Levinthal, Daniel (1990), Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, Vol: 35, pp.128-152.

Commercial Intelligence Services (2001), *Foreign Companies in Malaysia: Yearbook 2001*, Business Monitor International.

Commercial Intelligence Services (2003), *Foreign Companies in Malaysia: Yearbook 2003*, Business Monitor International.

Conner, Kathleen, R & Prahalad, C.K (1996) A resource-based theory of the firm: Knowledge versus opportunism, *Organization Science*, Providence, Vol: 7 (5) pp. 477-501.

Contractor, Frank.J & Lorange,Peter (1988),Why should firms cooperate? The strategy and economics basis for cooperative ventures in: *Cooperative strategies in international business*, Lexington Books, Lexington.

Coopy, J (1995), The Learning Organization: Power, Politics and Ideology, *Management Learning*, Vol: 26: (2), pp.193-213.

Creswell, John, W (1994) *Research Design – Qualitative and quantitative approaches,* Sage Publications, London.

Creswell, John, W (1998) *Qualitative inquiry and research design: choosing among five traditions*, Thousands Oaks, Ca: Sage

Cullen, J.B; Johnson, J.L. & Sakano, T (1991) Cultural congruency in international joint ventures: Does it matter? Proceedings of the 4th International Conference, *Eastern Academy of Management*, CERAM, Sophia-Antipolis, 9-13 June.

Daft, R.L & Lengel, R.H (1984), Information Richness: A new approach to managerial behavior and organization design, *Research in Organizational Behavior,* Vol:6, pp.191-223.

Denison, D.R (1990) *Corporate culture and organizational effectiveness,* John Wiley & Sons, New York.

Devlin, G. & Bleackley, M. (1988) Strategic Alliances: Guidelines for Success, *Long Range Planning*, Vol: 21 (5), pp.18-23.

Dodgson, M. (1992) The Strategic Management of R&D Collaboration, *Technology Analysis and Strategic Management*, Vol: 4 (3), pp.227-244.

Dodgson, M. (1993) Organizational Learning: A review of some literatures, *Organization Studies*, Vol: 14 (330) pp. 375-393.

Doz, Y. L. ((1996), The Evolution of Cooperation in Strategic Alliances, Initial Condition or Learning Process?, *Strategic Management Journal*, Vol: 17 (Special Issue), pp.55-85.

Drucker, Peter, F (1993) *Post-Capitalist Society*, Oxford: Butterworth Heinemann.

Drucker, Peter, F (1995), The Network Society, *Wall Street Journal*, March 29, p.12.

Duncan, L (1982) Impacts of new entry and horizontal joint ventures on industrial rates of return, *Review of Economics and Statistics,* Vol:64, pp.120-125.

Dutton, J.M. & Starbuck, W.H (1979), Diffusion of Intellectual Technology in K. Krippendorff (Ed), *Communication and Control in Society* , (pp.489-511) Gordon & Breach Science, New York.

Epple, D; Argore, L; & Devadas, R (1991), Organizational Learning Curves: A Method for Investigating Intraplant Transfer of Knowledge Acquired through Learning by Doing, *Organization Science*, Vol: 2, pp.58-70.

Fink, A. & Kosecoff, J. (1985) *How to conduct Surveys: A Step-by-step Guide*, Beverly Hills, CA: Sage Publications.

Fiol, Marlene & Lyles, Marjorie (1985) Organizational learning, *Academy of Management Review*, Vol 10, pp. 803-13.

Fowler, F.J. (1988) *Survey research methods*, Sage Publications: California.

Franko, Lawrence, G (1971) *Joint venture survival in multinational corporations,* New York : Praeger.

Geringer, J (1990) *Trends and traits of Canadian joint ventures,* Ottawa: Investment Canada.

Geringer, J. Michael & Herbert, Louis (1989) Control and Performance og International Joint Ventures, *Journal of International Business Studies*, Vol: 20, No. 2, pp.235-254.

Geringer, J. Michael & Herbert, Louis (1991) Measuring Performance of international joint ventures, *Journal of International Business Studies,* Vol: 22 (2) , pp. 249-63.

Gomes-Casseres, Benjamin (1987) Joint venture instability: Is it a problem? *Columbia Journal of World Business*, Vol 22(2) pp. 97-107.

Gomes-Casseres, Benjamin (1989) Ownership structures of foreign subsidiaries, *Journal of Economic Behaviour and Organization,* Vol:11, pp.1-25.

Gomes-Casseres (1990) Firm ownership preferences and host government restrictions: An integrated approach, *Journal of International Business Studies,* Vol:21 (1), pp.1-22.

Grant, R.M. (1991) The Resource-Based Theory of Competitive Advantage, *California Management Review*, Vol: 33 (Spring) pp. 114-135.

Grant, R.M. (1996), Prospering in dynamically competitive environments: organizational capability as knowledge integration, *Organization Science*, Vol: 7, pp.375-87.

Grant, R.M. (1998), *Contemporary Strategy Analysis: Concepts, Techniques and Applications,* Blackwell Publishers.

Grant, R.M. & Baden-Fuller, C (1995), A knowledge-based theory of interfirm collaboration. Best Paper Proceeding 1995, *Academy of Management*, pp.17-21.

Greene, W.H. (1998) *Limdep Version 7.0* – User's Manual, Econometric Software Inc, NSW, Australia.

Greene, William, H. (2003), *Econometric Analysis*, Fifth Edition, Prentice Hall, New Jersey.

Grindley, P (1995) *Standards, strategy and policy: Cases and stories*, Oxford University Press, New York.

Gulati, R.M. (1996) Prospering in dynamically-competitive environments: Organizational capability as knowledge integration, *Organization Science*, Vol :7 pp. 375-387.

Hagedoorn, J. (1990), Organizational modes of interfirm cooperation and technology transfer, *Technovation,* Vol : 10 (1),pp.17-30.

Hagedoorn, J. & Schakenraad, J. (1990) Inter-firm partnerships and co-operative strategies in core technologies. In C. Freeman and L. Soete (eds), *New Explorations in the Economics of Technical Change*, Frances Pinter, London, pp.3-37.

Hagedoorn, John, (1993) Understanding the Rationale of strategic technology partnering: Interorganizational modes of cooperation and sectoral differences, *Strategic Management Journal* Vol 14 (5), pp. 371-385.

Hagedoorn, John & Narula, Rajneesh (1995) Choosing organizational modes of strategic technology partnering: International and sectoral differences, *Journal of International Business Studies*, 2nd quarter,pp. 265-284.

Hair, J.F., Anderson, R.E., Tathan, R.L. & Black, W.C. (1998) *Multivariate Analysis*, 5th Edition, Prentice Hall, New Jersey

Haldin-Herrgard, Tua (2000) Difficulties in Diffusion of Tacit Knowledge in Organizations, *Journal of Intellectual Capital*, Vol: 1(4), pp.357-365.

Hall, G.R & Johnson, R.E (1970) Transfer of United States Aerospace Technology to Japan in : R. Vernon, *The technology factor in international trade,* New York, Columbia University Press.

Hamel, G. (1991), Competition for competence and inter-partner learning within international strategic alliances, *Strategic Management Journal*, Vol: 12, pp.83-103.

Hamel,Gary; Doz, Yves; & Prahalad, C.K. (1989), Collaborating With Your Competitors and Win, *Harvard Business Review*, Vol:67(1) pp.133-137.

Hamel, Gary. and Prahalad, C.K. (1994), Competing For the Future, *Harvard Business Review*, Jan-Feb, pp.133-139.

Hanssen-Bauer, J. & Snow, C.C (1996) Responding to Hypercompetition: The Structural Process of a regional Learning Network Organization, *Organization Science,* Vol: 7 (4), pp.413-427.

Harrigan, Kathryn, R (1986) *Managing for joint venture success*, Lexington, Mass: Lexington Books.

Harrigan, K.R. (1988) Joint ventures and competitive strategy, *Strategic Management Journal,* Vol 9 pp. 141-158.

Hawe, P; Degeling, D; & Hall, J (1990) *Evaluating health promotion: a health worker's guide.* Sydney, Philadelphia, London, Australia: MacLennan & Petty

Heath, S.B., (1984) Linguistics and Education, *Annual Review of Antropology,* Vol: 13, pp.251-274.

Hedberg, B. (1981), How Organizations Learn and Unlearn, In Nystrom, P.C. and Starbuck, W.H. (Eds), *Handbook of Organizational Design*, Vol.1, Oxford University Press, pp.3-27.

Hedlund, Gunnar (1994) A model of knowledge management and the N-Form corporation, *Strategic Management Journal*, Vol:15 (Special Issue),pp. 73-90.

Hedlund, Gunnar & Nonaka, Ikujiro (1993), 'Models of Knowledge Management in the West and Japan' In *Implementing Strategic Process: Change, Learning and Cooperation,* Lorange, P. et al. eds., (p.117-144), Basil Blackwell, Oxford.

Hickson, D.J (1996) The ASQ years then and now through the eyes of a Euro-Brit, *Administrative Science Quarterly*, Vol: 41, pp.217-228.

Hill, Robert C. & Hellriegel, Don (1994), Critical contingencies in joint venture management : Some lessons from managers, *Organization Science*, Vol: 5 (4), pp. 594-607

Hodgkinson, Myra (2000), Managerial Perceptions of Barriers to becoming a 'Learning Organization', *The Learning Organization*, Vol: 7 (3),pp.156-166.

Hofstede, G (1983) The cultural relativity of organizational practices and theories, *Journal of International Business Studies*, Vol:2, pp.75-89.

Hofstede, G. (1991) *Cultures and Organizations*, New York: McGraw Hill

Holland, T. (1985) Integrating Research and Practice in Social Work Education, *Journal of Applied Social Sciences*, Vol: 9 (2), pp.165-176.

Huber, G.P (1991) Organizational learning: An examination of the contributing processes and the literatures, *Organization Science*, Vol :2 pp. 88-115.

Imre, R.W. (1985) Tacit Knowledge in Social Work Research and Practice, *Smith College Studies in Social Work*, Vol: 55 (2), pp.137-149.

Inkpen, Andrew, C. (1992) *Learning and collaboration: An examination of North America-Japanese joint venture,* Unpublished Phd dissertation, The University of Western Ontario, Canada.

Inkpen, Andrew, C. (1996) Creating knowledge through collaboration, *California Management Review*, Vol :39 (1), pp.123-140.

Inkpen, Andrew, C. (1997) Knowledge, bargaining power and international joint venture instability, *Academy of Management Review,* Vol:22(1),pp.177-202.

Inkpen, Andrew, C. (1998), Learning and knowledge acquisition through international strategic alliances, *Academy of Management Executive,* Vol: 12 (4), pp.69-80.

Inkpen, A.C. & Beamish, P.W. (1997) Knowledge, Bargaining Power and International Joint Ventures Instability, *Academy of Management Review*, Vol: 22, No.1, pp.177-202.

Inkpen, A.C. & Crossan, M. (1995) Believing is Seeing: Joint Ventures and Organizational Learning, *Journal of Management Studies*, Vol: 32, no. 5, pp.595-618.

Inkpen, A.C. & Dinur, A. (1998) Knowledge Management Processes and International Joint Ventures, *Organization Science*, Vol: 9, pp.454-468.

Isaacs, W. (1993) Taking Flight: Dialogue, Collective Thinking and Organizational Learning, *Organizational Dynamics*, Vol: 22 (2), pp.24-39.

Jacob, M. & Ebrahimpur, G., (2001) Experience vs Expertise : The role of implicit understandings of knowledge in determining the nature of knowledge transfer in two companies, *Journal of Intellectual Capital*, Vol: 2, Iss: 1, p. 74.

Jagmin, N., Wagner, R.K. & Sternberg, R.J. (1989) The development of a Generalized Measure of Tacit Knowledge for Managers. In W.C. Borman (Chair), *Evaluating 'practical I.Q.': Measurement Issues and Research Applications in Personnel Selection and Performance Assessments*. Symposium conducted at the Fourth Annual Conference of the Society for Industrial and Organizational Psychology, Inc, Boston, MA.

Jarillo, J. (1988) On Strategic Networks, *Strategic Management Journal*, Vol: 12, No: 3, pp.1-41.

Jarillo, J. & Stevenson, H. (1991) A New Entrepreneurial Paradigm. In Etzioni, A & Lawrence, P.R., *Socio-economics: Toward a Synthesis*, Armonk, New York: M.E.Sharpe

Johnson-Laird (1983), *Mental models*, Cambridge: Cambridge University Press.

Johnsnton & Lawlence (1988) Beyond Vertical Integration: The Rise of the Value-adding Partnership, *Harvard Business Review*, Jul-Aug.

Khanna, T (1996), *Winner-take-all alliances*, Harvard Business School, Working Paper, No: 96-033.

Killing, Peter (1983), *How To Make a Global Joint Venture Work*, Harvard Business Review, Vol: 60(3) pp.120-129.

Kilmann, R.; Saxton, M.J.; & Serpa, R (1985) *Gaining control of the corporate culture*, Jossey Bass, San Francisco.

Kofman, F. & Senge, P. M. (1993) Communities of Commitment: The Heart of Learning Organizations, *Organizational Dynamics*, Vol: 22, Iss: 2, pp. 5-23.

Kogut, Bruce (1988), Joint ventures; Theoretical and empirical perspectives, *Strategic Management Journal* Vol: 9, pp. 319-32.

Kogut, Bruce & Zander, Udo (1992) Knowledge of the firm, combinative capabilities and the replication of technology, *Organizational Science*, Vol: 3(3), pp.383-397.

Kraut, R.E., Egido,C., & Galegher, J. (1990), 'Patterns of Contact and Communication in Scientific Research Collaboration' In J. Galegher, R.E. Kraut & C. Egido (Eds), *Intellectual Teamwork: Social and Technological Foundations of Cooperative Work* (pp.149-172), Lawrence Erlbaum, New Jersey.

Lam, Alice (1997), Embedded firms, embedded knowledge: Problems of collaboration and knowledge transfer in global cooperative ventures, *Organization Studies*, Vol: 18(6), pp.973-996.

Lane, H.W. & Beamish, P.W. (1990) Cross-cultural Cooperative Behavior in Joint Ventures in LDCs, *Management International Review*, Vol: 30, pp.87-102.

Laurent, A. (1986) The cross-cultural puzzle of International Human Resource Management, *Human Resource Management*, Vol: 25 (1), pp.91-102.

Lawson, Clive & Lorenz, Edward (1999), Collective learning, tacit knowledge and regional innovative capacity, *Regional Studies*, Cambridge, Vol 33(4),pp. 305-317.

Lei,D. & Slocum, J.W. (1992), Global strategy, competence building and strategic alliances, *California Management Review*, Fall, pp.81-2.

Lei, D.; Slocum, J.W. & Pitts, R.A. (1997) Building Cooperative Advantage: Managing Strategic Alliances to Promote Organizational Learning, *Journal of World Business*, Vol:32 (3), pp.203-223.

Liang, D.W., Moreland, R., & Argote, L. (1995), Group versus Individual Training and Group Performance: The Mediating Role of Transactive Memory, *Personality and Social Psychology Bulletin,* Vol:21, pp.384-393.

Liu, S. & Vince, R. (1999) The Cultural Context of Learning in International Joint Ventures, *Journal of Management Development*, Vol: 18, No.8, pp.666-675.

Locke, E.A., & Jain, V.K., (1995) Organizational Learning and Continuos Improvement, *International Journal of Organizational Analysis*, Vol: 3, No: 1,pp.45-68.

Love, Peter, E.D. and Gunasekaran, A. (1999), Learning Alliances: A Customer-Supplier Focus for Continuous Improvement in Manufacturing, *Industrial and Commercial Training*, Vol: 31 (3), pp.88-96.

Lundberg, C.C (1995) Learning in and by Organizations : Three Conceptual Issues, *International Journal of Organizational Analysis*, Vol: 3, No: 1,pp.77-105.

Luthans, F.; Rubach, M.J. & Marsnik, P. (1995) Going Beyond Total Quality: The Characteristics, Techniques and Measures of Learning Organizations, *International Journal of Organizational Analysis*, Vol: 3, No: 1,pp. 125-147.

Lyles, Marjorie, A (1988), Learning among joint venture sophisticated firms. In F.J. Contractor & P. Lorange, editors, *Cooperative Strategies in International Business.* Lexington Books: Lexington, MA.

Lyles, Marjorie, & Baird, Inga, S (1994) Performance of international joint ventures in two Eastern countries: The case of Hungary and Poland, *Management International Review*, Vol: 34 (4),pp.313-330.

Lyles, Marjorie, A & Salk, Jane, E (1996), Knowledge acquisition from foreign parents in international joint ventures: An empirical examination in the Hungarian context, *Journal of International Business Studies*, Vol: 27(5),pp:877-903.

Lyles, Marjorie, A & Schwenk, Charles, R (1992), Top management, strategy and organizational knowledge structures, *Journal of Management Sciences*, Vol: 29(2)pp:155-174.

Makino, Shigefumi (1995) *Joint venture ownership structure and performance: Japanese joint ventures in Asia,* Unpublished Phd Dissertation, The University of Western Ontario, Canada.

Makino, Shigefumi & Delios, Andrew (1996) Local knowledge transfer and performance: Implication for alliances formation in Asia, *Journal of International Business Studies,* Vol: 27 (5), pp.905-927.

Malaysian Economic Report (2003) 'Foreign Investment in Malaysia', [www document] http://www.treasury.gov.my (accessed 5 September 2003).

Malaysian International Trade and Industries (1990), *Investment Policies,* MIDA, Kuala Lumpur.

Malaysian Industrial Development Authority (MIDA), (2001), *About MIDA: The Functions of MIDA,* MIDA, Kuala Lumpur.

Malaysian Industrial Development Authority (MIDA), (2001), *Malaysia: Investment in the Manufacturing Sector; Policies, Incentives and Facilities,* MIDA, Kuala Lumpur, Febuary.

Malaysian Industrial Development Authority (MIDA), (2001), *Malaysia: Your Profit Centre in Asia,* MIDA, Kuala Lumpur, March.

Mansfield, E. (1988) Industrial innovation in Japan and the United States, *Science,* pp.1769-1776.

March, James,G. (1991) Exploration and exploitation in organizational learning, *Organization Science,* Vol: 2(1),pp.71-87.

Marengo, L. (1992), Coordination and organization learning in the firm, *Journal of Evolutionary Economics,* Vol :2, pp. 313-326.

Mariti, P. & Smiley, R.H. (1983) Cooperative agreements and the organization of industry, *Journal of Industrial Economics,* Vol: 31(4), pp. 437-451.

Markoczy, L. (1993) Managerial and Organizational Learning in Hungarian-Western Mixed Management Organizations, *The International Journal of Human Resource Management,* Vol: 4, No. 2, pp.277-304.

Marquardt, M & Reynolds, A (1994) *The global learning organization,* New York: Irwin.

McGill, M., Slocum, J. and Delhi, D. (1992), Management Practices in Learning Organizations, *Organizational Dynamics,* Vol: 21 (1), pp.5-17.

Meek, V.L. (1992) Organizational culture: Origins and weakness, In: Salaman, G, *Human Resources Strategies*, Sage Publications, London.

Miles, R.E. & Snow, C.C. (1986) Organizations: New Concepts for new Forms, *California Management Review*, Vol: XXVIII, No: 3, pp.62-73.

Miles, R.E. & Snow, C.C. (1992) Causes of Failure in Network Organizations, *California Management Review*, Vol: 34, No.4, pp.53-72.

Mintzberg, H. (1990) Strategy Formulation: Schools of Thought. In J. Frederickson, (Ed)., *Perspectives of Strategic Management*, New York: Harper Business.

Mody, A. (1993) Learning through alliances, *Journal of Economic Behavior and Organization*, Vol 15, pp.71-89.

Moran, E. T. & Volkwein, J. F. (1992) The cultural approach to the formation of organizational climate, *Human Relations*, Vol:45(1) ,pp.19-47.

Mowery, D.C; Oxley, J.E & Silverman, B.S (1996) Strategic alliances and interfirm knowledge transfer, *Strategic Management Journal*, Vol: 17 (Special Edition), pp.77-92.

Nahavandi, A. & Malekzadeh, A. (1988) Acculturation in Mergers and Acquisitions, *Academy of Management Review*, Vol: 13 (1), pp.79-90.

Nakamura, M., Shaver, J.M. & Yeung, B. (1996), An empirical investigation of joint venture dynamics: Evidence from US-Japan joint ventures, *International Journal of Industrial Organization*, Vol 14, pp.521-541.

National Economic Recovery Plan (2002), National Economic Action Council, *Economic Planning Unit*, Prime Minister's Department of Malaysia.

Nelson, R.R. & Winter, S.G. (1982), *An evolutionary theory of economic change*, Harvard University Press, Cambridge, MA.

Nielsen, R.P. (1988) Cooperative Strategy, *Strategic Management Journal*, Vol: 9, pp.475-492.

Nonaka, I. (1991), The Knowledge Creating Company, Harvard Business Review, Nov-Dec, pp. 96-104.

Nonaka, I. (1994), A dynamic theory of organization knowledge creation, *Organization Science*, Vol: 5(1), pp.14-37.

Nonaka, I. & Johansson, L. (1985) Organizational Learning in Japanese Companies. In R. Lamb & P. Shrivastava, *Advances in Strategic Management*, Vol: 3, Greenwich, CT: JAI Press.

Nonaka, I. & Konno, N., (1998), The Concept of "ba" : Building a Foundation for knowledge creation, *California Management Review*, Vol: 40, Iss:3, pp.40-55.

Nonaka, I. & Takeuchi, H., (1995), *The knowledge creating company: How Japanese companies foster creativity and innovation for competitive advantage.* New York, Oxford University Press.

Nueno, P. & Oosterreld, J. (1988) Managing Technology Alliances, *Long Range Planning*, Vol: 21 (3), pp.11-17.

Nystrom, P.C. & Starbuck, W.H. (1984), To Avoid Organizational Crisis, Unlearn, *Organizational Dynamics*, Spring, pp.53.

Ohmae, Kenichi (1989), The Global Logic of Strategic Alliances, *Harvard Business Review*, Mar-Apr, pp.143-154.

Osborn, R.W. & Baughn, C.C. (1990) Forms of interorganizational governance for multinational alliances, *Academy of Management Journal*, Vol: 33 (3), pp. 503-519.

Osland, Gregory, E. & Yaprak, A. (1995), Learning through strategic alliances, *European Journal of Marketing*, Vol: 29(3), pp. 52-66.

Ounjian, M.L. & Carne, E.B (1987) A study of the factors which affect technology transfer in a multilocation multibusiness unit corporation, *IEEE Transactions on Engineering Management*, EM Vol: 34 (3),pp.

Parkhe, A. (1991) Inter firm diversity, organizational learning and longevity in global strategic alliances, *Journal of international business studies*, 4th quarter, Vol: pp:579-601.

Parkhe, Andrew (1993) Strategic alliances structuring : A game theoretic and transaction cost examination of inter-firm cooperation, *Academy of Management Journal*, Vol: 36, pp.794-829.

Perlmutter, H. & Heenan, D. (1986) Cooperate to Compete Globally, *Harvard Business Review* (Mar-Apr), pp.136-152.

Personal Communication 1 (2002), Vive President, Eng Technology Sdn Bhd, Penang, Malaysia.

Personal Communication 2 (2002), Chief Executive Officer, Crystal Clear Technology, Selangor, Malaysia.

Personal Communication 3 (2002), Managing Director, Federal Power Sdn Bhd, Selangor, Malaysia.

Personal Communication 4 (2002), General Manager, Consolidated Cable, Selangor, Malaysia.

Personal Communication 5 (2002), Chief Executive Officer, MODENAS, Kedah, Malaysia.

Personal Communication 6 (2002), Human Resource Director, Automotive Lighting Sdn Bhd, Penang, Malaysia.

Peteraf, M.A. (1993) The Cornerstones of Competitive Advantage: A Resource-Based View, *Strategic Management Journal*, Vol: 14 (March),pp.179-191.

Pierre-Xavier, M. (1997) Longevity and Cultural Differences of International Joint Ventures: Toward Time-based Cultural Management, *Human Relations*, Vol:50 (2), pp.212-228.

Pierre-Xavier, Meschi & Alain, Roger (1994) Cultural context and social effectiveness in international joint ventures, *Management International Review,* Vol: 34 (3), pp.197-209.

Polanyi, M (1966), *The tacit dimension*, London: Routledge & Kegan Paul.

Polanyi, M (1967), *The tacit dimension*, Doubleday, New York.

Porter, M.E & Fuller, M.B.(1986) 'Coalitions and Global Strategy', In Porter, M.E. (ed) *Competition in Global Industries*, Boston, Harvard Business Press.

Powell, W.W., Koput, K.W. & Smith-Doerr. L (1996), Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology, *Administrative Science Quarterly*, Vol: 41, pp. 116-45.

Powell, W. & Brantley, P. (1992), Competitive cooperation in biotechnology: Learning through networks? In N . Nohria & R. Eccles (eds), *Network and Organizations: Structure, Form and Action*

Prahalad, C.K. & Betti, K.A. (1986), The dominant logic: A new linkage between diversity and performance, *Strategic Management Journal*, Vol: 7(6),pp.485-501.

Prahalad, C.K. & Hamel, G. (1990), The core competence of the cooperation, *Harvard Business Review*, Vol: 68 (May-June), pp.79-93.

Quinn, J.B. (1992), *Intelligent Enterprise: A Knowledge and Service Based Paradigm for Industry.* New York: The Free Press.

Rahim, M.A. (1995) Issues in Organizational Learning, *International Journal of Organization Analysis*, Vol: 3, Iss: 1, pp.5-9.

Reber, A.S. (1989) Implicit Learning and Tacit Knowledge, *Journal of Experimental Psychology: General,* Vol:118 (3), pp.219-235.

Richter, Frank-Jurgen & Vettel, Kai (1995) Successful joint ventures in Japan: Transferring knowledge through organizational learning, *Long Range Planning*, Vol: 28(3), pp.37-45.

Robbins, Stephen P. (2001) *Organizational Behavior*, 9th Edition, Prentice Hall, New Jersey.

Rogers, Everett (1983), *The Diffusion of Innovations*, (Third Edition)(First Edition 1962), New York: Free Press.

Romme, G. & Dillen, R. (1997) Mapping the Landscape of Organizational Learning, *European Management Journal*, Vol: 15, Iss: 1, pp.68-79.

Rosenberg, Nathan (1982) *Inside the black box: Technology and Economics,* New York: Cambridge University Press.

Salk, Jane E. (1992) *Shared management joint ventures: Their developmental patterns, challenges and possibilities.* Unpublished dissertation, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Schein, E. H. (1993) On Dialogue, Culture and Organizational Learning, *Organizational Dynamics*, Vol: 22, Iss: 2, pp.40-52.

Schon, D.A. (1983) *The Reflective Practitioner: How Professionals Think in Action,* New York : Basic Books, Inc.

Schulz, M., (1998) Limits to Bureaucratic Growth: The Density Dependence of Organizational Rule Birth, *Administration Science Quarterly*, Vol: 43, pp.845-876.

Schumacker, R.E, Anderson, C & Mount, R. (2003) *Multiple Linear Regression: General Linear Model,* Paper presented at American Educational Research Association, April 21, Chicago, Illinois

Schweiger, D.L & Ivancevich, J.M. (1987) The Effects of Mergers and Acquisitions on Organizations and Human Resources: A Contingency View, Paper presented at 1987 7th *Annual Strategic Management Society Conference*, Boston.

Senge, P.M. (1990), *The Fifth Discipline: The Age and Practice of the Learning Organization,* Century Business: London.

Senge, P.M. (1996) *The fifth discipline fieldbook: Strategies and tools for building a learning organization,* Nicholas Brealey Publication, London.

Shan, W (1990) An empirical analysis of organizational strategies by entrepreneurial high-technology firms, *Strategic Management Journal,* Vol: 11(2), pp. 129-139.

Simonin, Bernard, L (1997) The importance of collaborative know-how: An empirical test of the learning organization, *Academy of Management Journal,* Vol: 40(5), pp.1150-1174.

Simonin, B. L. & Helleloid, D. (1993) Do Organizations Learn? An Empirical Test of Organizational Learning in International Strategic Alliances. In D. Moore (Ed), *Academy of Management Best Paper Proceedings.*

Small and Medium Industries Development Corporation (SMIDEC), (2001), *Gearing SMIs Toward Globalisation,* SMIDEC, Petaling Jaya, Malaysia.

Smith, H.L., Dickson, K. & Smith, S.L. (1991) There are Two Sides to Every Story: Iinovation and Collaboration within Networks of Large and Small Firms, *Research Policy,* Vol: 20, pp.457-469.

Snow, C.C.; Miles, R.E & Coleman, H.J. (1992) Organizations, *Dynamics,* Vol:20, pp.5-19.

Statistics Department of Malaysia, (2002) Basic Demographic Characteristics Report, [www.document] http//:statistics.gov.my (accessed 15 September 2003).

Steensma, H.K. (1996) Acquiring Technological Competencies through inter-organizational Collaboration: An Organizational Learning Perspective, *Journal of Engineering and Technology Management,* Vol: 12, pp.267-286.

Stewart, M.B. (2002) *Semi-nonparametric Estimation of Extended Ordered Probit Models,* United Kingdom Stata Users' Group Meetings 2003 04, Stata Users Group, pp. 1-14

Sveiby, K.E, (1997) *The New Organizational Wealth, Managing and Measuring Knowledge-based Assets,* Berret-Koehler, San Francisco, CA.

Szulanski, Gabriel (1993), Intra-firm transfer of best practice, appropriative capabilities, and organizational barriers to appropriation. In D.P. Moore, editor, *Academy of Management* best papers proceedings 1993, pp47-51, 53rd Annual Meeting, Atlanta Georgia, August 8-11.

Talwar, R. (1994), Re-engineering – a wonder drug for the 1990s, In C. Coulson-Thomas (Ed), *Business Process Re-engineering: Myth and Reality,* Kogan Page, London, pp.40-60.

Thorelli, H. B (1986) Networks Between Markets and Hierarchies, *Strategic Management Journal*, Vol: 7, pp.37-51.

Tobin, J., (1958), 'Estimation of Relationships for Limited Dependent Varibales', Econometrica, Vol: 26, pp.24-36.

Toffler, A. (1990), *Powershift: Knowledge, Wealth and Violence at the Edge of the 21st Century*. New York: Bantam Books.

Tompkins, T.C., (1995) Role of Diffusion in Collective Learning, *International Journal of Organizational Analysis*, Vol: 3, No: 1,pp.

Trochim, W. M. K (2000) *Research Methods Knowledge Base*, Atomic Dog Publishing, Cincinatti, Ohio.

Tushman, M. & Scanlon, T.J. (1981) Boundary-scanning Individuals: Their Role in Information Transfer and their Antecedents, *Academy of Management Journal*, Vol: 24, pp.289-305.

United Nations Conference on Trade and Development (2000) 'World Investment Report', [www document] http//:www.unctad.org (accessed 10 September 2003).

Vachani, S (1991) Distinguishing between related and unrelated international geographic diversification: A comprehensive measure of global diversification, *Journal of International Business Studies*, Vol: 22, pp.307-322.

Von Krogh, G; Roos, Johan; & Slocum, Ken (1994), An essay on corporate epistemology, *Strategic Management Journal*, Vol: 15(Special issue),pp:53-71.

Wagner, R.K.(1987) Tacit Knowledge in Everyday Intelligent Behaviour, *Journal of Personality and Social Psychology*, Vol: 52, Iss: 6, pp.1236.

Westney, D Eleanor (1988) Domestic and foreign learning curves in managing international cooperative strategies. In F. Contractor & P. Lorange, editors, *Cooperative Strategies in international business*, San Francisco : New Lexington Press.

Winter, Sidney (1987), 'Knowledge and Competence as Strategic Assets', in *The Competitive Challenge-Strategies for Industrial Innovation and Renewal,* D. J. Teece (Ed), New York: Harper & Row.

Yan, A. & Gray, B. (1994) Bargaining Power, Management Control and Performance in United States-China Joint Ventures: A Comparative Case Study, *Academy of Management Journal*, Vol: 37 (6), pp.1478-1517.

Zander, U. & Kogut, B., (1995) Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities : An Empirical Test, *Organization Science*, Vol: 6, Iss: 1, pp.76-92.

Zavoina, R., and McElvey, W., (1975), 'A Statistical Model for the Analysis of Ordinal Level Dependent Variables', *Journal of Mathematical Sociology*, Summer, pp.103-120.

ASTON BUSINESS SCHOOL

APPENDIX 1

SURVEY ON INTERNATIONAL STRATEGIC ALLIANCES

Definition of terms
Alliance – refers to an agreement between two or more firms to work together to achieve mutual goals.

Joint venture – refers to cooperation between two or more firms which involves equity and a new company is formed.

Please refer your answer to a SINGLE international alliance or joint venture.

SECTION 1

1.0 Company's Profile
Refers to the background of the company.

1.1	Years of operation in this alliance/ joint venture. ____________ years

1.2	Sectors that your company (alliance/joint venture) involved in? ____________

2.0 Equity involvement
Equity refers to shares that are bought or owned by the company in a joint venture. An alliance do not involved any equity.
IF JOINT VENTURE (involve equity)

2.1	a)Percentage of equity involvement from each partner? Local partner ____________ %
	Foreign partner ____________ % Name of the country: ____________ Other partner – ____________ % Name of the country ____________
	b) Annual turnover of the joint venture (recent)? RM ____________
	c) Number of employees in the joint venture (recent)? ____________ people

IF AN ALLIANCE (not involve equity)

2.2	a)Type of alliance or contractual agreement that is involved? ____________(eg: joint development, R&D contract, licensing)
	b) Direction of technology flow with foreign partner: *(please tick one box)*
	One way ☐ Two ways ☐
	c) Annual turnover of the local company : RM ____________
	d) Number of employees in the local company: ____________ people

SECTION 2

3.0 Learning Capacity

Refers to the ability of a company to learn from other companies.
(*Please circle your answer*)
*An alliance or joint venture is referred as a relationship.

		Very Little	Little	Fair	Great	Very Great
3.1	How closely related is the technology used in the relationship to the core technology of the local company?	1	2	3	4	5
3.2	How closely related are the skills used in the relationship to the core skills of the local company?	1	2	3	4	5
3.3	How decentralized is the decision making in the relationship?	1	2	3	4	5
3.4	a) To what extent does the relationship depend on the foreign partner for core manufacturing activities?	1	2	3	4	5
	b) To what extent does the foreign partner bring capabilities to the relationship which are different from the local partner?	1	2	3	4	5

3.5	a)Does the current relationship have its own R&D capability?	Yes ☐ (Please continue 3.5)	No ☐ (Please go to 4.0)	
	b)What is the annual expenditure on R&D?	RM ____________		
	c)How many local employees are involved in R&D activities?	____________ people		
	d)Who controls the R&D capability?	Local ☐	Foreign ☐	Both ☐

4.0 Experience

Refers to a process where the company gained some knowledge and skills.

4.1	a)Has the local company been involved in any relationship before?	Yes ☐ (Please continue 4.1)	No ☐ (Please go to 5.0)
	b)How many alliances/joint ventures has the company had before?	____________	
	c)How many of these had international partners?	____________	
	d)How many years of experience does the company have in international relationship?	____________	
	e)How many of the international relationship can be regarded as successful?	____________	

		Very Little	Little	Fair	Great	Very Great
	f)To what extent does the previous international experience help in running the current alliance/joint venture?	1	2	3	4	5

ASTON BUSINESS SCHOOL

5.0 Accessibility

Refers to the extent of knowledge that the local partner can access.

		Very Little	Little	Fair	Great	Very Great
5.1	a) To what extent is the knowledge of local partner similar to the knowledge of foreign partner?	1	2	3	4	5

	b)Does the current relationship have written documents (eg: job manual)?	Yes ☐ [Please go to (bi)]	No ☐ [Please go to (c)]

		Very Little	Little	Fair	Great	Very Great
	i)To what extent do the documents provide understanding to the local company?	1	2	3	4	5

	c)Does the current alliance/joint venture have foreign managers working with local managers?	Yes ☐ [Please continue 5.1]	No ☐ (Please go to 5.2)

	d)How many expatriates are involved in the relationship?	___________ people

		Very Little	Little	Fair	Great	Very Great
	e)To what extent are the foreign managers willing to explain how to do things to local managers?	1	2	3	4	5
	f)To what extent do the foreign managers work together with local managers?	1	2	3	4	5

		Very Little	Little	Fair	Great	Very Great
5.2	a)To what extent do the following apply to the foreign partner in the alliance/joint venture?					
	Ready to transfer new ways of carrying tasks to the local partner?	1	2	3	4	5
	Ready to release information to the local partner?	1	2	3	4	5
	Ready to explain difficulties related to new ideas or tasks to the local partner?	1	2	3	4	5
	b)How do you evaluate your confidence level in the foreign partner in the alliance/joint venture?	1	2	3	4	5

6.0 Active Involvement

Refers to the contribution provided by the foreign partner in the alliance/joint venture.

		Very Little	Little	Fair	Great	Very Great
6.1	To what extent does the foreign partner contribute to the local partner in the following areas ?					
(a)	i)Sales or marketing support	1	2	3	4	5
	ii)Managerial resources	1	2	3	4	5
	iii)Administrative support	1	2	3	4	5
	iv)Emotional support	1	2	3	4	5
	v)Local employees training	1	2	3	4	5

(b)	i)Product-related technology	1	2	3	4	5
	ii)Manufacturing related technology	1	2	3	4	5
	iii)Manufacturing support	1	2	3	4	5
(c)	i)To what extent do you agree that the foreign partner provides the technology while the domestic partner provides the manufacturing capability?	Strongly Disagree 1	Disagree 2	Not Sure 3	Agree 4	Strongly Agree 5
	ii)To what extent do you agree that the foreign partner provides education and training of local managers?	1	2	3	4	5

7.0 <u>Articulated Goals</u>

Refers to the objectives and missions of the partners in forming the alliance/joint venture.

7.1	What are the goals of the relationship? eg: technology transfer, market growth, R&D	________ ________				
7.2	a)Are the objective of the alliance/joint venture written down? b)Are the long term plans of the alliance written down?	Yes ☐ Yes ☐			No ☐ No ☐	
7.3	To what extent the local managers understand the mission of the relationship?	Very Little 1	Little 2	Fair 3	Great 4	Very Great 5

8.0 <u>Knowledge Acquired</u>

Refers to the knowledge gained by the company from the foreign partner.

8.1	To what extent has the local company gained from the foreign partner in the following areas ?	Very Little	Little	Fair	Great	Very Great
	New technological expertise	1	2	3	4	5
	New marketing expertise	1	2	3	4	5
	Product development	1	2	3	4	5
	About foreign culture	1	2	3	4	5
	Managerial techniques	1	2	3	4	5
	Manufacturing process	1	2	3	4	5

<u>SECTION 3</u>

9.0 <u>Cultural differences</u>

Refers to the differences in beliefs and values system which influence organizational behaviour.

9.1	In the specific case of your relationship, estimate the national cultural differences between local and the foreign partner?	Very Little 1	Little 2	Fair 3	Great 4	Very Great 5
9.2	In the specific case of your relationship, estimate the organizational differences (administrative procedures, rules and values) between the local and the foreign partner?	1	2	3	4	5

10.0 Performance

Refers to the achievement made by the company based on human resource, business and general factors.

10.1	How do you assess the alliance/joint venture performance in the following areas ?	Very Poor	Poor	Fair	Good	Excellent
(a)	Training for employees in the alliance	1	2	3	4	5
	Improving management skills as a result of the alliance/joint venture	1	2	3	4	5
(b)	Business volume	1	2	3	4	5
	Market share	1	2	3	4	5
	Achieving planned goals	1	2	3	4	5
	Profitability	1	2	3	4	5
(c)	The local company's performance (due to the relationship)	1	2	3	4	5
	The foreign partner's performance (due to the relationship)	1	2	3	4	5
	Overall alliance performance (due to the relationship)	1	2	3	4	5

11.0 Comment and suggestions

Please provide your comments or suggestions in the following boxes.

11.1	What are the areas that the alliance/joint venture could improve to make the relationship more effective?

11.2	What are the significant areas in the alliance/joint venture that are not covered in this study?

12.0 **RESPONDENT'S PROFILE**

12.1	Title of position held in the company?	________________
12.2	Years of working experience in the company?	____________ years
12.3	Highest education level achieved?	Certificate/Diploma ☐ Professional ☐ Degree ☐ Master ☐ Phd ☐ Others :________ ☐

FOR ANY QUERIES, PLEASE CONTACT:

FARIZA HASHIM
SCHOOL OF MANAGEMENT
UNIVERSITI UTARA MALAYSIA
SINTOK, JITRA
KEDAH
06010

Tel : 04-700-5090
Fax : 04-700-5000
e-mail : farizahashim@hotmail.com

THANK YOU VERY MUCH FOR YOUR COOPERATION

INFORMATION PROVIDED WILL BE HELD IN STRICTEST CONFIDENCE

APPENDIX 2

Questions for face-to-face interviews. **'Knowledge Acquisition Through International Strategic Alliances'**

No	Topic	Questions	Options	Notes
1	Learning capacity	a-i) Degree of dependency on foreign partner for core manufacturing activities? -Why? (reasons for the answer)	Highly dependent ☐ Dependent ☐ Some dependent ☐ Little dependent ☐ Independent ☐	
		a-ii) Areas of dependency -Actions taken to counter the dependency? (if applicable)	Core activities ☐ Supporting activities ☐ Marketing activities ☐ Technical activities ☐ Others ☐	
		b)Usefulness of foreign partner's capabilities to the alliance? -How does it become useful? (elaborate)	Highly useful ☐ Useful ☐ Some useful ☐ Little useful ☐ Not useful ☐	
		c) Degree of trust in the foreign partner in terms of transferring capabilities to the local firm? -If highly trust: What makes the foreign partner can be highly trusted? Example? - If not trust: What actins are taken to counter the trust problem? Example?	Highly trust ☐ Trust ☐ Some trust ☐ Little trust ☐ No trust ☐	

2	Accessibility	a)Can knowledge be easily accessed from the foreign partner? -How is the knowledge accessed? -What kind of knowledge is easily to access and which is difficult to access?	Highly access ☐ Easily access ☐ Some access ☐ Little access ☐ No access ☐	
		b) Is the manufacturing control embodied in the form of ________?	Manuals only ☐ Standard software ☐ Modified software ☐ Developed software ☐ Not in a software ☐ Other forms ☐	
		c) How do the local employees learn from the skilled employees? -Ask for examples.	Communicating ☐ Studying the blue print ☐ Observing ☐ Doing together ☐ Training ☐	
3	Knowledge Acquired	a)How many changes that take place in terms of the organizational systems after the alliance/joint venture was formed? -How significant are the changes? - Examples for changes?	Too many changes ☐ Many changes ☐ Some changes ☐ Little changes ☐ Very little changes ☐	
		b) How many changes that take place in terms of the organizational process after the alliance/joint venture was formed? - How significant are the changes? -Ask for examples.	Too many changes ☐ Many changes ☐ Some changes ☐ Little changes ☐ Very little changes ☐	

APPENDIX 3: RESULTS OF DESCRIPTIVE STATISTICS

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
number of years operating	65	26	2	28	9.82	7.086
sectors that the company involve	65	6	1	7	2.55	1.630
group sector in 5	65	4	0	4	1.08	1.150
electronic	65	1	0	1	.40	.494
electrical	65	1	0	1	.31	.465
telecom	65	1	0	1	.17	.378
automotive	65	1	0	1	.09	.292
other	65	1	0	1	.03	.174
type of relationship	65	1	0	1	.48	.503
percentage of equity by local	31	80	10	90	54.10	23.499
percentage of equity by foreign	31	85	5	90	42.32	25.898
group of equity holding	31	2	0	2	.77	.845
minority and majority equity	23	1	0	1	.35	.487
shared equity	31	1	0	1	.26	.445
name of foreign country	31	16	1	17	6.39	5.506
percentage equity by other partner	6	25	5	30	16.83	9.704
name of country for other partner	6	2	1	3	1.33	.816
annual turnover of jv	28	8.0E+12	3000000	8.0E+12	7.0E+11	2.176E+12
no. of employees in jv	31	5973	27	6000	843.90	1607.630
types of alliances	34	4	1	5	2.68	1.319
country of foreign partner	25	12	1	13	3.76	3.443
technology flow	34	1	1	2	1.79	.410
dummy for technology flow	34	1	0	1	.79	.410
employees in companies	65	8973	27	9000	1193.58	2237.741
size of company based on employees	65	2	0	2	1.32	.886
turnover alliance	29	5.0E+09	1000000	5.0E+09	4.2E+08	1278410522
no. of employees in alliances	31	8970	30	9000	1319.42	2428.717
technology related to core technology	65	3	2	5	3.94	.882
skills related to core skills	65	4	1	5	3.86	.864
prior knowledge	65	3.50	1.50	5.00	3.9000	.84871
decent technological decisions	65	4	1	5	2.28	1.083
decentralise managerial decisions	65	4	1	5	3.22	.780
Valid N (listwise)	0					

APPENDIX 3: RESULTS OF DESCRIPTIVE STATISTICS

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
flexibility of firm	65	4.00	1.00	5.00	2.7462	.81549
depend on foreign partner	65	3	2	5	3.85	.734
different capabilities	65	5	0	5	3.80	.814
determination to learn	65	3.00	2.00	5.00	3.8231	.65210
learning capacity	65	2.00	2.33	4.33	3.4897	.44182
has R&D	65	1	0	1	.57	.499
annual expenditure on R&D	56	5.0E+08	0	5.0E+08	1.0E+07	66695685.130
R&D expenditure group	56	1	0	1	.25	.437
no of local in R&D	37	298	2	300	28.05	57.074
number of people in group	37	1	0	1	.41	.498
control of R&D	37	2	1	3	2.05	.911
local and foreign control	21	1	0	1	.33	.483
both have control on R&D	37	1	0	1	.43	.502
involve in any relationship	65	1	0	1	.38	.490
no of relationship	65	20	0	20	1.57	3.557
no. of intl partner	65	15	0	15	1.34	2.975
no. of year experience intl r/sship	65	25	0	25	3.66	6.107
longer term of experience	65	1	0	1	.26	.443
no. of successful r/ship	65	16	0	16	1.15	2.943
group of successful relationship	65	1	0	1	.12	.331
experience help in running r/ship	65	5	0	5	1.40	1.877
similarity of technical knowledge	65	4	1	5	3.37	.961
similarity of mgrl knowledge	65	3	1	4	3.08	.957
average of similairty of technical and managerial knowledge	65	3.50	1.00	4.50	3.2231	.87514
written document in the r/ship	65	1	0	1	.89	.312
document provide udstdg	65	5	0	5	3.34	1.395
foreign mgrs working with	65	1	0	1	.65	.482
no. of expatriates in the company	65	50	0	50	5.94	10.193
foreign mgrs willing to explain	65	5	0	5	2.45	1.896
Valid N (listwise)	15					

APPENDIX 3: RESULTS OF DESCRIPTIVE STATISTICS

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
foreign mgrs work together with local	65	5	0	5	2.42	1.870
transfer new ways to local	65	4	1	5	3.77	.766
release information to local	65	4	1	5	3.55	.848
new ideas to local	65	3	2	5	3.66	.756
avg grafting with 0	65	5	0	5	2.43	1.881
grafting expatriate	42	2.40	2.20	4.60	3.6762	.58926
indirect experience	65	3.33	1.67	5.00	3.6615	.71076
grafting2 + indirect experience	65	3	1	5	3.17	.868
previou and current experience	65	3.33	1.17	4.50	2.8744	.82392
confidence level in foreign	65	4	1	5	3.72	.820
trust the foreign partner	65	3	1	4	3.46	.812
average of confidence and trust	65	3.50	1.00	4.50	3.5923	.75463
accessibility of knowledge	65	2.75	1.50	4.25	3.4077	.63518
mktg contribution	65	4	1	5	2.74	1.241
mgrl contribution	65	3	1	4	2.32	1.002
admin contribution	65	3	1	4	1.86	.950
emotional contribution	65	4	1	5	1.63	.945
training contribution	65	3	2	5	3.45	.751
average of managerial contribution	65	2.75	1.25	4.00	2.5923	.69817
product related technology	65	4	1	5	3.83	.720
mfg related technology	65	3	2	5	3.57	.790
mfg support	65	3	2	5	3.34	.871
average of technical contribution	65	2.67	2.33	5.00	3.5795	.65425
foreign provide technology	65	4	1	5	3.89	.687
foreign provide training	65	4	1	5	3.60	.787
active involvement average	65	2.30	1.80	4.10	3.0385	.49645
Valid N (listwise)	42					

APPENDIX 3: RESULTS OF DESCRIPTIVE STATISTICS

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
goal of relationship	64	5	1	6	1.63	1.031
type of goals, technology and none	65	1	0	1	.60	.494
objective of the relationship	65	1	0	1	.85	.364
long term plan of r/ship	65	1	0	1	.78	.414
neither written or one or both	65	1	0	1	.85	.364
group of written objective and long plan	65	2	0	2	1.63	.741
understand mission	63	3	2	5	3.81	.564
new technological expertise	65	3	2	5	3.72	.673
TECHEXP2	65	3	1	4	2.72	.673
new maktg expertise	65	4	1	5	2.62	.947
product development	65	4	1	5	3.18	.950
PRODEV2	65	4	0	4	2.18	.950
foreign culture	65	4	1	5	3.43	.749
managerial techniques	65	4	1	5	2.57	1.000
manufacturing process	65	4	1	5	3.34	.853
MFPRO2	65	4	0	4	2.34	.853
avg knowledge acquired	65	3.00	2.40	5.40	3.7692	.63268
groups for knowledge acquired	65	1	0	1	.95	.211
cultural differences	65	4	1	5	3.31	.683
organizational culture	65	3	2	5	3.35	.648
avg national cult and orgzn culture	65	3.00	2.00	5.00	3.3308	.58814
training performance	65	4	1	5	3.42	.864
mgmt performance	65	4	1	5	2.86	1.044
avg of training and mgmt improvement	65	3.50	1.00	4.50	3.1385	.81733
two grp of human	65	1	0	1	.72	.451
business volume	65	2	3	5	3.68	.615
market share	65	3	2	5	3.57	.612
plan goals	65	3	2	5	3.71	.655
profitability	65	4	1	5	3.62	.678
avg buss, makt, plangoal and profit	65	2.50	2.50	5.00	3.6423	.50189
two grp buss	65	1	0	1	.98	.124
local firm's performance	45	4	1	5	3.58	.723
foreign firm's performance	45	4	1	5	3.67	.739
overall alliance performance	65	3	2	5	3.80	.565
avg local,foreign and overall perf	45	3.00	2.00	5.00	3.6667	.61955
two grp genper	45	1	0	1	.93	.252
avg of all hr,bus and general performance	45	2.31	2.11	4.42	3.4519	.53819
two grp of performa	45	1	0	1	.89	.318
Valid N (listwise)	42					

PAGE
MISSING
IN
ORIGINAL

APPENDIX 4 : RESULTS OF RELIABILITY TEST

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	SKILL	3.8615	.8638	65.0
2.	TECH	3.9385	.8817	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	7.8000	2.8812	1.6974	2

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
SKILL	3.9385	.7774	.8913	.
TECH	3.8615	.7462	.8913	.

Reliability Coefficients

N of Cases = 65.0 N of Items = 2

Alpha = .9424

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	TECDEC	2.2769	1.0826	65.0
2.	DECENT	3.2154	.7805	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	5.4923	2.6601	1.6310	2

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
TECDEC	3.2154	.6091	.5200	.
DECENT	2.2769	1.1721	.5200	.

Reliability Coefficients

N of Cases = 65.0 N of Items = 2

Alpha = .6608

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	DEPEND	3.8462	.7338	65.0
2.	CAPAB	3.8000	.8139	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	7.6462	1.7010	1.3042	2

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
DEPEND	3.8000	.6625	.4186	.
CAPAB	3.8462	.5385	.4186	.

Reliability Coefficients

N of Cases = 65.0 N of Items = 2

Alpha = .5879

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	EXPLAIN	2.4462	1.8960	65.0
2.	TOGETHER	2.4154	1.8699	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	4.8615	14.1524	3.7620	2

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
EXPLAIN	2.4154	3.4966	.9958	.
TOGETHER	2.4462	3.5947	.9958	.

Reliability Coefficients

N of Cases = 65.0 N of Items = 2

Alpha = .9979

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	TRANSFER	3.7692	.7659	65.0
2.	RELEASE	3.5538	.8484	65.0
3.	IDEAS	3.6615	.7557	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	10.9846	4.5466	2.1323	3

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
TRANSFER	7.2154	2.2341	.7539	.8444
RELEASE	7.4308	1.9990	.7620	.8418
IDEAS	7.3231	2.1909	.7977	.8075

Reliability Coefficients

N of Cases = 65.0 N of Items = 3

Alpha = .8806

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	TECHKNO	3.3692	.9613	65.0
2.	MGRLKNO	3.0769	.9570	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	6.4462	3.0635	1.7503	2

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
TECHKNO	3.0769	.9159	.6650	.
MGRLKNO	3.3692	.9240	.6650	.

Reliability Coefficients

N of Cases = 65.0 N of Items = 2

Alpha = .7988

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	CONFIDEN	3.7231	.8198	65.0
2.	TRUST	3.4615	.8116	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	7.1846	2.2779	1.5093	2

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
CONFIDEN	3.4615	.6587	.7117	.
TRUST	3.7231	.6721	.7117	.

Reliability Coefficients

N of Cases = 65.0 N of Items = 2

Alpha = .8316

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	PRODUCT	3.8308	.7196	65.0
2.	MFTECH	3.5692	.7900	65.0
3.	MFSUPP	3.3385	.8710	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	10.7385	3.8524	1.9628	3

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
PRODUCT	6.9077	2.4288	.4038	.8614
MFTECH	7.1692	1.6428	.7830	.4460
MFSUPP	7.4000	1.6812	.6253	.6417

Reliability Coefficients

N of Cases = 65.0 N of Items = 3

Alpha = .7600

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	MKTG	2.7385	1.2409	65.0
2.	MGRL	2.3231	1.0017	65.0
3.	ADMIN	1.8615	.9499	65.0
4.	TRAIN	3.4462	.7506	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	10.3692	7.7990	2.7927	4

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
MKTG	7.6308	4.1740	.4112	.6126
MGRL	8.0462	4.1697	.6419	.4187
ADMIN	8.5077	4.5976	.5644	.4864
TRAIN	6.9231	6.6659	.1470	.7246

Reliability Coefficients

N of Cases = 65.0 N of Items = 4

Alpha = .6479

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	TECHEXP	3.7231	.6733	65.0
2.	MKTGEXP	2.6154	.9469	65.0
3.	PRODEV	3.1846	.9502	65.0
4.	FORCULT	3.4308	.7494	65.0
5.	MGRLTEC	2.5692	.9995	65.0
6.	MFPRO	3.3385	.8529	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	18.8615	10.0274	3.1666	6

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
TECHEXP	15.1385	8.1212	.3786	.6209
MKTGEXP	16.2462	7.2822	.3617	.6245
PRODEV	15.6769	6.5971	.5178	.5607
FORCULT	15.4308	8.1865	.2983	.6424

MGRLTEC	16.2923	6.8038	.4266	.5993
MFPRO	15.5231	7.6596	.3475	.6277

Reliability Coefficients

N of Cases = 65.0 N of Items = 6

Alpha = .6566

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	CULDIF	3.3077	.6829	65.0
2.	ORGCUL	3.3538	.6479	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	6.6615	1.3837	1.1763	2

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
CULDIF	3.3538	.4197	.5624	.
ORGCUL	3.3077	.4663	.5624	.

Reliability Coefficients

N of Cases = 65.0 N of Items = 2

Alpha = .7192

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	TRAINPE	3.4154	.8641	65.0
2.	MGMTPE	2.8615	1.0440	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	6.2769	2.6721	1.6347	2

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted

TRAINPE	2.8615	1.0899	.4631	.
MGMTPE	3.4154	.7466	.4631	.

Reliability Coefficients

N of Cases = 65.0 N of Items = 2

Alpha = .6254

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	BUSVOL	3.6769	.6151	65.0
2.	MKTSH	3.5692	.6116	65.0
3.	PLANGO	3.7077	.6549	65.0
4.	PROFIT	3.6154	.6776	65.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	14.5692	4.0303	2.0076	4

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
BUSVOL	10.8923	2.3476	.6920	.6936
MKTSH	11.0000	2.3750	.6797	.7002
PLANGO	10.8615	2.3087	.6496	.7128
PROFIT	10.9538	2.6697	.4071	.8363

Reliability Coefficients

N of Cases = 65.0 N of Items = 4

Alpha = .7906

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	LOCPER	3.5778	.7226	45.0
2.	FORPER	3.6667	.7385	45.0
3.	ALLYPER	3.7556	.6089	45.0

Statistics for	Mean	Variance	Std Dev	N of Variables
SCALE	11.0000	3.4545	1.8586	3

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
LOCPER	7.4222	1.6131	.7186	.8641
FORPER	7.3333	1.5455	.7426	.8444
ALLYPER	7.2444	1.7343	.8415	.7688

Reliability Coefficients

N of Cases = 45.0 N of Items = 3

Alpha = .8754

Correlations

		learning capacity	knowledge acquired
learning capacity	Pearson Correlation	1.000	.435**
	Sig. (1-tailed)	.	.000
	N	65	65
knowledge acquired	Pearson Correlation	.435**	1.000
	Sig. (1-tailed)	.000	.
	N	65	65

**. Correlation is significant at the 0.01 level (1-tailed).

Correlations

Correlations

		knowledge acquired	prior knowledge
knowledge acquired	Pearson Correlation	1.000	.276*
	Sig. (1-tailed)	.	.013
	N	65	65
prior knowledge	Pearson Correlation	.276*	1.000
	Sig. (1-tailed)	.013	.
	N	65	65

*. Correlation is significant at the 0.05 level (1-tailed).

Correlations

Correlations

		knowledge acquired	flexibility of firm
knowledge acquired	Pearson Correlation	1.000	.169
	Sig. (1-tailed)	.	.089
	N	65	65
flexibility of firm	Pearson Correlation	.169	1.000
	Sig. (1-tailed)	.089	.
	N	65	65

Correlations

Correlations

		knowledge acquired	determination to learn
knowledge acquired	Pearson Correlation	1.000	.312**
	Sig. (1-tailed)	.	.006
	N	65	65
determination to learn	Pearson Correlation	.312**	1.000
	Sig. (1-tailed)	.006	.
	N	65	65

**. Correlation is significant at the 0.01 level (1-tailed).

T-Test

Group Statistics

	has R&D	N	Mean	Std. Deviation	Std. Error Mean
knowledge acquired	no	28	3.5571	.6741	.1274
	yes	37	3.9297	.5562	9.144E-02

Independent Samples Test

		Levene's Test for Equality of Variances	
		F	Sig.
knowledge acquired	Equal variances assumed	.694	.408
	Equal variances not assumed		

Independent Samples Test

		t-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
knowledge acquired	Equal variances assumed	-2.440	63	.017	-.3726
	Equal variances not assumed	-2.376	51.697	.021	-.3726

Independent Samples Test

		t-test for Equality of Means		
			95% Confidence Interval of the Difference	
		Std. Error Difference	Lower	Upper
knowledge acquired	Equal variances assumed	.1527	-.6777	-6.75E-02
	Equal variances not assumed	.1568	-.6873	-5.79E-02

Correlations

Correlations

		avg knowledge acquired	no of local in R&D
avg knowledge acquired	Pearson Correlation	1	.023
	Sig. (1-tailed)	.	.446
	N	65	37
no of local in R&D	Pearson Correlation	.023	1
	Sig. (1-tailed)	.446	.
	N	37	37

Correlations

Correlations

		avg knowledge acquired	annual expenditure on R&D
avg knowledge acquired	Pearson Correlation	1	.104
	Sig. (1-tailed)	.	.222
	N	65	56
annual expenditure on R&D	Pearson Correlation	.104	1
	Sig. (1-tailed)	.222	.
	N	56	56

T-Test

Group Statistics

	local and foreign control	N	Mean	Std. Deviation	Std. Error Mean
knowledge acquired	local	14	3.9143	.5641	.1508
	foreign	7	4.1143	.5273	.1993

Independent Samples Test

		Levene's Test for Equality of Variances	
		F	Sig.
knowledge acquired	Equal variances assumed	.079	.782
	Equal variances not assumed		

Independent Samples Test

		t-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
knowledge acquired	Equal variances assumed	-.782	19	.444	-.2000
	Equal variances not assumed	-.800	12.884	.438	-.2000

Independent Samples Test

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
knowledge acquired	Equal variances assumed	.2559	-.7356	.3356
	Equal variances not assumed	.2499	-.7404	.3404

T-Test

Group Statistics

	involve in any relationship	N	Mean	Std. Deviation	Std. Error Mean
knowledge acquired	no	40	3.7950	.6251	9.884E-02
	yes	25	3.7280	.6554	.1311

Independent Samples Test

		Levene's Test for Equality of Variances	
		F	Sig.
knowledge acquired	Equal variances assumed	.001	.979
	Equal variances not assumed		

Independent Samples Test

		t-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
knowledge acquired	Equal variances assumed	.413	63	.681	6.700E-02
	Equal variances not assumed	.408	49.248	.685	6.700E-02

Independent Samples Test

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
knowledge acquired	Equal variances assumed	.1624	-.2574	.3914
	Equal variances not assumed	.1642	-.2629	.3969

Correlations

Correlations

		knowledge acquired	no. of year experience intl r/sship	no. of successful r/ship	experience help in running r/ship
knowledge acquired	Pearson Correlation	1.000	.031	.024	-.058
	Sig. (1-tailed)	.	.402	.424	.323
	N	65	65	65	65
no. of year experience intl r/sship	Pearson Correlation	.031	1.000	.616**	.834**
	Sig. (1-tailed)	.402	.	.000	.000
	N	65	65	65	65
no. of successful r/ship	Pearson Correlation	.024	.616**	1.000	.571**
	Sig. (1-tailed)	.424	.000	.	.000
	N	65	65	65	65
experience help in running r/ship	Pearson Correlation	-.058	.834**	.571**	1.000
	Sig. (1-tailed)	.323	.000	.000	.
	N	65	65	65	65

**. Correlation is significant at the 0.01 level (1-tailed).

Correlations

Correlations

		knowledge acquired	grafting2 + indirect experience	previou and current experience
knowledge acquired	Pearson Correlation	1.000	.533**	.446**
	Sig. (1-tailed)	.	.000	.000
	N	65	65	65
grafting2 + indirect experience	Pearson Correlation	.533**	1.000	.926**
	Sig. (1-tailed)	.000	.	.000
	N	65	65	65
previou and current experience	Pearson Correlation	.446**	.926**	1.000
	Sig. (1-tailed)	.000	.000	.
	N	65	65	65
indirect experience	Pearson Correlation	.312**	.498**	.513**
	Sig. (1-tailed)	.006	.000	.000
	N	65	65	65
avg grafting with 0	Pearson Correlation	.438**	.871**	.777**
	Sig. (1-tailed)	.000	.000	.000
	N	65	65	65

APPENDIX 5: RESULTS OF UNIVARIATE ANALYSIS (T-TEST AND CORRELATION)

Group Statistics

	group of written objective and long plan	N	Mean	Std. Deviation	Std. Error Mean
avg knowledge acquired	either written	4	3.3500	.57446	.28723
	both written	51	3.8549	.62492	.08751

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower
avg knowledge acquired	Equal variances assumed	.038	.846	-1.563	53	.124	-.5049	.32306	-1.15287
	Equal variances not assumed			-1.682	3.581	.176	-.5049	.30026	-1.37849

PAGE NUMBERING AS ORIGINAL

T-Test

Group Statistics

	objective of the relationship	N	Mean	Std. Deviation	Std. Error Mean
knowledge acquired	no	10	3.5000	.6055	.1915
	yes	55	3.8182	.6304	8.501E-02

Independent Samples Test

		Levene's Test for Equality of Variances	
		F	Sig.
knowledge acquired	Equal variances assumed	.075	.785
	Equal variances not assumed		

Independent Samples Test

		t-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
knowledge acquired	Equal variances assumed	-1.476	63	.145	-.3182
	Equal variances not assumed	-1.519	12.814	.153	-.3182

Independent Samples Test

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
knowledge acquired	Equal variances assumed	.2155	-.7489	.1125
	Equal variances not assumed	.2095	-.7715	.1351

T-Test

Group Statistics

	long term plan of r/ship	N	Mean	Std. Deviation	Std. Error Mean
knowledge acquired	no	14	3.4571	.5787	.1547
	yes	51	3.8549	.6249	8.751E-02

Independent Samples Test

		Levene's Test for Equality of Variances	
		F	Sig.
knowledge acquired	Equal variances assumed	.031	.862
	Equal variances not assumed		

Independent Samples Test

		t-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
knowledge acquired	Equal variances assumed	-2.141	63	.036	-.3978
	Equal variances not assumed	-2.238	22.066	.036	-.3978

Independent Samples Test

		t-test for Equality of Means		
			95% Confidence Interval of the Difference	
		Std. Error Difference	Lower	Upper
knowledge acquired	Equal variances assumed	.1858	-.7690	-2.65E-02
	Equal variances not assumed	.1777	-.7663	-2.93E-02

Correlations

Correlations

		knowledge acquired	active involvement average
knowledge acquired	Pearson Correlation	1.000	.716**
	Sig. (1-tailed)	.	.000
	N	65	65
active involvement average	Pearson Correlation	.716**	1.000
	Sig. (1-tailed)	.000	.
	N	65	65

**. Correlation is significant at the 0.01 level (1-tailed).

Correlations

Correlations

		knowledge acquired	average of technical contribution
knowledge acquired	Pearson Correlation	1.000	.572**
	Sig. (1-tailed)	.	.000
	N	65	65
average of technical contribution	Pearson Correlation	.572**	1.000
	Sig. (1-tailed)	.000	.
	N	65	65

**. Correlation is significant at the 0.01 level (1-tailed).

Correlations

Correlations

		knowledge acquired	average of managerial contribution
knowledge acquired	Pearson Correlation	1.000	.624**
	Sig. (1-tailed)	.	.000
	N	65	65
average of managerial contribution	Pearson Correlation	.624**	1.000
	Sig. (1-tailed)	.000	.
	N	65	65

**. Correlation is significant at the 0.01 level (1-tailed).

Correlations

Correlations

		knowledge acquired	foreign provide technology
knowledge acquired	Pearson Correlation	1.000	.186
	Sig. (1-tailed)	.	.069
	N	65	65
foreign provide technology	Pearson Correlation	.186	1.000
	Sig. (1-tailed)	.069	.
	N	65	65

Correlations

Correlations

		knowledge acquired	foreign provide training
knowledge acquired	Pearson Correlation	1.000	.540**
	Sig. (1-tailed)	.	.000
	N	65	65
foreign provide training	Pearson Correlation	.540**	1.000
	Sig. (1-tailed)	.000	.
	N	65	65

**. Correlation is significant at the 0.01 level (1-tailed).

T-Test

Group Statistics

	written document in the r/ship	N	Mean	Std. Deviation	Std. Error Mean
knowledge acquired	no	7	3.3143	.7819	.2955
	yes	55	3.8364	.6099	8.224E-02

Independent Samples Test

		Levene's Test for Equality of Variances	
		F	Sig.
knowledge acquired	Equal variances assumed	2.467	.122
	Equal variances not assumed		

Independent Samples Test

		t-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
knowledge acquired	Equal variances assumed	-2.068	60	.043	-.5221
	Equal variances not assumed	-1.702	6.961	.133	-.5221

Independent Samples Test

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
knowledge acquired	Equal variances assumed	.2525	-1.0272	-1.70E-02
	Equal variances not assumed	.3068	-1.2483	.2042

Correlations

Correlations

		knowledge acquired	document provide udstdg
knowledge acquired	Pearson Correlation	1.000	.252*
	Sig. (1-tailed)	.	.021
	N	65	65
document provide udstdg	Pearson Correlation	.252*	1.000
	Sig. (1-tailed)	.021	.
	N	65	65

*. Correlation is significant at the 0.05 level (1-tailed).

Correlations

Correlations

		knowledge acquired	accessibility of knowledge	average of confidence and trust	average of similairty of technical and managerial knowledge
knowledge acquired	Pearson Correlation	1.000	.356**	.356**	.210*
	Sig. (1-tailed)	.	.002	.002	.046
	N	65	65	65	65
accessibility of knowledge	Pearson Correlation	.356**	1.000	.739**	.814**
	Sig. (1-tailed)	.002	.	.000	.000
	N	65	65	65	65
average of confidence and trust	Pearson Correlation	.356**	.739**	1.000	.211*
	Sig. (1-tailed)	.002	.000	.	.046
	N	65	65	65	65
average of similairty of technical and managerial knowledge	Pearson Correlation	.210*	.814**	.211*	1.000
	Sig. (1-tailed)	.046	.000	.046	.
	N	65	65	65	65

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

Correlations

Correlations

		knowledge acquired	avg national cult and orgzn culture
knowledge acquired	Pearson Correlation	1.000	-.060
	Sig. (1-tailed)	.	.316
	N	65	65
avg national cult and orgzn culture	Pearson Correlation	-.060	1.000
	Sig. (1-tailed)	.316	.
	N	65	65

Correlations

Correlations

		avg of all hr,bus and general performance	avg national cult and orgzn culture
avg of all hr,bus and general performance	Pearson Correlation	1.000	-.273*
	Sig. (1-tailed)	.	.035
	N	45	45
avg national cult and orgzn culture	Pearson Correlation	-.273*	1.000
	Sig. (1-tailed)	.035	.
	N	45	65

*. Correlation is significant at the 0.05 level (1-tailed).

Correlations

Correlations

		knowledge acquired	avg of training and mgmt improvement	avg buss, makt, plangoal and profit
knowledge acquired	Pearson Correlation	1.000	.694**	.339**
	Sig. (1-tailed)	.	.000	.003
	N	65	65	65
avg of training and mgmt improvement	Pearson Correlation	.694**	1.000	.223*
	Sig. (1-tailed)	.000	.	.037
	N	65	65	65
avg buss, makt, plangoal and profit	Pearson Correlation	.339**	.223*	1.000
	Sig. (1-tailed)	.003	.037	.
	N	65	65	65
avg local,foreign and overall perf	Pearson Correlation	.430**	.383**	.672**
	Sig. (1-tailed)	.002	.005	.000
	N	45	45	45
avg of all hr,bus and general performance	Pearson Correlation	.677**	.788**	.721**
	Sig. (1-tailed)	.000	.000	.000
	N	45	45	45

APPENDIX 6: RESULTS OF CENSORED REGRESSION (KNOWLEDGE ACQUISITION)

```
--> RESET
--> READ; File=a:\rawdata1.wk1; format=wks; names$
WKx file does not have the expected format. Cannot continue
--> Read; Nobs=100; File=Data.PRJ$
READ - error reading NVAR or NVAR not specified.
--> read; file=a:\rawdata1.wk1; format=wks; names$
WKx file does not have the expected format. Cannot continue
--> read; file=c:\rawdata1.wk1; format=wks; names$
Could not open the WKS File listed below('Data area is',I7,' by',I4,'. WKS cell
c:\rawdata1.wk1
READ - error or end of file occurs while reading data set.
--> RESET
--> LOAD;file="A:\fariza.lpj"$
LOAD has reconstructed your previous session.
--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...

+----------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression             |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = KNOAC    Mean=  3.769230769    , S.D.=  .6326835398      |
| Model size: Observations =      65, Parameters =  10, Deg.Fr.=    55 |
| Residuals:  Sum of squares= 15.42807271    , Std.Dev.=         .52963 |
| Fit:        R-squared=  .397775, Adjusted R-squared =          .29923 |
| Model test: F[  9,     55] =    4.04,    Prob value =          .00052 |
| Diagnostic: Log-L =    -45.4896, Restricted(b=0) Log-L =    -61.9711 |
|             LogAmemiyaPrCrt.=   -1.128, Akaike Info. Crt.=     1.707 |
+----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  1.145943232      .61938085       1.850   .0643
 YEARS    -.3208960409E-02  .10514292E-01   -.305   .7602  9.8153846
 TYPE      .3120845799      .14595825       2.138   .0325  .47692308
 SIZE      .1830419675      .88272865E-01   2.074   .0381  1.3230769
 ELECTRON -.2276007775      .40729049       -.559   .5763  .40000000
 ELECTRIC -.2585807765      .41292527       -.626   .5312  .30769231
 TELECOM  -.4639107626      .43020413      -1.078   .2809  .16923077
 AUTOMOTI -.6141154103      .46326256      -1.326   .1850  .92307692E-01
 RESDEV    .2382983456      .14359732       1.659   .0970  .56923077
 LECAP     .6974490079      .15998962       4.359   .0000  3.4897436

Normal exit from iterations. Exit status=0.

          +---------------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates                |
          | Dependent variable              KNOAC       |
          | Weighting variable              ONE         |
          | Number of observations          65          |
          | Iterations completed            4           |
          | Log likelihood function     -46.34887       |
          | Threshold values for the model:             |
          | Lower=     1.0000    Upper=     5.0000      |
```

```
          +------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
        Primary Index Equation for Model
 Constant 1.094096137    .57086372      1.917  .0553
 YEARS   -.1508062307E-02 .97061440E-02  -.155  .8765 9.8153846
 TYPE     .3266626007    .13391162      2.439  .0147 .47692308
 SIZE     .1792850783    .81024458E-01  2.213  .0269 1.3230769
 ELECTRON -.2265831765    .37309142      -.607  .5436 .40000000
 ELECTRIC -.2552933924    .37811445      -.675  .4996 .30769231
 TELECOM  -.4829151866    .39410629     -1.225  .2204 .16923077
 AUTOMOTI -.6079925265    .42443356     -1.432  .1520 .92307692E-01
 RESDEV   .2192038057    .13225720      1.657  .0974 .56923077
 LECAP    .7105151515    .14762427      4.813  .0000 3.4897436
        Disturbance standard deviation
 Sigma    .4849767567    .43589812E-01  11.126  .0000

--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...

+-----------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression              |
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = KNOAC    Mean=  3.742857143    , S.D.=  .6344237594       |
| Model size: Observations =      56, Parameters =  10, Deg.Fr.=    46 |
| Residuals:  Sum of squares= 14.18971694    , Std.Dev.=         .55540 |
| Fit:        R-squared=  .359009, Adjusted R-squared =         .23360 |
| Model test: F[  9,    46] =   2.86,    Prob value =         .00911 |
| Diagnostic: Log-L =   -41.0212, Restricted(b=0) Log-L =    -53.4739 |
|             LogAmemiyaPrCrt.=   -1.012, Akaike Info. Crt.=    1.822 |
+-----------------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant 1.064391468    .69019545      1.542  .1230
 YEARS    .8253946931E-02 .12235952E-01   .675  .5000 9.5178571
 TYPE     .2827475685    .16622308      1.701  .0889 .42857143
 SIZE     .1888008229    .99431417E-01  1.899  .0576 1.2142857
 ELECTRON -.1790609120    .42749447      -.419  .6753 .41071429
 ELECTRIC -.1701967390    .43870659      -.388  .6981 .30357143
 TELECOM  -.3047865329    .45429774      -.671  .5023 .16071429
 AUTOMOTI -.5861771538    .49343485     -1.188  .2349 .89285714E-01
 EXPEND   -.3591494010E-09 .12602259E-08  -.285  .7757 10243214.
 LECAP    .7048835120    .18633628      3.783  .0002 3.5178571

Normal exit from iterations. Exit status=0.

          +------------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates              |
          | Dependent variable              KNOAC     |
```

```
          | Weighting variable             ONE    |
          | Number of observations          56    |
          | Iterations completed             4    |
          | Log likelihood function   -41.48293   |
          | Threshold values for the model:       |
          | Lower=   1.0000   Upper=   5.0000     |
          +---------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Primary Index Equation for Model
 Constant 1.002792104    .62697000      1.599  .1097
 YEARS    .1052745911E-01 .11147052E-01   .944  .3450 9.5178571
 TYPE     .2964014866    .14985647      1.978  .0479 .42857143
 SIZE     .1839671283    .89860865E-01  2.047  .0406 1.2142857
 ELECTRON -.1917191853   .38539223      -.497  .6189 .41071429
 ELECTRIC -.1746136341   .39498550      -.442  .6584 .30357143
 TELECOM  -.3403648564   .40951040      -.831  .4059 .16071429
 AUTOMOTI -.5963071158   .44494684     -1.340  .1802 .89285714E-01
 EXPEND   -.3876142419E-09 .11395061E-08 -.340  .7337 10243214.
 LECAP    .7206429497    .16927298      4.257  .0000 3.5178571
      Disturbance standard deviation
 Sigma    .4999803536    .48525713E-01 10.303  .0000
```

```
--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...

+-------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED  Regression           |
| Ordinary   least squares regression    Weighting variable = none  |
| Dep. var. = KNOAC   Mean=  3.769230769   , S.D.=  .6326835398     |
| Model size: Observations =     65, Parameters =  12, Deg.Fr.=  53 |
| Residuals:  Sum of squares= 15.25068949    , Std.Dev.=     .53642 |
| Fit:        R-squared=  .404699, Adjusted R-squared =      .28115 |
| Model test: F[ 11,    53] =   3.28,   Prob value =        .00178 |
| Diagnostic: Log-L =  -45.1137, Restricted(b=0) Log-L =  -61.9711 |
|            LogAmemiyaPrCrt.=  -1.076, Akaike Info. Crt.=   1.757 |
+-------------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant 1.131030062    .68919718      1.641  .1008
 YEARS    -.5189091483E-02 .10993822E-01 -.472  .6369 9.8153846
 TYPE     .3424220608    .15339089      2.232  .0256 .47692308
 SIZE     .1951176576    .90721455E-01  2.151  .0315 1.3230769
 ELECTRON -.2015445017   .47803860      -.422  .6733 .40000000
 ELECTRIC -.2046345865   .48410177      -.423  .6725 .30769231
 TELECOM  -.4213551615   .53316840      -.790  .4294 .16923077
 AUTOMOTI -.6285304153   .54737300     -1.148  .2509 .92307692E-01
 RESDEV   .2537939582    .14784164      1.717  .0860 .56923077
 PRIOR    .2018125701    .10056165      2.007  .0448 3.9000000
 FLEXIBI  .2912855534    .92898198E-01  3.136  .0017 2.7461538
```

```
DETERMIN .2116422040    .11495005     1.841  .0656 3.8230769

Normal exit from iterations. Exit status=0.

          +---------------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates                |
          | Dependent variable              KNOAC       |
          | Weighting variable              ONE         |
          | Number of observations          65          |
          | Iterations completed            4           |
          | Log likelihood function    -45.99545        |
          | Threshold values for the model:             |
          | Lower=  1.0000    Upper=  5.0000            |
          +---------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
      Primary Index Equation for Model
 Constant 1.084751237    .62181146      1.745  .0811
 YEARS   -.3450447567E-02 .99624322E-02  -.346  .7291 9.8153846
 TYPE     .3557518406    .13805059      2.577  .0100 .47692308
 SIZE     .1907820571    .81690821E-01  2.335  .0195 1.3230769
 ELECTRON -.2032484842   .42988261      -.473  .6364 .40000000
 ELECTRIC -.2053524874   .43507029      -.472  .6369 .30769231
 TELECOM  -.4446043495   .47929465      -.928  .3536 .16923077
 AUTOMOTI -.6240481991   .49226001     -1.268  .2049 .92307692E-01
 RESDEV   .2347995835    .13358734      1.758  .0788 .56923077
 PRIOR    .2076765201    .90797028E-01  2.287  .0222 3.9000000
 FLEXIBI  .2934918056    .83574834E-01  3.512  .0004 2.7461538
 DETERMIN .2155844548    .10338108      2.085  .0370 3.8230769
      Disturbance standard deviation
 Sigma    .4820185687    .43333015E-01  11.124 .0000

--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...

+-----------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED  Regression               |
| Ordinary   least squares regression   Weighting variable = none       |
| Dep. var. = KNOAC   Mean=  3.742857143   , S.D.=  .6344237594         |
| Model size: Observations =     56, Parameters =  12, Deg.Fr.=    44   |
| Residuals:  Sum of squares= 14.13624732    , Std.Dev.=      .56681    |
| Fit:        R-squared= .361424, Adjusted R-squared =         .20178   |
| Model test: F[ 11,    44] =   2.26,  Prob value =         .02738      |
| Diagnostic: Log-L =   -40.9155, Restricted(b=0) Log-L =    -53.4739   |
|          LogAmemiyaPrCrt.=  -.941, Akaike Info. Crt.=     1.890       |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant .9550162492    .79701670      1.198  .2308
```

```
 YEARS     .6928135374E-02 .12915198E-01    .536  .5917 9.5178571
 TYPE     .2995170027     .17497638     1.712  .0869 .42857143
 SIZE     .1939445941     .10309977     1.881  .0600 1.2142857
 ELECTRON -.9601095646E-01 .51324269     -.187  .8516 .41071429
 ELECTRIC -.8033186103E-01 .51863458     -.155  .8769 .30357143
 TELECOM  -.1895259646    .58799420     -.322  .7472 .16071429
 AUTOMOTI -.5009023645    .60133300     -.833  .4049 .89285714E-01
 EXPEND   -.3534811341E-09 .12861973E-08  -.275  .7834 10243214.
 PRIOR    .1997655868     .11431841     1.747  .0806 3.9017857
 FLEXIBI  .2602929084     .10598558     2.456  .0141 2.8035714
 DETERMIN .2576421767     .13776581     1.870  .0615 3.8482143

Normal exit from iterations. Exit status=0.

          +-------------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates              |
          | Dependent variable           KNOAC    |
          | Weighting variable            ONE    |
          | Number of observations          56    |
          | Iterations completed           4    |
          | Log likelihood function     -41.40586    |
          | Threshold values for the model:          |
          | Lower=   1.0000   Upper=   5.0000     |
          +-------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Primary Index Equation for Model
 Constant .9197724896     .70469935     1.305  .1918
 YEARS    .9345991441E-02 .11521206E-01   .811  .4173 9.5178571
 TYPE     .3107887119     .15420175     2.015  .0439 .42857143
 SIZE     .1885874615     .91103091E-01  2.070  .0384 1.2142857
 ELECTRON -.1260093377    .45323328     -.278  .7810 .41071429
 ELECTRIC -.1024283228    .45715303     -.224  .8227 .30357143
 TELECOM  -.2491082642    .51889733     -.480  .6312 .16071429
 AUTOMOTI -.5307996551    .53104629    -1.000  .3175 .89285714E-01
 EXPEND   -.3802729433E-09 .11374866E-08  -.334  .7381 10243214.
 PRIOR    .2113765175     .10147210     2.083  .0372 3.9017857
 FLEXIBI  .2631484749     .93477084E-01  2.815  .0049 2.8035714
 DETERMIN .2560865892     .12134467     2.110  .0348 3.8482143
       Disturbance standard deviation
 Sigma    .4990797616     .48448704E-01  10.301  .0000

--> RESET
--> LOAD;file="A:\fariza.lpj"$
LOAD has reconstructed your previous session.
--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...

+------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression            |
```

```
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = KNOAC    Mean=  3.783870968    , S.D.=  .6440633174      |
| Model size: Observations =      62, Parameters =  10, Deg.Fr.=    52 |
| Residuals:  Sum of squares= 16.22738772    , Std.Dev.=        .55863 |
| Fit:        R-squared=  .358699, Adjusted R-squared =        .24771 |
| Model test: F[  9,     52] =   3.23,   Prob value =          .00348 |
| Diagnostic: Log-L =   -46.4207, Restricted(b=0) Log-L =   -60.1927 |
|          LogAmemiyaPrCrt.=  -1.015, Akaike Info. Crt.=      1.820 |
+---------------------------------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	1.253081416	.65425007	1.915	.0555	
YEARS	.6273241474E-02	.11513411E-01	.545	.5858	10.000000
TYPE	.1142734741	.15574439	.734	.4631	.50000000
SIZE	.2377461090	.96906337E-01	2.453	.0142	1.3387097
ELECTRON	-.7923781500E-01	.46156675	-.172	.8637	.37096774
ELECTRIC	-.1475356892	.49567274	-.298	.7660	.32258065
TELECOM	-.2911357605	.50786210	-.573	.5665	.17741935
AUTOMOTI	-.4354656189	.51088791	-.852	.3940	.96774194E-01
MISSION	.5469703683	.14256208	3.837	.0001	3.8225806
EXPLICIT	.1009493497	.13806877	.731	.4647	1.7096774

Normal exit from iterations. Exit status=0.

```
+---------------------------------------------+
| Limited Dependent Variable Model - CENSORED |
| Maximum Likelihood Estimates                |
| Dependent variable              KNOAC       |
| Weighting variable                ONE       |
| Number of observations             62       |
| Iterations completed                4       |
| Log likelihood function     -47.67421       |
| Threshold values for the model:             |
| Lower=   1.0000   Upper=   5.0000           |
+---------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Primary Index Equation for Model					
Constant	1.261140710	.60734996	2.076	.0379	
YEARS	.7543465483E-02	.10672735E-01	.707	.4797	10.000000
TYPE	.1234794255	.14420228	.856	.3918	.50000000
SIZE	.2340859574	.89786203E-01	2.607	.0091	1.3387097
ELECTRON	-.8413071047E-01	.42548243	-.198	.8433	.37096774
ELECTRIC	-.1478002171	.45696647	-.323	.7464	.32258065
TELECOM	-.3113108248	.46882999	-.664	.5067	.17741935
AUTOMOTI	-.4338766050	.47102155	-.921	.3570	.96774194E-01
MISSION	.5422208077	.13278117	4.084	.0000	3.8225806
EXPLICIT	.1035213164	.12741663	.812	.4165	1.7096774
Disturbance standard deviation					
Sigma	.5148981652	.47401959E-01	10.862	.0000	

```
--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...

+------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression          |
| Ordinary   least squares regression   Weighting variable = none   |
| Dep. var. = KNOAC   Mean=  3.942857143   , S.D.=  .5156775591     |
| Model size: Observations =    42, Parameters =  11, Deg.Fr.=   31 |
| Residuals:  Sum of squares= 5.872724283   , Std.Dev.=      .43525 |
| Fit:      R-squared=  .461359, Adjusted R-squared =        .28760 |
| Model test: F[ 10,    31] =   2.66,   Prob value =        .01812 |
| Diagnostic: Log-L =   -18.2810, Restricted(b=0) Log-L =   -31.2739 |
|         LogAmemiyaPrCrt.=  -1.431, Akaike Info. Crt.=     1.394 |
+------------------------------------------------------------------+
+---------+-------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+----------------+--------+---------+----------+
 Constant .9490697163    .64828218      1.464  .1432
 YEARS    .4045411047E-02 .10916095E-01   .371  .7109 11.095238
 TYPE     .2075735694    .16887207      1.229  .2190 .64285714
 SIZE     .2656304228    .10778552      2.464  .0137 1.4523810
 ELECTRON .4159244233    .37289441      1.115  .2647 .35714286
 ELECTRIC .3675928963    .40628113       .905  .3656 .33333333
 TELECOM  .2038192723    .42196939       .483  .6291 .14285714
 AUTOMOTI .1699242234    .41123964       .413  .6795 .11904762
 INVOLVE  -.2125266314   .17354409     -1.225  .2207 .35714286
 GRAFT    1.188261037    .33415548      3.556  .0004 3.6761905
 IDEXP    -.6032325010   .26826156     -2.249  .0245 3.6190476

Normal exit from iterations. Exit status=0.

        +--------------------------------------------+
        | Limited Dependent Variable Model - CENSORED |
        | Maximum Likelihood Estimates               |
        | Dependent variable             KNOAC       |
        | Weighting variable             ONE         |
        | Number of observations          42         |
        | Iterations completed            4          |
        | Log likelihood function     -19.44064      |
        | Threshold values for the model:            |
        | Lower=   1.0000   Upper=   5.0000          |
        +--------------------------------------------+
+---------+-------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+----------------+--------+---------+----------+
      Primary Index Equation for Model
 Constant .8132980967    .57851474      1.406  .1598
 YEARS    .5377899365E-02 .96109360E-02   .560  .5758 11.095238
 TYPE     .2194347925    .14798076      1.483  .1381 .64285714
 SIZE     .2774499466    .94769608E-01  2.928  .0034 1.4523810
 ELECTRON .4083011288    .32606017      1.252  .2105 .35714286
 ELECTRIC .3794455617    .35532719      1.068  .2856 .33333333
```

```
 TELECOM  .2010801306     .36890520       .545  .5857  .14285714
 AUTOMOTI .1704898366     .35951783       .474  .6353  .11904762
 INVOLVE  -.2365545762    .15310199      -1.545  .1223  .35714286
 GRAFT    1.250610363     .29695304      4.211  .0000 3.6761905
 IDEXP    -.6362416821    .23621425     -2.693  .0071 3.6190476
        Disturbance standard deviation
 Sigma    .3805082103     .42168309E-01   9.024  .0000
```

```
--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...

+-----------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression               |
| Ordinary   least squares regression    Weighting variable = none      |
| Dep. var. = KNOAC    Mean=  3.942857143    , S.D.=  .5156775591        |
| Model size: Observations =     42, Parameters =  10, Deg.Fr.=    32   |
| Residuals:  Sum of squares= 7.628127861    , Std.Dev.=        .48824  |
| Fit:        R-squared=  .300355, Adjusted R-squared =         .10358  |
| Model test: F[  9,     32] =   1.53,    Prob value =         .18104   |
| Diagnostic: Log-L =    -23.7730, Restricted(b=0) Log-L =    -31.2739  |
|             LogAmemiyaPrCrt.=  -1.220, Akaike Info. Crt.=      1.608  |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant 2.201878386     .56186724       3.919  .0001
 YEARS    .4903505120E-02 .12241017E-01    .401  .6887 11.095238
 TYPE     .1639058249     .18874706        .868  .3852 .64285714
 SIZE     .1741854695     .11611723       1.500  .1336 1.4523810
 ELECTRON .1099276111     .40280770        .273  .7849 .35714286
 ELECTRIC -.3965824192E-01 .43032643      -.092  .9266 .33333333
 TELECOM  -.2015255184    .44915647       -.449  .6537 .14285714
 AUTOMOTI -.1831722044    .44257576       -.414  .6790 .11904762
 INVOLVE  -.9033864191E-01 .18939373      -.477  .6334 .35714286
 PRECURX  .3797108256     .14337297       2.648  .0081 3.6476190

Normal exit from iterations. Exit status=0.

          +---------------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates                |
          | Dependent variable              KNOAC       |
          | Weighting variable                ONE       |
          | Number of observations             42       |
          | Iterations completed                4       |
          | Log likelihood function      -25.24468      |
          | Threshold values for the model:             |
          | Lower=    1.0000    Upper=    5.0000        |
          +---------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
```

```
     Primary Index Equation for Model
Constant 2.145711646    .50309952      4.265  .0000
YEARS    .6023940297E-02 .10951614E-01  .550  .5823 11.095238
TYPE     .1716592072    .16828473      1.020  .3077 .64285714
SIZE     .1798374245    .10356526      1.736  .0825 1.4523810
ELECTRON .9048813396E-01 .35925779      .252  .8011 .35714286
ELECTRIC -.4764564017E-01 .38340785    -.124  .9011 .33333333
TELECOM  -.2212934367   .40051443     -.553  .5806 .14285714
AUTOMOTI -.1979923726   .39448008     -.502  .6157 .11904762
INVOLVE  -.1045855562   .16920741     -.618  .5365 .35714286
PRECURX  .3946791314    .12843669      3.073  .0021 3.6476190
     Disturbance standard deviation
Sigma    .4349301797    .48336064E-01  8.998  .0000
```

```
--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...
Models - Regression; regressors are collinear.
--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...
Models - Regression; regressors are collinear.
--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...
```

```
+----------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression             |
| Ordinary   least squares regression    Weighting variable = none     |
| Dep. var. = KNOAC    Mean=   3.769230769    , S.D.=  .6326835398     |
| Model size: Observations =      65, Parameters =  9, Deg.Fr.=    56 |
| Residuals:  Sum of squares= 11.66733781     , Std.Dev.=      .45645 |
| Fit:        R-squared=  .544573, Adjusted R-squared =        .47951 |
| Model test: F[  8,     56] =    8.37,    Prob value =       .00000 |
| Diagnostic: Log-L =    -36.4092, Restricted(b=0) Log-L =   -61.9711 |
|             LogAmemiyaPrCrt.=   -1.439, Akaike Info. Crt.=    1.397 |
+----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant .9411410965     .46120904      2.041  .0413
 YEARS    -.5522658992E-02 .89709156E-02  -.616  .5381 9.8153846
 TYPE     .1359057577     .12463615      1.090  .2755 .47692308
 SIZE     .5942468704E-01 .78540814E-01   .757  .4493 1.3230769
 ELECTRON -.1142649914    .34347418      -.333  .7394 .40000000
 ELECTRIC .4427130179E-02 .34449444       .013  .9897 .30769231
 TELECOM  .7013935582E-01 .35172502       .199  .8419 .16923077
 AUTOMOTI -.2428215355E-01 .38073964     -.064  .9491 .92307692E-01
 ACTIVE   .9128212191     .12924112      7.063  .0000 3.0384615
```

Normal exit from iterations. Exit status=0.

```
+--------------------------------------------+
| Limited Dependent Variable Model - CENSORED |
| Maximum Likelihood Estimates               |
```

```
| Dependent variable            KNOAC   |
| Weighting variable             ONE    |
| Number of observations          65    |
| Iterations completed            4   |
| Log likelihood function    -36.99280   |
| Threshold values for the model:       |
| Lower=   1.0000   Upper=   5.0000     |
+---------------------------------------+
+---------+-------------+--------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+--------------+--------+---------+----------+
      Primary Index Equation for Model
 Constant .9354328926     .41905391      2.232  .0256
 YEARS   -.4338999904E-02 .81779793E-02  -.531  .5957 9.8153846
 TYPE     .1487323934     .11332061      1.312  .1894 .47692308
 SIZE    .5149363880E-01 .71431519E-01   .721  .4710 1.3230769
 ELECTRON -.1122848320     .31202159     -.360  .7190 .40000000
 ELECTRIC .3506803388E-02 .31293038       .011  .9911 .30769231
 TELECOM  .4129689199E-01 .31967476       .129  .8972 .16923077
 AUTOMOTI -.1580302442E-01 .34586938      -.046  .9636 .92307692E-01
 ACTIVE   .9128671375     .11741084      7.775  .0000 3.0384615
      Disturbance standard deviation
 Sigma    .4146055174    .37345323E-01  11.102  .0000
```

```
--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...
```

```
+-----------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED  Regression          |
| Ordinary   least squares regression   Weighting variable = none   |
| Dep. var. = KNOAC   Mean=  3.769230769   , S.D.=  .6326835398    |
| Model size: Observations =      65, Parameters =  13, Deg.Fr.=    52 |
| Residuals:  Sum of squares= 10.56518769   , Std.Dev.=        .45075 |
| Fit:       R-squared=  .587595, Adjusted R-squared =          .49242 |
| Model test: F[ 12,     52] =    6.17,    Prob value =         .00000 |
| Diagnostic: Log-L =    -33.1843, Restricted(b=0) Log-L =     -61.9711 |
|            LogAmemiyaPrCrt.=   -1.411, Akaike Info. Crt.=      1.421 |
+-----------------------------------------------------------------+
+---------+-------------+--------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+--------------+--------+---------+----------+
 Constant .9217888779     .49087608      1.878  .0604
 YEARS   -.4249012159E-02 .90726465E-02  -.468  .6395 9.8153846
 TYPE    .5328267942E-01 .12933652       .412  .6804 .47692308
 SIZE    .6207514575E-01 .78640193E-01   .789  .4299 1.3230769
 ELECTRON .2775358631     .39919683       .695  .4869 .40000000
 ELECTRIC .3403113795     .40808274       .834  .4043 .30769231
 TELECOM  .5411458885     .41092744      1.317  .1879 .16923077
 AUTOMOTI .3129085716     .42640852       .734  .4631 .92307692E-01
 MGRLCTRB .4161242764     .10435747      3.987  .0001 2.5923077
 TECHCTRB .2837941190     .11132431      2.549  .0108 3.5794872
 FORTECH -.8451679024E-01 .10745507      -.787  .4316 3.8923077
```

```
 FORTRAIN .1884422159     .85206143E-01   2.212  .0270 3.6000000
 WRITTEN  .1388776467E-02 .84608428E-01    .016  .9869 1.0307692

Normal exit from iterations. Exit status=0.

          +------------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates              |
          | Dependent variable              KNOAC     |
          | Weighting variable               ONE      |
          | Number of observations            65      |
          | Iterations completed             4        |
          | Log likelihood function     -33.60223     |
          | Threshold values for the model:           |
          | Lower=   1.0000    Upper=   5.0000        |
          +------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
       Primary Index Equation for Model
 Constant .9143956440      .42796334      2.137  .0326
 YEARS    -.2951516777E-02 .79404310E-02  -.372  .7101 9.8153846
 TYPE      .6312060032E-01 .11280042       .560  .5758 .47692308
 SIZE      .5417465734E-01 .68624928E-01   .789  .4299 1.3230769
 ELECTRON .2867671345     .34795507       .824  .4099 .40000000
 ELECTRIC .3470585284     .35580920       .975  .3294 .30769231
 TELECOM  .5202430551     .35833738      1.452  .1466 .16923077
 AUTOMOTI .3286380872     .37170028       .884  .3766 .92307692E-01
 MGRLCTRB .4127295381     .90965000E-01  4.537  .0000 2.5923077
 TECHCTRB .2959476722     .97157681E-01  3.046  .0023 3.5794872
 FORTECH  -.8974251549E-01 .93714738E-01  -.958  .3383 3.8923077
 FORTRAIN .1829957057     .74288318E-01  2.463  .0138 3.6000000
 WRITTEN  .1244787648E-02 .73749013E-01   .017  .9865 1.0307692
       Disturbance standard deviation
 Sigma    .3928716411     .35387314E-01 11.102  .0000

--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...

+-------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED  Regression            |
| Ordinary   least squares regression   Weighting variable = none    |
| Dep. var. = KNOAC   Mean=  3.769230769   , S.D.=  .6326835398      |
| Model size: Observations =     65, Parameters =  9, Deg.Fr.=    56 |
| Residuals:  Sum of squares= 18.87460768   , Std.Dev.=      .58056 |
| Fit:       R-squared= .263242, Adjusted R-squared =        .15799 |
| Model test: F[  8,    56] =   2.50,   Prob value =        .02132 |
| Diagnostic: Log-L =   -52.0425, Restricted(b=0) Log-L =   -61.9711 |
|          LogAmemiyaPrCrt.=   -.958, Akaike Info. Crt.=     1.878 |
+-------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
```

```
+---------+-------------+---------------+--------+---------+----------+
 Constant 2.374742491     .50028130      4.747  .0000
 YEARS    -.1785099533E-02 .11483268E-01  -.155  .8765 9.8153846
 TYPE      .2277940933    .15735202      1.448  .1477 .47692308
 SIZE     .2025090705     .95630149E-01  2.118  .0342 1.3230769
 ELECTRON -.2248070634    .46000914      -.489  .6251 .40000000
 ELECTRIC -.2324243710    .46619923      -.499  .6181 .30769231
 TELECOM  -.4432518947    .48782948      -.909  .3636 .16923077
 AUTOMOTI -.4591347387    .51242297      -.896  .3702 .92307692E-01
 ACCESS   .3856762301     .12544182      3.075  .0021 3.4076923

Normal exit from iterations. Exit status=0.

          +-----------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates             |
          | Dependent variable           KNOAC      |
          | Weighting variable           ONE        |
          | Number of observations       65         |
          | Iterations completed         4          |
          | Log likelihood function      -53.00006  |
          | Threshold values for the model:         |
          | Lower=   1.0000   Upper=   5.0000       |
          +-----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Primary Index Equation for Model
 Constant 2.363883743     .46169168      5.120  .0000
 YEARS    -.4160802277E-03 .10637071E-01  -.039  .9688 9.8153846
 TYPE      .2386908787    .14536119      1.642  .1006 .47692308
 SIZE     .1964985894     .88413616E-01  2.222  .0263 1.3230769
 ELECTRON -.2268374985    .42449648      -.534  .5931 .40000000
 ELECTRIC -.2332981408    .43025372      -.542  .5877 .30769231
 TELECOM  -.4701139145    .45051759     -1.043  .2967 .16923077
 AUTOMOTI -.4552084229    .47286671      -.963  .3357 .92307692E-01
 ACCESS   .3871852753     .11576694      3.345  .0008 3.4076923
       Disturbance standard deviation
 Sigma    .5357208369     .48228237E-01  11.108  .0000
```

```
--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...

+-----------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression         |
| Ordinary   least squares regression   Weighting variable = none |
| Dep. var. = KNOAC   Mean=  3.769230769   , S.D.=  .6326835398    |
| Model size: Observations =     65, Parameters =  10, Deg.Fr.=   55 |
| Residuals:  Sum of squares= 18.63501447   , Std.Dev.=      .58208 |
| Fit:       R-squared= .272594, Adjusted R-squared =      .15356 |
| Model test: F[  9,    55] =   2.29,   Prob value =      .02909 |
| Diagnostic: Log-L =   -51.6273, Restricted(b=0) Log-L =   -61.9711 |
```

```
|         LogAmemiyaPrCrt.=   -.939, Akaike Info. Crt.=     1.896 |
+-----------------------------------------------------------------+
+---------+-------------+--------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+--------------+--------+---------+----------+
 Constant  2.275266383     .51535498       4.415   .0000
 YEARS    -.4759353330E-03 .11618192E-01   -.041   .9673  9.8153846
 TYPE      .2299684065     .15778627       1.457   .1450  .47692308
 SIZE      .1968168216     .96119834E-01   2.048   .0406  1.3230769
 ELECTRON -.1882316470     .46326303       -.406   .6845  .40000000
 ELECTRIC -.2013883601     .46887786       -.430   .6676  .30769231
 TELECOM  -.3657602066     .49771531       -.735   .4624  .16923077
 AUTOMOTI -.4082146707     .51732422       -.789   .4301  .92307692E-01
 PROTECT   .2600193531     .10167133       2.557   .0105  3.5923077
 SIMILAR   .1338233220     .94232080E-01   1.420   .1556  3.2230769

Normal exit from iterations. Exit status=0.

          +-------------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates               |
          | Dependent variable              KNOAC     |
          | Weighting variable              ONE       |
          | Number of observations            65      |
          | Iterations completed               4      |
          | Log likelihood function     -52.57379     |
          | Threshold values for the model:           |
          | Lower=    1.0000    Upper=    5.0000      |
          +-------------------------------------------+
+---------+-------------+--------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+--------------+--------+---------+----------+
        Primary Index Equation for Model
 Constant  2.263262247     .47184341       4.797   .0000
 YEARS     .9377096282E-03 .10683117E-01    .088   .9301  9.8153846
 TYPE      .2407535113     .14457830       1.665   .0959  .47692308
 SIZE      .1909536602     .88129147E-01   2.167   .0303  1.3230769
 ELECTRON -.1900754467     .42399758       -.448   .6539  .40000000
 ELECTRIC -.2015982761     .42924789       -.470   .6386  .30769231
 TELECOM  -.3914200286     .45608236       -.858   .3908  .16923077
 AUTOMOTI -.4039577429     .47348135       -.853   .3936  .92307692E-01
 PROTECT   .2613944261     .93171964E-01   2.806   .0050  3.5923077
 SIMILAR   .1339642715     .86423454E-01   1.550   .1211  3.2230769
        Disturbance standard deviation
 Sigma     .5327430490     .47950053E-01  11.110   .0000

--> skip$
--> tobit; lhs=knoac; rhs=one,years,type,size,electron,electric,telecom,autom...

+-----------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED  Regression         |
| Ordinary   least squares regression   Weighting variable = none  |
```

```
| Dep. var. = KNOAC    Mean=  3.956097561    , S.D.=  .5148051964    |
| Model size: Observations =    41, Parameters =  12, Deg.Fr.=    29 |
| Residuals:  Sum of squares= 3.750828749    , Std.Dev.=        .35964 |
| Fit:        R-squared=  .646181, Adjusted R-squared =         .51197 |
| Model test: F[ 11,    29] =   4.81,   Prob value =         .00033 |
| Diagnostic: Log-L =    -9.1488, Restricted(b=0) Log-L =    -30.4476 |
|             LogAmemiyaPrCrt.=  -1.789, Akaike Info. Crt.=     1.032 |
+----------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  .3922009119     .63978790        .613   .5399
 YEARS    -.1357136918E-02 .93497637E-02   -.145   .8846  11.268293
 TYPE      .8136881945E-01 .14416394        .564   .5725  .65853659
 SIZE      .1224816205     .86349807E-01   1.418   .1561  1.4634146
 ELECTRON -.1047410011     .30836507       -.340   .7341  .34146341
 ELECTRIC -.4696986046E-01 .31624467       -.149   .8819  .34146341
 TELECOM  -.6312850381E-01 .33933201       -.186   .8524  .14634146
 AUTOMOTI -.2198718664     .34482883       -.638   .5237  .12195122
 PRECURX   .6453174294E-02 .16261608        .040   .9683  3.6406504
 ACCESS    .6676671568E-02 .14312245        .047   .9628  3.4329268
 ACTIVE    .7859122873     .16750674       4.692   .0000  3.2048780
 MISSION   .2284046605     .16185603       1.411   .1582  3.8048780

Normal exit from iterations. Exit status=0.

          +---------------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates                |
          | Dependent variable              KNOAC       |
          | Weighting variable                ONE       |
          | Number of observations             41       |
          | Iterations completed                4       |
          | Log likelihood function     -11.31862       |
          | Threshold values for the model:             |
          | Lower=    1.0000    Upper=    5.0000        |
          +---------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
     Primary Index Equation for Model
 Constant  .3498801473     .55186403        .634   .5261
 YEARS    -.3244133542E-03 .81029886E-02   -.040   .9681  11.268293
 TYPE      .8585682523E-01 .12409515        .692   .4890  .65853659
 SIZE      .1233997991     .74290505E-01   1.661   .0967  1.4634146
 ELECTRON -.1103465255     .26533503       -.416   .6775  .34146341
 ELECTRIC -.5120762167E-01 .27209010       -.188   .8507  .34146341
 TELECOM  -.6948230116E-01 .29198435       -.238   .8119  .14634146
 AUTOMOTI -.2204314954     .29665134       -.743   .4574  .12195122
 PRECURX   .2070990291E-01 .14054929        .147   .8829  3.6406504
 ACCESS   -.5375376950E-02 .12365649       -.043   .9653  3.4329268
 ACTIVE    .7876637165     .14411302       5.466   .0000  3.2048780
 MISSION   .2329263871     .13930837       1.672   .0945  3.8048780
     Disturbance standard deviation
 Sigma     .3093902776     .34895453E-01   8.866   .0000
```

APPENDIX 7: RESULTS OF ORDERED PROBIT

```
--> RESET
--> RESET
--> LOAD;file="C:\My Documents\fariza2.lpj"$
An end of file error has occurred reloading from the file.
--> RESET
--> LOAD;file="C:\My Documents\fariza3.lpj"$
LOAD has reconstructed your previous session.
--> SAVE;file="C:\My Documents\fariza3.lpj"$
--> skip$
--> ordered; lhs=prodev; rhs=one, years,type,size,
   electron,electric,telecom,automoti,resdev,
   lecap$

+----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary    least squares regression    Weighting variable = none  |
| Dep. var. = Y=0/Not0 Mean=  .9384615385   , S.D.=  .2421855614   |
| Model size: Observations =    65, Parameters =  10, Deg.Fr.=    55 |
| Residuals:  Sum of squares= 153.1235474   , Std.Dev.=      1.66855 |
| Fit:      R-squared=*********, Adjusted R-squared =     -46.46602 |
| Diagnostic: Log-L =  -120.0789, Restricted(b=0) Log-L =      .4462 |
|           LogAmemiyaPrCrt.=   1.167, Akaike Info. Crt.=    4.002 |
+----------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant .2497474642     1.9512950       .128  .8982
 YEARS    .7961609940E-03 .33124182E-01    .024  .9808 9.8153846
 TYPE     .1516195361     .45982629       .330  .7416 .47692308
 SIZE    -.6428939164E-01 .27809448      -.231  .8172 1.3230769
 ELECTRON .4147107030     1.2831264       .323  .7465 .40000000
 ELECTRIC .3103673951     1.3008781       .239  .8114 .30769231
 TELECOM  .2652163594     1.3553134       .196  .8449 .16923077
 AUTOMOTI .4462730649     1.4594605       .306  .7598 .92307692E-01
 RESDEV   .1164127578     .45238842       .257  .7969 .56923077
 LECAP    .8021320918E-01 .50403066       .159  .8736 3.4897436

Normal exit from iterations. Exit status=0.

        +------------------------------------------+
        | Ordered Probit Model                      |
        | Maximum Likelihood Estimates              |
        | Dependent variable            PRODEV      |
        | Weighting variable              ONE       |
        | Number of observations           65       |
        | Iterations completed             17       |
        | Log likelihood function     -73.81871     |
        | Restricted log likelihood   -84.55097     |
        | Chi-squared                 21.46453      |
        | Degrees of freedom               9        |
        | Significance level        .1074010E-01    |
        |   Cell frequencies for outcomes           |
        | Y Count Freq  Y Count Freq  Y Count Freq  |
        | 0    4 .061 1   10 .153 2   23 .353       |
        | 3   26 .400 4    2 .030                   |
        +------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
```

```
+---------+-------------+---------------+--------+---------+----------+
      Index function for probability
 Constant -2.296627176    1.5457573     -1.486  .1373
 YEARS    .6064823598E-02 .22413348E-01   .271  .7867 9.8153846
 TYPE     .3563151421     .42260916      .843  .3992 .47692308
 SIZE     .8316956571E-01 .20919283      .398  .6909 1.3230769
 ELECTRON .8714732968     .92328032       .944  .3452 .40000000
 ELECTRIC .5319230430     .88654148      .600  .5485 .30769231
 TELECOM  .8085063098E-01 .97840573      .083  .9341 .16923077
 AUTOMOTI 1.039430290     .97503333     1.066  .2864 .92307692E-01
 RESDEV   .7244058425     .33729388     2.148  .0317 .56923077
 LECAP    .7979580393     .44548648     1.791  .0733 3.4897436
      Threshold parameters for index
 Mu( 1)   .9320259269     .38252091     2.437  .0148
 Mu( 2)   2.069619374     .44850947     4.614  .0000
 Mu( 3)   4.090954163     .66840421     6.120  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------  ---------------------- + -----
Actual    0   1   2   3   4  | Total
------  ---------------------- + -----
  0       1   1   2   0   0  |   4
  1       0   2   3   5   0  |  10
  2       0   2  12   9   0  |  23
  3       0   0   5  21   0  |  26
  4       0   0   0   2   0  |   2
------  ---------------------- + -----
Total     1   5  22  37   0  |  65
--> skip$
--> ordered; lhs=prodev; rhs=one, years,type,size,
   electron,electric,telecom,automoti,resdev,
   lecap; test: B(2)+B(5)+B(6)+B(7)+B(8)=0$

+-----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary   least squares regression   Weighting variable = none |
| Dep. var. = Y=0/Not0 Mean=  .9384615385   , S.D.=  .2421855614  |
| Model size: Observations =      65, Parameters =  10, Deg.Fr.=    55 |
| Residuals:  Sum of squares= 153.1235474   , Std.Dev.=      1.66855 |
| Fit:        R-squared=*********, Adjusted R-squared =    -46.46602 |
| Diagnostic: Log-L =  -120.0789, Restricted(b=0) Log-L =      .4462 |
|           LogAmemiyaPrCrt.=   1.167, Akaike Info. Crt.=    4.002 |
+-----------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
Constant .2497474642      1.9512950      .128  .8982
YEARS    .7961609940E-03 .33124182E-01    .024  .9808 9.8153846
TYPE     .1516195361      .45982629     .330  .7416 .47692308
SIZE     -.6428939164E-01 .27809448     -.231  .8172 1.3230769
ELECTRON .4147107030      1.2831264      .323  .7465 .40000000
ELECTRIC .3103673951      1.3008781      .239  .8114 .30769231
TELECOM  .2652163594      1.3553134      .196  .8449 .16923077
AUTOMOTI .4462730649      1.4594605      .306  .7598 .92307692E-01
RESDEV   .1164127578      .45238842     .257  .7969 .56923077
LECAP    .8021320918E-01 .50403066      .159  .8736 3.4897436
```

Normal exit from iterations. Exit status=0.

```
+----------------------------------------+
| Ordered Probit Model                   |
| Maximum Likelihood Estimates           |
| Dependent variable           PRODEV    |
| Weighting variable             ONE     |
| Number of observations          65     |
| Iterations completed            17     |
| Log likelihood function    -73.81871   |
| Restricted log likelihood  -84.55097   |
| Chi-squared                 21.46453   |
| Degrees of freedom               9     |
| Significance level      .1074010E-01   |
|   Cell frequencies for outcomes        |
| Y Count Freq  Y Count Freq  Y Count Freq |
| 0    4 .061   1   10 .153   2   23 .353 |
| 3   26 .400   4    2 .030               |
| Wald test of 1 linear restrictions     |
| Chi-squared =    .52, Sig. level = .47073 |
+----------------------------------------+
+---------+-------------+---------------+-------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+-------+---------+----------+
        Index function for probability
 Constant -2.296627176    1.5457573     -1.486  .1373
 YEARS    .6064823598E-02 .22413348E-01   .271  .7867  9.8153846
 TYPE     .3563151421     .42260916       .843  .3992  .47692308
 SIZE     .8316956571E-01 .20919283       .398  .6909  1.3230769
 ELECTRON .8714732968     .92328032       .944  .3452  .40000000
 ELECTRIC .5319230430     .88654148       .600  .5485  .30769231
 TELECOM  .8085063098E-01 .97840573       .083  .9341  .16923077
 AUTOMOTI 1.039430290     .97503333      1.066  .2864  .92307692E-01
 RESDEV   .7244058425     .33729388      2.148  .0317  .56923077
 LECAP    .7979580393     .44548648      1.791  .0733  3.4897436
        Threshold parameters for index
 Mu( 1)   .9320259269     .38252091      2.437  .0148
 Mu( 2)   2.069619374     .44850947      4.614  .0000
 Mu( 3)   4.090954163     .66840421      6.120  .0000
```

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

```
          Predicted
------  ---------------------- + -----
Actual    0   1   2   3   4 | Total
------  ---------------------- + -----
 0        1   1   2   0   0 |    4
 1        0   2   3   5   0 |   10
 2        0   2  12   9   0 |   23
 3        0   0   5  21   0 |   26
 4        0   0   0   2   0 |    2
------  ---------------------- + -----
Total     1   5  22  37   0 |   65
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
  resdev,lecap$
```

```
+---------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0            |
| Ordinary    least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=  .9384615385    , S.D.=  .2421855614    |
| Model size: Observations =     65, Parameters =  5, Deg.Fr.=    60 |
| Residuals:  Sum of squares= 154.8619394    , Std.Dev.=       1.60656 |
| Fit:       R-squared=*********, Adjusted R-squared =     -43.00449 |
| Diagnostic: Log-L =  -120.4458, Restricted(b=0) Log-L =       .4462 |
|          LogAmemiyaPrCrt.=   1.022, Akaike Info. Crt.=     3.860 |
+---------------------------------------------------------------+
+--------+------------+--------------+--------+--------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+--------+------------+--------------+--------+--------+----------+
 Constant .4820265072     1.6765827      .288   .7737
 TYPE     .1158278917     .40972931      .283   .7774  .47692308
 SIZE    -.3339103986E-01 .23208405     -.144   .8856  1.3230769
 RESDEV   .1257879288     .42120906      .299   .7652  .56923077
 LECAP    .1071054597     .46592246      .230   .8182  3.4897436
```

Normal exit from iterations. Exit status=0.

```
+---------------------------------------------+
| Ordered Probit Model                        |
| Maximum Likelihood Estimates                |
| Dependent variable              PRODEV      |
| Weighting variable                 ONE      |
| Number of observations              65      |
| Iterations completed                13      |
| Log likelihood function      -76.11605      |
| Restricted log likelihood    -84.55097      |
| Chi-squared                   16.86984      |
| Degrees of freedom                   4      |
| Significance level        .2048797E-02      |
|   Cell frequencies for outcomes             |
| Y Count Freq  Y Count Freq  Y Count Freq    |
| 0    4 .061 1   10 .153 2   23 .353         |
| 3   26 .400 4    2 .030                     |
+---------------------------------------------+
+--------+------------+--------------+--------+--------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+--------+------------+--------------+--------+--------+----------+
        Index function for probability
 Constant -1.769121243    1.3161872    -1.344   .1789
 TYPE      .2155313587    .29575973      .729   .4662  .47692308
 SIZE      .2173090202    .17515419     1.241   .2147  1.3230769
 RESDEV    .6638789104    .31975730     2.076   .0379  .56923077
 LECAP     .7943004896    .39258052     2.023   .0430  3.4897436
        Threshold parameters for index
 Mu( 1)    .8567014314    .33341667     2.569   .0102
 Mu( 2)   1.970587232     .42108412     4.680   .0000
 Mu( 3)   3.931394703     .61199194     6.424   .0000
```

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

```
          Predicted
------  ---------------------- + -----
Actual     0   1   2   3   4  | Total
------  ---------------------- + -----
```

```
0      0  0   4   0   0 |   4
1      0  0   6   4   0 |  10
2      1  1  11  10   0 |  23
3      0  0   6  20   0 |  26
4      0  0   0   2   0 |   2
------ ---------------------- + -----
Total    1  1  27  36   0 |  65
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
   resdev,expend,lecap$

+--------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0           |
| Ordinary    least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=  .9285714286   , S.D.=  .2598700974    |
| Model size: Observations =      56, Parameters =  6, Deg.Fr.=    50 |
| Residuals:  Sum of squares= 131.9896495   , Std.Dev.=        1.62474 |
| Fit:        R-squared=*********, Adjusted R-squared =       -38.08924 |
| Diagnostic: Log-L =   -103.4670, Restricted(b=0) Log-L =     -3.4919 |
|             LogAmemiyaPrCrt.=   1.072, Akaike Info. Crt.=     3.910 |
+--------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant  .3816169207     1.8798502        .203   .8391
 TYPE      .1321316826     .45225508        .292   .7702  .42857143
 SIZE     -.3404545112E-01  .24525628      -.139   .8896  1.2142857
 RESDEV    .1193350987     .45223904        .264   .7919  .50000000
 EXPEND   -.2095727446E-09  .34248492E-08  -.061   .9512  10243214.
 LECAP     .1347828177     .52878814        .255   .7988  3.5178571

Initial iterations cannot improve function.Status=3
Abnormal exit from iterations. If current results are shown
check convergence values shown below. This may not be a
solution value (especially if initial iterations stopped).
Gradient value: Tolerance= .1000D-05, current value= .1609D+09
Function chg. : Tolerance= .0000D+00, current value= .8034D+02
Parameters chg: Tolerance= .0000D+00, current value= .1609D+15
Smallest abs. parameter change from start value = .0000D+00
Note:  At least one parameter did not leave start value.

          +----------------------------------------+
          | Ordered Probit Model                   |
          | Maximum Likelihood Estimates           |
          | Dependent variable             PRODEV  |
          | Weighting variable              ONE    |
          | Number of observations           56    |
          | Iterations completed              1    |
          | Log likelihood function     -80.34403  |
          |   Cell frequencies for outcomes        |
          |  Y Count Freq  Y Count Freq  Y Count Freq  |
          | 0     4 .071 1     9 .160 2    20 .357  |
          | 3    21 .375 4     2 .035              |
          +----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant  .3816169207     1.5344157        .249   .8036
 TYPE      .1321316826     .29993023        .441   .6595  .42857143
```

```
SIZE    -.3404545112E-01 .18664243      -.182  .8553 1.2142857
RESDEV   .1193350987     .30683671       .389  .6973 .50000000
EXPEND  -.2095727446E-09 .10343522E-07  -.020  .9838 10243214.
LECAP    .1347828177     .44208687       .305  .7605 3.5178571
       Threshold parameters for index
Mu( 1)  .7339634312     .27830275      2.637  .0084
Mu( 2)  1.690828552     .36894327      4.583  .0000
Mu( 3)  3.268662304     .57217393      5.713  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

          Predicted
------ ---------------------- + -----
Actual    0  1  2  3  4 | Total
------ ---------------------- + -----
 0        0  0  4  0  0 |   4
 1        0  0  9  0  0 |   9
 2        0  0 20  0  0 |  20
 3        0  0 21  0  0 |  21
 4        0  0  2  0  0 |   2
------ ---------------------- + -----
Total     0  0 56  0  0 |  56
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
   precurx$

+----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary   least squares regression   Weighting variable = none  |
| Dep. var. = Y=0/Not0 Mean=  .9384615385   , S.D.=  .2421855614   |
| Model size: Observations =     65, Parameters =  4, Deg.Fr.=   61 |
| Residuals:  Sum of squares= 157.3492604   , Std.Dev.=      1.60608 |
| Fit:        R-squared=*********, Adjusted R-squared =    -42.97829 |
| Diagnostic: Log-L =  -120.9636, Restricted(b=0) Log-L =      .4462 |
|             LogAmemiyaPrCrt.=  1.007, Akaike Info. Crt.=   3.845 |
+----------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
Constant  .8167538099      .74922545     1.090  .2757
TYPE      .1016305869      .41784213      .243  .8078 .47692308
SIZE     -.2210084313E-01 .23051858      -.096  .9236 1.3230769
PRECURX   .3565277435E-01 .25942107       .137  .8907 2.8743590

Normal exit from iterations. Exit status=0.

          +------------------------------------------+
          | Ordered Probit Model                      |
          | Maximum Likelihood Estimates              |
          | Dependent variable            PRODEV      |
          | Weighting variable               ONE      |
          | Number of observations            65      |
          | Iterations completed              12      |
          | Log likelihood function    -76.99733      |
          | Restricted log likelihood  -84.55097      |
          | Chi-squared                 15.10730      |
          | Degrees of freedom                 3      |
          | Significance level      .1727215E-02      |
```

```
| Cell frequencies for outcomes            |
| Y Count Freq  Y Count Freq  Y Count Freq  |
| 0    4 .061 1    10 .153 2    23 .353  |
| 3   26 .400 4    2 .030               |
+------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant -.2842766982      .61870701        -.459   .6459
 TYPE     -.9037411124E-01 .35824252        -.252   .8008  .47692308
 SIZE      .2254550091      .16733261       1.347   .1779  1.3230769
 PRECURX   .6168437333      .21999996       2.804   .0050  2.8743590
       Threshold parameters for index
 Mu( 1)    .8201545712      .26047726       3.149   .0016
 Mu( 2)   1.928544415       .29773573       6.477   .0000
 Mu( 3)   3.935706804       .50145938       7.849   .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------ ---------------------- + -----
Actual    0   1   2   3   4 | Total
------ ---------------------- + -----
  0       0   0   2   2   0 |    4
  1       0   0   8   2   0 |   10
  2       0   0  13  10   0 |   23
  3       0   0   9  17   0 |   26
  4       0   0   0   2   0 |    2
------ ---------------------- + -----
Total     0   0  32  33   0 |   65
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
    resdev,prior,flexibi,determin$

+---------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary    least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=   .9384615385    , S.D.=   .2421855614    |
| Model size: Observations =      65, Parameters =   7, Deg.Fr.=     58 |
| Residuals:  Sum of squares= 153.5564728    , Std.Dev.=       1.62712 |
| Fit:        R-squared=*********, Adjusted R-squared =      -44.13814 |
| Diagnostic: Log-L =   -120.1706, Restricted(b=0) Log-L =       .4462 |
|             LogAmemiyaPrCrt.=    1.076, Akaike Info. Crt.=     3.913 |
+---------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant  .5140848838     1.7400910        .295   .7677
 TYPE      .1596669759      .43543973       .367   .7139  .47692308
 SIZE     -.3315806519E-01  .23511717      -.141   .8878  1.3230769
 RESDEV    .1446683930      .43030197       .336   .7367  .56923077
 PRIOR     .1083687576E-01  .24704179       .044   .9650  3.9000000
 FLEXIBI   .1114450864      .26734544       .417   .6768  2.7461538
 DETERMIN -.1008622364E-01  .31775735      -.032   .9747  3.8230769

Normal exit from iterations. Exit status=0.
```

```
+-----------------------------------------+
| Ordered Probit Model                    |
| Maximum Likelihood Estimates            |
| Dependent variable            PRODEV    |
| Weighting variable             ONE      |
| Number of observations          65      |
| Iterations completed            14      |
| Log likelihood function    -74.84008    |
| Restricted log likelihood  -84.55097    |
| Chi-squared                 19.42178    |
| Degrees of freedom               6      |
| Significance level      .3507558E-02    |
|   Cell frequencies for outcomes         |
| Y Count Freq  Y Count Freq  Y Count Freq |
| 0    4 .061  1   10 .153  2   23 .353   |
| 3   26 .400  4    2 .030                |
+-----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant -1.658168656   1.5025967     -1.104   .2698
 TYPE      .3385276201   .29675581      1.141   .2540  .47692308
 SIZE      .2217063280   .18542002      1.196   .2318  1.3230769
 RESDEV    .7419408138   .33410301      2.221   .0264  .56923077
 PRIOR     .2207858185   .20198050      1.093   .2743  3.9000000
 FLEXIBI   .4966155578   .20113674      2.469   .0135  2.7461538
 DETERMIN  .1004980704   .26597649       .378   .7055  3.8230769
       Threshold parameters for index
 Mu( 1)    .9033767996   .37442587      2.413   .0158
 Mu( 2)    2.036060487   .45391222      4.486   .0000
 Mu( 3)    4.015437404   .62700209      6.404   .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------  ---------------------- + -----
Actual    0   1   2   3   4  | Total
------  ---------------------- + -----
  0       0   2   2   0   0  |    4
  1       0   0   5   5   0  |   10
  2       0   2  12   9   0  |   23
  3       0   0   8  18   0  |   26
  4       0   0   0   2   0  |    2
------  ---------------------- + -----
Total     0   4  27  34   0  |   65
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
   resdev,prior,flexibi,determin$

+-----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0               |
| Ordinary    least squares regression    Weighting variable = none |
| Dep. var. = Y=0/Not0 Mean=  .9384615385   , S.D.=  .2421855614    |
| Model size: Observations =    65, Parameters =  7, Deg.Fr.=    58 |
| Residuals:  Sum of squares= 153.5564728   , Std.Dev.=     1.62712 |
| Fit:      R-squared=*********, Adjusted R-squared =     -44.13814 |
| Diagnostic: Log-L =  -120.1706, Restricted(b=0) Log-L =     .4462 |
```

```
|          LogAmemiyaPrCrt.=   1.076, Akaike Info. Crt.=    3.913 |
+-------------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant .5140848838     1.7400910        .295  .7677
 TYPE     .1596669759     .43543973        .367  .7139 .47692308
 SIZE    -.3315806519E-01 .23511717       -.141  .8878 1.3230769
 RESDEV   .1446683930     .43030197        .336  .7367 .56923077
 PRIOR    .1083687576E-01 .24704179        .044  .9650 3.9000000
 FLEXIBI  .1114450864     .26734544        .417  .6768 2.7461538
 DETERMIN -.1008622364E-01 .31775735      -.032  .9747 3.8230769

Normal exit from iterations. Exit status=0.

          +---------------------------------------------+
          | Ordered Probit Model                        |
          | Maximum Likelihood Estimates                |
          | Dependent variable            PRODEV        |
          | Weighting variable            ONE           |
          | Number of observations          65          |
          | Iterations completed            14          |
          | Log likelihood function     -74.84008       |
          | Restricted log likelihood   -84.55097       |
          | Chi-squared                 19.42178        |
          | Degrees of freedom               6          |
          | Significance level         .3507558E-02     |
          |   Cell frequencies for outcomes             |
          |  Y Count Freq  Y Count Freq  Y Count Freq   |
          | 0    4 .061 1    10 .153 2    23 .353       |
          | 3   26 .400 4     2 .030                    |
          +---------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
        Index function for probability
 Constant -1.658168656    1.5025967       -1.104  .2698
 TYPE     .3385276201     .29675581        1.141  .2540 .47692308
 SIZE     .2217063280     .18542002        1.196  .2318 1.3230769
 RESDEV   .7419408138     .33410301        2.221  .0264 .56923077
 PRIOR    .2207858185     .20198050        1.093  .2743 3.9000000
 FLEXIBI  .4966155578     .20113674        2.469  .0135 2.7461538
 DETERMIN .1004980704     .26597649         .378  .7055 3.8230769
        Threshold parameters for index
 Mu( 1)   .9033767996     .37442587        2.413  .0158
 Mu( 2)   2.036060487     .45391222        4.486  .0000
 Mu( 3)   4.015437404     .62700209        6.404  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------ ---------------------- + -----
Actual    0  1  2  3  4 | Total
------ ---------------------- + -----
 0        0  2  2  0  0 |   4
 1        0  0  5  5  0 |  10
 2        0  2 12  9  0 |  23
 3        0  0  8 18  0 |  26
```

```
 4      0  0  0  2  0 |   2
------ ----------------------- + -----
Total     0  4  27  34   0 |   65
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
    help,graft2,idexp$

+-----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=   .9384615385    , S.D.=   .2421855614    |
| Model size: Observations =       65, Parameters =   6, Deg.Fr.=    59 |
| Residuals:  Sum of squares= 154.5597645    , Std.Dev.=        1.61854 |
| Fit:        R-squared=*********, Adjusted R-squared =      -43.66301 |
| Diagnostic: Log-L =   -120.3823, Restricted(b=0) Log-L =        .4462 |
|             LogAmemiyaPrCrt.=    1.051, Akaike Info. Crt.=     3.889 |
+-----------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  .6194727997      1.1350453        .546   .5852
 TYPE      .7782935345E-01  .44087026        .177   .8599  .47692308
 SIZE     -.9467604589E-02  .23516366       -.040   .9679  1.3230769
 HELP     -.3343386344E-01  .11219735       -.298   .7657  1.4000000
 GRAFT2    .2281629374E-01  .11910707        .192   .8481  2.4307692
 IDEXP     .7803898832E-01  .29088173        .268   .7885  3.6615385

Normal exit from iterations. Exit status=0.

          +---------------------------------------------+
          | Ordered Probit Model                        |
          | Maximum Likelihood Estimates                |
          | Dependent variable              PRODEV      |
          | Weighting variable                 ONE      |
          | Number of observations              65      |
          | Iterations completed                14      |
          | Log likelihood function      -71.90724      |
          | Restricted log likelihood    -84.55097      |
          | Chi-squared                   25.28747      |
          | Degrees of freedom                   5      |
          | Significance level          .1226059E-03    |
          |   Cell frequencies for outcomes             |
          | Y Count Freq  Y Count Freq  Y Count Freq    |
          | 0     4 .061  1    10 .153  2    23 .353    |
          | 3    26 .400  4     2 .030                  |
          +---------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
        Index function for probability
 Constant -1.723226384      1.0097678      -1.707   .0879
 TYPE     -.2003548897      .38439397       -.521   .6022  .47692308
 SIZE      .3303524063      .17731930       1.863   .0625  1.3230769
 HELP     -.1087515984      .83421507E-01  -1.304   .1924  1.4000000
 GRAFT2    .2544086081      .99325612E-01   2.561   .0104  2.4307692
 IDEXP     .7721769467      .26840555       2.877   .0040  3.6615385
        Threshold parameters for index
 Mu( 1)    .9110491712      .31301033       2.911   .0036
 Mu( 2)   2.118530115       .36309385       5.835   .0000
 Mu( 3)   4.303736126       .60525967       7.111   .0000
```

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

```
         Predicted
------ ---------------------- + -----
Actual   0  1  2  3  4 | Total
------ ---------------------- + -----
 0       1  0  2  1  0 |   4
 1       0  0  9  1  0 |  10
 2       0  3 10 10  0 |  23
 3       0  0  7 19  0 |  26
 4       0  0  0  2  0 |   2
------ ---------------------- + -----
Total    1  3 28 33  0 |  65
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
   mission,explicit$

+----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0             |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=  .9365079365   , S.D.=  .2458045298    |
| Model size: Observations =      63, Parameters =  5, Deg.Fr.=    58 |
| Residuals:  Sum of squares= 155.6607325    , Std.Dev.=        1.63823 |
| Fit:        R-squared=*********, Adjusted R-squared =       -43.41926 |
| Diagnostic: Log-L =  -117.8863, Restricted(b=0) Log-L =        -.4863 |
|             LogAmemiyaPrCrt.=   1.064, Akaike Info. Crt.=     3.901 |
+----------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant  .7243965433      1.5064500      .481   .6306
 TYPE      .1166430638      .42028786      .278   .7814  .49206349
 SIZE     -.9625359522E-02  .23807398     -.040   .9678  1.3492063
 MISSION   .4249240044E-01  .39373370      .108   .9141  3.8095238
 EXPLICIT  .3462851432E-02  .31698006      .011   .9913  1.6825397
```

Normal exit from iterations. Exit status=0.

```
         +------------------------------------------+
         | Ordered Probit Model                     |
         | Maximum Likelihood Estimates             |
         | Dependent variable              PRODEV   |
         | Weighting variable                 ONE   |
         | Number of observations              63   |
         | Iterations completed                13   |
         | Log likelihood function      -76.58226   |
         | Restricted log likelihood    -82.41468   |
         | Chi-squared                   11.66485   |
         | Degrees of freedom                   4   |
         | Significance level        .2002554E-01   |
         |   Cell frequencies for outcomes          |
         | Y Count Freq  Y Count Freq  Y Count Freq |
         | 0    4 .063 1   10 .158 2   21 .333      |
         | 3   26 .412 4    2 .031                  |
         +------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
```

```
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant -1.583516117     1.1791986      -1.343  .1793
 TYPE      .4719323721E-01  .32562118       .145  .8848  .49206349
 SIZE      .3608789547      .19454034      1.855  .0636  1.3492063
 MISSION   .7481375263      .28387990      2.635  .0084  3.8095238
 EXPLICIT -.5617041183E-01  .25827105      -.217  .8278  1.6825397
       Threshold parameters for index
 Mu( 1)    .8225311920      .26512992      3.102  .0019
 Mu( 2)   1.825621441       .29828277      6.120  .0000
 Mu( 3)   3.785156035       .50238548      7.534  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

          Predicted
------  ---------------------  +  -----
Actual    0   1   2   3   4  | Total
------  ---------------------  +  -----
  0       0   0   3   1   0  |   4
  1       0   3   3   4   0  |  10
  2       0   0  13   8   0  |  21
  3       0   0   8  18   0  |  26
  4       0   0   0   2   0  |   2
------  ---------------------  +  -----
Total     0   3  27  33   0  |  63
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
   active$

+-----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary    least squares regression    Weighting variable = none  |
| Dep. var. = Y=0/Not0 Mean=  .9384615385   , S.D.=  .2421855614   |
| Model size: Observations =     65, Parameters =  4, Deg.Fr.=    61 |
| Residuals:  Sum of squares= 153.5493956   , Std.Dev.=      1.58657 |
| Fit:        R-squared=*********, Adjusted R-squared =    -41.91625 |
| Diagnostic: Log-L =  -120.1691, Restricted(b=0) Log-L =      .4462 |
|             LogAmemiyaPrCrt.=   .983, Akaike Info. Crt.=   3.821 |
+-----------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant  .3610774631    1.2388721       .291  .7707
 TYPE      .1001090562    .39626689       .253  .8006  .47692308
 SIZE     -.5512363294E-01 .23915415      -.230  .8177  1.3230769
 ACTIVE    .1983150207    .42890273       .462  .6438  3.0384615

Normal exit from iterations. Exit status=0.

          +-----------------------------------------+
          | Ordered Probit Model                     |
          | Maximum Likelihood Estimates             |
          | Dependent variable             PRODEV    |
          | Weighting variable               ONE     |
          | Number of observations            65     |
          | Iterations completed              12     |
          | Log likelihood function     -73.12232    |
          | Restricted log likelihood   -84.55097    |
```

```
| Chi-squared                22.85730   |
| Degrees of freedom                3   |
| Significance level        .4324463E-04 |
|  Cell frequencies for outcomes         |
| Y Count Freq  Y Count Freq  Y Count Freq |
| 0   4 .061 1   10 .153 2   23 .353 |
| 3   26 .400 4   2 .030              |
+----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
        Index function for probability
Constant -2.444090246    .90423819    -2.703  .0069
TYPE    .9535614261E-01 .31742888      .300  .7639  .47692308
SIZE    .6068222397E-01 .19933563      .304  .7608  1.3230769
ACTIVE   1.394398177    .34202565     4.077  .0000  3.0384615
        Threshold parameters for index
Mu( 1)  .9636573814    .31431408     3.066  .0022
Mu( 2)  2.143556896    .38678089     5.542  .0000
Mu( 3)  4.201954933    .57600714     7.295  .0000
```

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

```
        Predicted
------ ---------------------- + -----
Actual   0  1  2  3  4 | Total
------ ---------------------- + -----
 0       1  0  3  0  0 |   4
 1       0  1  8  1  0 |  10
 2       0  2  9 12  0 |  23
 3       0  1  7 18  0 |  26
 4       0  0  0  2  0 |   2
------ ---------------------- + -----
Total    1  4 27 33  0 |  65
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
   mgrlctrb,techctrb,fortech,fortrain,written$

+-----------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                    |
| Ordinary   least squares regression    Weighting variable = none      |
| Dep. var. = Y=0/Not0 Mean=  .9384615385   , S.D.=  .2421855614        |
| Model size: Observations =     65, Parameters =  8, Deg.Fr.=    57 |
| Residuals:  Sum of squares= 154.0630451   , Std.Dev.=        1.64404 |
| Fit:        R-squared=*********, Adjusted R-squared =      -45.08156 |
| Diagnostic: Log-L =  -120.2777, Restricted(b=0) Log-L =        .4462 |
|             LogAmemiyaPrCrt.=   1.110, Akaike Info. Crt.=    3.947 |
+-----------------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
Constant .2942683435     1.6897712      .174  .8618
TYPE    .1037391497     .43143140      .240  .8100  .47692308
SIZE    -.6162337266E-01 .25288760     -.244  .8075  1.3230769
MGRLCTRB .1085235186     .35696955      .304  .7611  2.5923077
TECHCTRB -.2762895124E-01 .41478319     -.067  .9469  3.5794872
FORTECH  .4824644129E-01 .33609026      .144  .8859  3.8923077
FORTRAIN .5205695330E-01 .30474118      .171  .8644  3.6000000
```

```
WRITTEN .1329431114   .71215969      .187  .8519  .89230769
```

Normal exit from iterations. Exit status=0.

```
+------------------------------------------+
| Ordered Probit Model                     |
| Maximum Likelihood Estimates             |
| Dependent variable          PRODEV       |
| Weighting variable          ONE          |
| Number of observations      65           |
| Iterations completed        16           |
| Log likelihood function     -72.32141    |
| Restricted log likelihood   -84.55097    |
| Chi-squared                 24.45913     |
| Degrees of freedom          7            |
| Significance level          .9457906E-03 |
|   Cell frequencies for outcomes          |
| Y Count Freq  Y Count Freq  Y Count Freq |
| 0    4 .061   1   10 .153   2   23 .353  |
| 3   26 .400   4    2 .030                |
+------------------------------------------+
+--------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+--------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant -1.660589348    1.0681708     -1.555  .1200
 TYPE     .1163961223E-01 .35078901      .033  .9735  .47692308
 SIZE     .4368591944E-01 .22269654      .196  .8445  1.3230769
 MGRLCTRB .7563129481     .28433235     2.660  .0078  2.5923077
 TECHCTRB .4885635160     .35665639     1.370  .1707  3.5794872
 FORTECH  -.1497070954    .29479410     -.508  .6116  3.8923077
 FORTRAIN .2708713496E-01 .17719852      .153  .8785  3.6000000
 WRITTEN  .3812783120     .55816375      .683  .4945  .89230769
       Threshold parameters for index
 Mu( 1)   .9854004537     .33841002     2.912  .0036
 Mu( 2)   2.210276543     .40763504     5.422  .0000
 Mu( 3)   4.262803854     .62572863     6.813  .0000
```

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

```
        Predicted
------ ---------------------- + -----
Actual   0  1  2  3  4 | Total
------ ---------------------- + -----
 0       0  1  3  0  0 |   4
 1       0  3  6  1  0 |  10
 2       0  2 10 11  0 |  23
 3       0  0  8 18  0 |  26
 4       0  0  0  2  0 |   2
------ ---------------------- + -----
Total    0  6 27 32  0 |  65
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
   access$

+------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0          |
| Ordinary   least squares regression   Weighting variable = none |
```

```
| Dep. var. = Y=0/Not0 Mean=  .9384615385    , S.D.=  .2421855614    |
| Model size: Observations =      65, Parameters =  4, Deg.Fr.=    61 |
| Residuals:  Sum of squares= 156.3807523    , Std.Dev.=      1.60113 |
| Fit:        R-squared=*********, Adjusted R-squared =     -42.70760 |
| Diagnostic: Log-L =  -120.7630, Restricted(b=0) Log-L =       .4462 |
|             LogAmemiyaPrCrt.=   1.001, Akaike Info. Crt.=    3.839 |
+---------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  .6692655879     1.1298570          .592   .5536
 TYPE      .1150412200     .39818350          .289   .7726  .47692308
 SIZE      -.1835469763E-01 .22625074         -.081   .9353  1.3230769
 ACCESS    .7002240614E-01 .31560740          .222   .8244  3.4076923

Normal exit from iterations. Exit status=0.

           +---------------------------------------------+
           | Ordered Probit Model                        |
           | Maximum Likelihood Estimates                |
           | Dependent variable              PRODEV      |
           | Weighting variable              ONE         |
           | Number of observations          65          |
           | Iterations completed            12          |
           | Log likelihood function         -76.19101   |
           | Restricted log likelihood       -84.55097   |
           | Chi-squared                     16.71992    |
           | Degrees of freedom              3           |
           | Significance level              .8069365E-03|
           |   Cell frequencies for outcomes             |
           |  Y Count Freq  Y Count Freq  Y Count Freq   |
           |  0    4 .061   1   10 .153   2   23 .353    |
           |  3   26 .400   4    2 .030                  |
           +---------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
          Index function for probability
 Constant -1.393623259     .97911145        -1.423   .1546
 TYPE      .1686684569     .31857274          .529   .5965  .47692308
 SIZE      .2902975315     .16643270         1.744   .0811  1.3230769
 ACCESS    .8013847962     .27718752         2.891   .0038  3.4076923
          Threshold parameters for index
 Mu( 1)    .8710946704     .25851678         3.370   .0008
 Mu( 2)    2.020671601     .29965311         6.743   .0000
 Mu( 3)    3.934736560     .44817647         8.779   .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

          Predicted
------  ----------------------  +  -----
Actual    0   1   2   3   4  |  Total
------  ----------------------  +  -----
  0       1   0   2   1   0  |    4
  1       2   0   7   1   0  |   10
  2       1   0  13   9   0  |   23
  3       0   0   8  18   0  |   26
  4       0   0   0   2   0  |    2
```

```
------ ---------------------- + -----
Total     4  0  30  31   0 |   65
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
    protect,similar$

+-----------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0         |
| Ordinary   least squares regression   Weighting variable = none  |
| Dep. var. = Y=0/Not0 Mean=  .9384615385   , S.D.=  .2421855614   |
| Model size: Observations =     65, Parameters =  5, Deg.Fr.=    60 |
| Residuals:  Sum of squares= 156.1430808   , Std.Dev.=       1.61319 |
| Fit:        R-squared=*********, Adjusted R-squared =     -43.36853 |
| Diagnostic: Log-L =  -120.7135, Restricted(b=0) Log-L =       .4462 |
|            LogAmemiyaPrCrt.=   1.031, Akaike Info. Crt.=    3.868 |
+-----------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant .6581992242     1.1617642        .567  .5710
 TYPE      .1157947344    .40149361        .288  .7730  .47692308
 SIZE    -.1885978632E-01 .22820071       -.083  .9341  1.3230769
 PROTECT  .4564828639E-01 .27386067        .167  .8676  3.5923077
 SIMILAR  .2668487071E-01 .23610104        .113  .9100  3.2230769

Normal exit from iterations. Exit status=0.

          +----------------------------------------+
          | Ordered Probit Model                   |
          | Maximum Likelihood Estimates           |
          | Dependent variable            PRODEV   |
          | Weighting variable              ONE    |
          | Number of observations           65    |
          | Iterations completed             13    |
          | Log likelihood function    -74.54313   |
          | Restricted log likelihood  -84.55097   |
          | Chi-squared                20.01569    |
          | Degrees of freedom                4    |
          | Significance level       .4958507E-03  |
          |   Cell frequencies for outcomes        |
          |  Y Count Freq  Y Count Freq  Y Count Freq |
          | 0    4 .061 1   10 .153 2   23 .353    |
          | 3   26 .400 4    2 .030                |
          +----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
        Index function for probability
Constant -1.670187554    .87217292     -1.915  .0555
TYPE      .1915612812    .33151064       .578  .5634  .47692308
SIZE      .2826701752    .18417452      1.535  .1248  1.3230769
PROTECT   .6789060206    .17200408      3.947  .0001  3.5923077
SIMILAR   .1948230205    .19278972      1.011  .3122  3.2230769
        Threshold parameters for index
Mu( 1)   .9013318763    .26113914      3.452  .0006
Mu( 2)  2.098398355     .30531754      6.873  .0000
Mu( 3)  4.036623571     .45998882      8.775  .0000


Frequencies of actual & predicted outcomes
```

Predicted outcome has maximum probability.

```
          Predicted
------ ---------------------- + -----
Actual    0  1  2  3  4 | Total
------ ---------------------- + -----
 0        0  1  2  1  0 |   4
 1        2  0  6  2  0 |  10
 2        1  0 15  7  0 |  23
 3        0  0  7 19  0 |  26
 4        0  0  0  2  0 |   2
------ ---------------------- + -----
Total     3  1 30 31  0 |  65
--> skip$
--> ordered; lhs=prodev; rhs=one,type,size,
   lecap,precurx,access,active,mission$

+---------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                  |
| Ordinary    least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=  .9365079365   , S.D.=  .2458045298      |
| Model size: Observations =      63, Parameters =  8, Deg.Fr.=    55 |
| Residuals:  Sum of squares= 151.3713913   , Std.Dev.=      1.65898 |
| Fit:        R-squared=*********, Adjusted R-squared =     -44.55136 |
| Diagnostic: Log-L =  -117.0061, Restricted(b=0) Log-L =      -.4863 |
|             LogAmemiyaPrCrt.=   1.132, Akaike Info. Crt.=     3.968 |
+---------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  .8387629274E-01  2.0856741        .040   .9679
 TYPE      .1518005897      .47197609        .322   .7477  .49206349
 SIZE     -.4792004283E-01  .25920315       -.185   .8533  1.3492063
 LECAP     .9671304933E-01  .56686273        .171   .8645  3.4947090
 PRECURX  -.6274369884E-01  .36507024       -.172   .8635  2.8650794
 ACCESS    .1814623368E-01  .41979349        .043   .9655  3.4087302
 ACTIVE    .2190744428      .54990330        .398   .6903  3.0428571
 MISSION  -.1157519795E-01  .44411810       -.026   .9792  3.8095238
```

Normal exit from iterations. Exit status=0.

```
+----------------------------------------------+
| Ordered Probit Model                         |
| Maximum Likelihood Estimates                 |
| Dependent variable              PRODEV       |
| Weighting variable              ONE          |
| Number of observations          63           |
| Iterations completed            17           |
| Log likelihood function         -67.16402    |
| Restricted log likelihood       -82.41468    |
| Chi-squared                     30.50134     |
| Degrees of freedom              7            |
| Significance level              .7681574E-04 |
|   Cell frequencies for outcomes              |
| Y Count Freq  Y Count Freq  Y Count Freq     |
| 0    4 .063   1   10 .158   2   21 .333      |
| 3   26 .412   4    2 .031                    |
+----------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
```

```
+---------+-------------+--------------+--------+---------+----------+
      Index function for probability
 Constant -4.947610759    1.6109672      -3.071  .0021
 TYPE    -.1574570015E-01 .35523670       -.044  .9646 .49206349
 SIZE     .1560872470     .21593399       .723  .4698 1.3492063
 LECAP    .2055677484     .50196377        .410  .6822 3.4947090
 PRECURX  .1668391843     .32783729        .509  .6108 2.8650794
 ACCESS   .2664873704     .34408536        .774  .4386 3.4087302
 ACTIVE   1.035218672     .49684552       2.084  .0372 3.0428571
 MISSION  .4025121691     .36882662       1.091  .2751 3.8095238
      Threshold parameters for index
 Mu( 1)   1.021023026     .34549509      2.955  .0031
 Mu( 2)   2.249577595     .46990684      4.787  .0000
 Mu( 3)   4.477370225     .75606006      5.922  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------ ---------------------- + -----
Actual    0  1  2  3  4  | Total
------ ---------------------- + -----
 0        0  2  2  0  0 |   4
 1        0  4  4  2  0 |  10
 2        1  2  7 11  0 |  21
 3        0  0  6 20  0 |  26
 4        0  0  0  2  0 |   2
------ ---------------------- + -----
Total     1  8 19 35  0 |  63
--> skip$
--> ordered; lhs=techexp; rhs=one,years,type,size,
   electron,electric,telecom,automoti,resdev,
   lecap$

+--------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                 |
| Ordinary    least squares regression    Weighting variable = none  |
| Dep. var. = Y=0/Not0 Mean=  .9538461538   , S.D.=  .2114510309     |
| Model size: Observations =      65, Parameters =  10, Deg.Fr.=  55 |
| Residuals:  Sum of squares= 68.33156386   , Std.Dev.=     1.11463 |
| Fit:        R-squared=*********, Adjusted R-squared =   -26.78683 |
| Diagnostic: Log-L =   -93.8555, Restricted(b=0) Log-L =    9.2674 |
|             LogAmemiyaPrCrt.=   .360, Akaike Info. Crt.=    3.196 |
+--------------------------------------------------------------------+
+---------+-------------+--------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+--------------+--------+---------+----------+
 Constant .2020013798     1.3035047       .155  .8768
 YEARS    .1195329308E-02 .22127628E-01   .054  .9569 9.8153846
 TYPE     .9765937799E-01 .30717332       .318  .7505 .47692308
 SIZE    -.3251654457E-01 .18577277      -.175  .8611 1.3230769
 ELECTRON .4055128568     .85715451       .473  .6361 .40000000
 ELECTRIC .4272445481     .86901307       .492  .6230 .30769231
 TELECOM  .4381700677     .90537692       .484  .6284 .16923077
 AUTOMOTI .4756120003     .97494933       .488  .6257 .92307692E-01
 RESDEV  -.6346019140E-02 .30220467      -.021  .9832 .56923077
 LECAP    .9411891426E-01 .33670274       .280  .7798 3.4897436

Normal exit from iterations. Exit status=0.
```

```
+----------------------------------------+
| Ordered Probit Model                   |
| Maximum Likelihood Estimates           |
| Dependent variable          TECHEXP    |
| Weighting variable              ONE    |
| Number of observations           65    |
| Iterations completed             17    |
| Log likelihood function   -56.19759    |
| Restricted log likelihood -66.24525    |
| Chi-squared                20.09531    |
| Degrees of freedom                9    |
| Significance level     .1733326E-01    |
|   Cell frequencies for outcomes        |
| Y Count Freq Y Count Freq Y Count Freq |
| 0    3 .046 1   17 .261 2   39 .600    |
| 3    6 .092                            |
+----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant -1.306231640     1.2688449      -1.029   .3033
 YEARS    .7368150890E-03 .22028292E-01    .033   .9733  9.8153846
 TYPE     .4121716647     .44991750        .916   .3596  .47692308
 SIZE     -.1898203806    .23482651       -.808   .4189  1.3230769
 ELECTRON -.9375377871    .63984179      -1.465   .1428  .40000000
 ELECTRIC -.4846712659    .61912886       -.783   .4337  .30769231
 TELECOM  -.6542411557    .79404208       -.824   .4100  .16923077
 AUTOMOTI -.7139970511    .98311555       -.726   .4677  .92307692E-01
 RESDEV   .7140337893     .37493325       1.904   .0569  .56923077
 LECAP    1.075951513     .44385971       2.424   .0153  3.4897436
       Threshold parameters for index
 Mu( 1)   1.513642898     .42139315       3.592   .0003
 Mu( 2)   3.705293286     .53087163       6.980   .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

        Predicted
------ ------------------ + -----
Actual   0   1   2   3 | Total
------ ------------------ + -----
 0       0   3   0   0 |    3
 1       0   6  11   0 |   17
 2       0   2  37   0 |   39
 3       0   0   6   0 |    6
------ ------------------ + -----
Total    0  11  54   0 |   65
--> skip$
--> ordered; lhs=techexp; rhs=one,years,type,size,
   electron,electric,telecom,automoti,resdev,
   expend,lecap$

+-----------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                    |
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = Y=0/Not0 Mean=  .9642857143   , S.D.=  .1872563352        |
| Model size: Observations =      56, Parameters =  11, Deg.Fr.=    45  |
```

```
| Residuals:  Sum of squares= 57.55558095   , Std.Dev.=        1.13093 |
| Fit:       R-squared=*********, Adjusted R-squared =      -35.47555 |
| Diagnostic: Log-L =   -80.2277, Restricted(b=0) Log-L =     14.8595 |
|            LogAmemiyaPrCrt.=    .425, Akaike Info. Crt.=     3.258 |
+---------------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant .3044967801      1.4255657      .214   .8309
 YEARS     .3205773077E-02 .25129651E-01   .128   .8985 9.5178571
 TYPE      .6482967689E-01 .33933720       .191   .8485 .42857143
 SIZE     -.2777824072E-01 .20277879      -.137   .8910 1.2142857
 ELECTRON .4275748964      .87657911       .488   .6257 .41071429
 ELECTRIC .4234225051      .89797266       .472   .6373 .30357143
 TELECOM  .4498186640      .94026716       .478   .6324 .16071429
 AUTOMOTI .4691192986      1.0126984       .463   .6432 .89285714E-01
 RESDEV    .2318034398E-01 .32371401       .072   .9429 .50000000
 EXPEND   -.1663513748E-09 .25672771E-08  -.065   .9483 10243214.
 LECAP     .5884525157E-01 .38532384       .153   .8786 3.5178571

Initial iterations cannot improve function.Status=3
Abnormal exit from iterations. If current results are shown
check convergence values shown below. This may not be a
solution value (especially if initial iterations stopped).
Gradient value: Tolerance= .1000D-05, current value= .7003D+08
Function chg. : Tolerance= .0000D+00, current value= .7037D+02
Parameters chg: Tolerance= .0000D+00, current value= .7003D+14
Smallest abs. parameter change from start value = .0000D+00
Note:  At least one parameter did not leave start value.

          +----------------------------------------+
          | Ordered Probit Model                   |
          | Maximum Likelihood Estimates           |
          | Dependent variable           TECHEXP   |
          | Weighting variable               ONE   |
          | Number of observations            56   |
          | Iterations completed               1   |
          | Log likelihood function    -70.36512   |
          |   Cell frequencies for outcomes        |
          | Y Count Freq  Y Count Freq  Y Count Freq |
          | 0    2 .035  1   15 .267  2   34 .607  |
          | 3    5 .089                            |
          +----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
        Index function for probability
 Constant .3044967801      1.1888738      .256   .7979
 YEARS     .3205773077E-02 .21254015E-01   .151   .8801 9.5178571
 TYPE      .6482967689E-01 .30239497       .214   .8302 .42857143
 SIZE     -.2777824072E-01 .20253198      -.137   .8909 1.2142857
 ELECTRON .4275748964      .77637242       .551   .5818 .41071429
 ELECTRIC .4234225051      .57127961       .741   .4586 .30357143
 TELECOM  .4498186640      .70085114       .642   .5210 .16071429
 AUTOMOTI .4691192986      .96201699       .488   .6258 .89285714E-01
 RESDEV    .2318034398E-01 .31925667       .073   .9421 .50000000
 EXPEND   -.1663513748E-09 .66488291E-08  -.025   .9800 10243214.
 LECAP     .5884525157E-01 .38919654       .151   .8798 3.5178571
        Threshold parameters for index
 Mu( 1)   1.289394219      .38420709      3.356  .0008
```

```
Mu( 2)  3.148529723    .50474572      6.238  .0000

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

          Predicted
------ ------------------ + -----
Actual    0   1   2   3 | Total
------ ------------------ + -----
 0        0   2   0   0 |   2
 1        0  15   0   0 |  15
 2        0  34   0   0 |  34
 3        0   5   0   0 |   5
------ ------------------ + -----
Total     0  56   0   0 |  56
--> skip$
--> ordered; lhs=techexp; rhs=one,years,type,size,
   electron,electric,telecom,automoti,resdev,
   expend,lecap;
   test:B(2)+B(5)+B(6)+B(7)+B(8)=0$

+----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0             |
| Ordinary    least squares regression    Weighting variable = none  |
| Dep. var. = Y=0/Not0 Mean=  .9642857143    , S.D.=  .1872563352   |
| Model size: Observations =      56, Parameters =  11, Deg.Fr.=    45 |
| Residuals:  Sum of squares= 57.55558095    , Std.Dev.=       1.13093 |
| Fit:        R-squared=*********, Adjusted R-squared =      -35.47555 |
| Diagnostic: Log-L =    -80.2277, Restricted(b=0) Log-L =     14.8595 |
|             LogAmemiyaPrCrt.=    .425, Akaike Info. Crt.=    3.258 |
+----------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant .3044967801      1.4255657       .214   .8309
 YEARS    .3205773077E-02 .25129651E-01    .128   .8985  9.5178571
 TYPE     .6482967689E-01 .33933720        .191   .8485  .42857143
 SIZE    -.2777824072E-01 .20277879       -.137   .8910  1.2142857
 ELECTRON .4275748964      .87657911       .488   .6257  .41071429
 ELECTRIC .4234225051      .89797266       .472   .6373  .30357143
 TELECOM  .4498186640      .94026716       .478   .6324  .16071429
 AUTOMOTI .4691192986      1.0126984       .463   .6432  .89285714E-01
 RESDEV   .2318034398E-01 .32371401        .072   .9429  .50000000
 EXPEND  -.1663513748E-09 .25672771E-08   -.065   .9483  10243214.
 LECAP    .5884525157E-01 .38532384        .153   .8786  3.5178571

Initial iterations cannot improve function.Status=3
Abnormal exit from iterations. If current results are shown
check convergence values shown below. This may not be a
solution value (especially if initial iterations stopped).
Gradient value: Tolerance= .1000D-05, current value= .7003D+08
Function chg. : Tolerance= .0000D+00, current value= .7037D+02
Parameters chg: Tolerance= .0000D+00, current value= .7003D+14
Smallest abs. parameter change from start value = .0000D+00
Note:  At least one parameter did not leave start value.

          +---------------------------------------------+
          | Ordered Probit Model                         |
          | Maximum Likelihood Estimates                 |
```

```
| Dependent variable            TECHEXP    |
| Weighting variable               ONE    |
| Number of observations             56    |
| Iterations completed              1    |
| Log likelihood function     -70.36512    |
|   Cell frequencies for outcomes          |
| Y Count Freq  Y Count Freq  Y Count Freq  |
| 0    2 .035  1   15 .267  2   34 .607  |
| 3    5 .089                            |
| Wald test of  1 linear restrictions        |
| Chi-squared =     .42, Sig. level =  .51698 |
+------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
        Index function for probability
 Constant  .3044967801      1.1888738         .256   .7979
 YEARS      .3205773077E-02  .21254015E-01    .151   .8801  9.5178571
 TYPE       .6482967689E-01  .30239497        .214   .8302  .42857143
 SIZE      -.2777824072E-01  .20253198       -.137   .8909  1.2142857
 ELECTRON  .4275748964       .77637242        .551   .5818  .41071429
 ELECTRIC  .4234225051       .57127961        .741   .4586  .30357143
 TELECOM   .4498186640       .70085114        .642   .5210  .16071429
 AUTOMOTI  .4691192986       .96201699        .488   .6258  .89285714E-01
 RESDEV     .2318034398E-01  .31925667        .073   .9421  .50000000
 EXPEND    -.1663513748E-09  .66488291E-08   -.025   .9800  10243214.
 LECAP      .5884525157E-01  .38919654        .151   .8798  3.5178571
        Threshold parameters for index
 Mu( 1)    1.289394219      .38420709       3.356   .0008
 Mu( 2)    3.148529723      .50474572       6.238   .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

           Predicted
------  ------------------ + -----
Actual    0   1   2   3 | Total
------  ------------------ + -----
 0        0   2   0   0 |    2
 1        0  15   0   0 |   15
 2        0  34   0   0 |   34
 3        0   5   0   0 |    5
------  ------------------ + -----
Total     0  56   0   0 |   56
--> skip$
--> ordered; lhs=techexp; rhs=one,type,size,
   resdev,expend,lecap$

+----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0               |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=  .9642857143    , S.D.=  .1872563352    |
| Model size: Observations =      56, Parameters =  6, Deg.Fr.=    50 |
| Residuals:  Sum of squares= 57.01734986    , Std.Dev.=        1.06787 |
| Fit:        R-squared=*********, Adjusted R-squared =      -31.52101 |
| Diagnostic: Log-L =   -79.9647, Restricted(b=0) Log-L =     14.8595 |
|             LogAmemiyaPrCrt.=    .233, Akaike Info. Crt.=     3.070 |
+----------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
```

|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	.5689944935	1.2355400	.461	.6451	
TYPE	.7083489150E-01	.29724669	.238	.8116	.42857143
SIZE	-.1784031709E-01	.16119580	-.111	.9119	1.2142857
RESDEV	.5342995273E-01	.29723615	.180	.8573	.50000000
EXPEND	-.1366695320E-09	.22509976E-08	-.061	.9516	10243214.
LECAP	.1026993413	.34754839	.295	.7676	3.5178571

Initial iterations cannot improve function.Status=3
Abnormal exit from iterations. If current results are shown
check convergence values shown below. This may not be a
solution value (especially if initial iterations stopped).
Gradient value: Tolerance= .1000D-05, current value= .7006D+08
Function chg. : Tolerance= .0000D+00, current value= .6995D+02
Parameters chg: Tolerance= .0000D+00, current value= .7006D+14
Smallest abs. parameter change from start value = .0000D+00
Note: At least one parameter did not leave start value.

```
+-----------------------------------------+
| Ordered Probit Model                    |
| Maximum Likelihood Estimates            |
| Dependent variable          TECHEXP     |
| Weighting variable              ONE     |
| Number of observations           56     |
| Iterations completed              1     |
| Log likelihood function   -69.95499     |
|   Cell frequencies for outcomes         |
| Y Count Freq  Y Count Freq  Y Count Freq |
| 0    2 .035  1   15 .267  2   34 .607   |
| 3    5 .089                             |
+-----------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Index function for probability					
Constant	.5689944935	1.0850744	.524	.6000	
TYPE	.7083489150E-01	.27294485	.260	.7952	.42857143
SIZE	-.1784031709E-01	.15478409	-.115	.9082	1.2142857
RESDEV	.5342995273E-01	.26805991	.199	.8420	.50000000
EXPEND	-.1366695320E-09	.66151929E-08	-.021	.9835	10243214.
LECAP	.1026993413	.31814771	.323	.7468	3.5178571
Threshold parameters for index					
Mu(1)	1.289394219	.36741903	3.509	.0004	
Mu(2)	3.148529723	.43946036	7.165	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted				
Actual	0	1	2	3	Total
0	0	2	0	0	2
1	0	15	0	0	15
2	0	34	0	0	34
3	0	5	0	0	5
Total	0	56	0	0	56

```
--> ordered; lhs=techexp; rhs=one,type,size,
--> skip$
--> ordered; lhs=techexp; rhs=one,type,size,
   help,graft2,idexp$

+-----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=  .9538461538    , S.D.=  .2114510309    |
| Model size: Observations =      65, Parameters =   6, Deg.Fr.=     59 |
| Residuals:  Sum of squares= 69.33898361    , Std.Dev.=        1.08408 |
| Fit:        R-squared=*********, Adjusted R-squared =      -25.28487 |
| Diagnostic: Log-L =    -94.3312, Restricted(b=0) Log-L =      9.2674 |
|             LogAmemiyaPrCrt.=    .250, Akaike Info. Crt.=     3.087 |
+-----------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant .7303003044      .76024522         .961  .3367
 TYPE     .1088242732      .29529175         .369  .7125  .47692308
 SIZE    -.1587405353E-01  .15751094        -.101  .9197  1.3230769
 HELP    -.5380695709E-02  .75148987E-01    -.072  .9429  1.4000000
 GRAFT2  -.1384779249E-01  .79777067E-01    -.174  .8622  2.4307692
 IDEXP    .6386424736E-01  .19483051         .328  .7431  3.6615385

Normal exit from iterations. Exit status=0.

          +---------------------------------------------+
          | Ordered Probit Model                         |
          | Maximum Likelihood Estimates                 |
          | Dependent variable              TECHEXP      |
          | Weighting variable                  ONE      |
          | Number of observations               65      |
          | Iterations completed                 12      |
          | Log likelihood function       -58.97298      |
          | Restricted log likelihood     -66.24525      |
          | Chi-squared                    14.54454      |
          | Degrees of freedom                    5      |
          | Significance level          .1249649E-01     |
          |   Cell frequencies for outcomes              |
          | Y Count Freq  Y Count Freq  Y Count Freq     |
          | 0    3 .046  1   17 .261  2   39 .600        |
          | 3    6 .092                                  |
          +---------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
        Index function for probability
 Constant -.2932117023     .82341757        -.356  .7218
 TYPE     .1591868538      .41276114         .386  .6997  .47692308
 SIZE    -.1848784490      .22123751        -.836  .4033  1.3230769
 HELP    -.4692782433E-02  .84029758E-01    -.056  .9555  1.4000000
 GRAFT2   .2033546214      .10571756        1.924  .0544  2.4307692
 IDEXP    .5270356763      .20893320        2.523  .0117  3.6615385
        Threshold parameters for index
 Mu( 1)  1.377402094      .40098025        3.435  .0006
 Mu( 2)  3.459768502      .43276853        7.995  .0000


Frequencies of actual & predicted outcomes
```

Predicted outcome has maximum probability.

```
         Predicted
------ ---------------- + -----
Actual   0  1  2  3 | Total
------ ---------------- + -----
  0      0  1  2  0 |   3
  1      0  5 12  0 |  17
  2      0  1 38  0 |  39
  3      0  0  6  0 |   6
------ ---------------- + -----
Total    0  7 58  0 |  65
--> skip$
--> ordered; lhs=techexp; rhs=one,type,size,
   precurx$

+-----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=  .9538461538    , S.D.=  .2114510309     |
| Model size: Observations =      65, Parameters =  4, Deg.Fr.=    61 |
| Residuals:  Sum of squares= 69.76033104    , Std.Dev.=       1.06940 |
| Fit:        R-squared=*********, Adjusted R-squared =     -24.57756 |
| Diagnostic: Log-L =   -94.5280, Restricted(b=0) Log-L =     9.2674 |
|             LogAmemiyaPrCrt.=    .194, Akaike Info. Crt.=     3.032 |
+-----------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant .9339564654      .49886660       1.872  .0612
 TYPE     .8828646019E-01 .27821731         .317  .7510  .47692308
 SIZE    -.2271834802E-01 .15348921        -.148  .8823  1.3230769
 PRECURX  .2728246631E-02 .17273373         .016  .9874  2.8743590

Normal exit from iterations. Exit status=0.

         +----------------------------------------+
         | Ordered Probit Model                   |
         | Maximum Likelihood Estimates           |
         | Dependent variable             TECHEXP |
         | Weighting variable                 ONE |
         | Number of observations              65 |
         | Iterations completed                10 |
         | Log likelihood function      -60.18648 |
         | Restricted log likelihood    -66.24525 |
         | Chi-squared                   12.11753 |
         | Degrees of freedom                   3 |
         | Significance level        .6991196E-02 |
         |   Cell frequencies for outcomes        |
         | Y Count Freq  Y Count Freq  Y Count Freq |
         | 0    3 .046 1   17 .261 2   39 .600   |
         | 3    6 .092                           |
         +----------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
        Index function for probability
 Constant .4320121965      .72505752        .596  .5513
 TYPE     .1910126246      .36615693        .522  .6019  .47692308
 SIZE    -.2149176267      .20077076      -1.070  .2844  1.3230769
```

```
PRECURX .5759935857    .17160776      3.356  .0008 2.8743590
      Threshold parameters for index
Mu( 1)  1.325904824    .34628392      3.829  .0001
Mu( 2)  3.368533687    .40361861      8.346  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

          Predicted
------ ------------------ + -----
Actual    0   1   2   3 | Total
------ ------------------ + -----
 0        0   1   2   0 |   3
 1        0   3  14   0 |  17
 2        0   0  39   0 |  39
 3        0   1   5   0 |   6
------ ------------------ + -----
Total     0   5  60   0 |  65
--> skip$
--> ordered; lhs=techexp; rhs=one,type,size,
   mission,explicit$

+-------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                  |
| Ordinary    least squares regression    Weighting variable = none  |
| Dep. var. = Y=0/Not0 Mean=  .9682539683    , S.D.=  .1767314318    |
| Model size: Observations =      63, Parameters =  5, Deg.Fr.=   58 |
| Residuals:  Sum of squares= 63.89442210     , Std.Dev.=     1.04958 |
| Fit:        R-squared=*********, Adjusted R-squared =     -34.27015 |
| Diagnostic: Log-L =   -89.8372, Restricted(b=0) Log-L =     20.2977 |
|             LogAmemiyaPrCrt.=    .173, Akaike Info. Crt.=    3.011 |
+-------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
Constant .4907059721      .96515411        .508   .6112
TYPE      .3399693340E-01 .26927050        .126   .8995  .49206349
SIZE     -.1982145961E-01 .15252951       -.130   .8966 1.3492063
MISSION  .1051683641      .25225776        .417   .6767 3.8095238
EXPLICIT .5166071224E-01  .20308315        .254   .7992 1.6825397

Normal exit from iterations. Exit status=0.

        +---------------------------------------------+
        | Ordered Probit Model                        |
        | Maximum Likelihood Estimates                |
        | Dependent variable              TECHEXP     |
        | Weighting variable                  ONE     |
        | Number of observations               63     |
        | Iterations completed                 12     |
        | Log likelihood function       -53.06034     |
        | Restricted log likelihood     -62.48774     |
        | Chi-squared                    18.85480     |
        | Degrees of freedom                    4     |
        | Significance level          .8392826E-03    |
        |   Cell frequencies for outcomes             |
        | Y Count Freq  Y Count Freq  Y Count Freq    |
        | 0    2 .031   1   17 .269   2   38 .603     |
        | 3    6 .095                                 |
```

```
          +------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant -1.382202670    1.0974992     -1.259  .2079
 TYPE     .1997457742    .33516717       .596  .5512  .49206349
 SIZE    -.1095363299    .22411286      -.489  .6250  1.3492063
 MISSION  .7907625964    .29593651      2.672  .0075  3.8095238
 EXPLICIT .5348849493    .23423674      2.284  .0224  1.6825397
       Threshold parameters for index
 Mu( 1)   1.925520063    .65042984      2.960  .0031
 Mu( 2)   3.995788477    .69354033      5.761  .0000
```

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

```
        Predicted
------ ----------------- + -----
Actual   0  1  2  3 | Total
------ ----------------- + -----
 0       0  2  0  0 |   2
 1       0  9  8  0 |  17
 2       0  3 35  0 |  38
 3       0  0  6  0 |   6
------ ----------------- + -----
Total    0 14 49  0 |  63
--> skip$
--> ordered; lhs=techexp; rhs=one,type,size,
   active$

+----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0             |
| Ordinary    least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=  .9538461538    , S.D.=  .2114510309    |
| Model size: Observations =      65, Parameters =  4, Deg.Fr.=    61 |
| Residuals:  Sum of squares= 69.63663220    , Std.Dev.=       1.06845 |
| Fit:        R-squared=*********, Adjusted R-squared =       -24.53220 |
| Diagnostic: Log-L =   -94.4704, Restricted(b=0) Log-L =      9.2674 |
|             LogAmemiyaPrCrt.=    .192, Akaike Info. Crt.=     3.030 |
+----------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant .9040500860      .83429818      1.084  .2785
 TYPE     .8833959347E-01  .26685947       .331  .7406  .47692308
 SIZE    -.2489126178E-01  .16105446      -.155  .8772  1.3230769
 ACTIVE   .1336134444E-01  .28883754       .046  .9631  3.0384615
```

Normal exit from iterations. Exit status=0.

```
          +------------------------------------------+
          | Ordered Probit Model                     |
          | Maximum Likelihood Estimates             |
          | Dependent variable              TECHEXP  |
          | Weighting variable                  ONE  |
          | Number of observations               65  |
          | Iterations completed                 11  |
          | Log likelihood function       -60.43843  |
```

```
| Restricted log likelihood    -66.24525    |
| Chi-squared                  11.61363     |
| Degrees of freedom                 3      |
| Significance level        .8830979E-02    |
|   Cell frequencies for outcomes           |
| Y Count Freq  Y Count Freq  Y Count Freq  |
| 0    3 .046 1   17 .261 2   39 .600       |
| 3    6 .092                               |
+-------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
        Index function for probability
 Constant -.7211404715     1.2239736      -.589   .5557
 TYPE      .3624076968     .34261035      1.058   .2902  .47692308
 SIZE     -.3132229368     .22339604     -1.402   .1609  1.3230769
 ACTIVE    .9429439766     .39535628      2.385   .0171  3.0384615
        Threshold parameters for index
 Mu( 1)   1.341259102      .32158195      4.171   .0000
 Mu( 2)   3.375425039      .38258079      8.823   .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------  ------------------ + -----
Actual    0   1   2   3 | Total
------  ------------------ + -----
 0        0   1   2   0 |   3
 1        0   6  11   0 |  17
 2        0   0  39   0 |  39
 3        0   0   6   0 |   6
------  ------------------ + -----
Total     0   7  58   0 |  65
--> skip$
--> ordered; lhs=techexp; rhs=one,type,size,
   mgrlctrb,techctrb,fortech,fortrain,written$

+-----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary    least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=  .9538461538   , S.D.=  .2114510309    |
| Model size: Observations =     65, Parameters =  8, Deg.Fr.=    57 |
| Residuals:  Sum of squares= 68.40404684    , Std.Dev.=      1.09548 |
| Fit:        R-squared=*********, Adjusted R-squared =     -25.84030 |
| Diagnostic: Log-L =   -93.8900, Restricted(b=0) Log-L =     9.2674 |
|             LogAmemiyaPrCrt.=    .298, Akaike Info. Crt.=    3.135 |
+-----------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
Constant   .7318390444      1.1259512        .650   .5157
TYPE       .7474856076E-01  .28747720        .260   .7949  .47692308
SIZE      -.2611042830E-01  .16850748       -.155   .8769  1.3230769
MGRLCTRB  -.2836768279E-01  .23786078       -.119   .9051  2.5923077
TECHCTRB   .5683886150E-02  .27638395        .021   .9836  3.5794872
FORTECH    .4715764509E-02  .22394821        .021   .9832  3.8923077
FORTRAIN   .4520629818E-01  .20305926        .223   .8238  3.6000000
WRITTEN    .1042223288      .47453587        .220   .8262  .89230769
```

```
Normal exit from iterations. Exit status=0.

          +-----------------------------------------+
          | Ordered Probit Model                    |
          | Maximum Likelihood Estimates            |
          | Dependent variable             TECHEXP  |
          | Weighting variable                 ONE  |
          | Number of observations              65  |
          | Iterations completed                15  |
          | Log likelihood function      -53.83978  |
          | Restricted log likelihood    -66.24525  |
          | Chi-squared                   24.81093  |
          | Degrees of freedom                   7  |
          | Significance level         .8196298E-03 |
          |   Cell frequencies for outcomes         |
          | Y Count Freq  Y Count Freq  Y Count Freq |
          | 0    3 .046 1   17 .261 2   39 .600     |
          | 3    6 .092                             |
          +-----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant -1.628703064    1.3434632     -1.212  .2254
 TYPE      .1680670109    .44872081       .375  .7080  .47692308
 SIZE     -.3246068475    .26949208     -1.205  .2284  1.3230769
 MGRLCTRB  .8121599901E-01 .40627150      .200  .8416  2.5923077
 TECHCTRB  .3669984801    .41815963       .878  .3801  3.5794872
 FORTECH  -.6014989026E-01 .26760869     -.225  .8222  3.8923077
 FORTRAIN  .7688188875    .24614159      3.123  .0018  3.6000000
 WRITTEN   .1544078366    .66497819       .232  .8164  .89230769
       Threshold parameters for index
 Mu( 1)   1.603136924     .39422836     4.067  .0000
 Mu( 2)   3.856592058     .48078162     8.022  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------ ---------------- + -----
Actual   0   1   2   3 | Total
------ ---------------- + -----
 0       0   2   1   0 |   3
 1       1   7   9   0 |  17
 2       0   2  37   0 |  39
 3       0   0   5   1 |   6
------ ---------------- + -----
Total    1  11  52   1 |  65
--> skip$
--> ordered; lhs=techexp; rhs=one,type,size,
   access$

+--------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                 |
| Ordinary    least squares regression    Weighting variable = none  |
| Dep. var. = Y=0/Not0 Mean=   .9538461538    , S.D.=   .2114510309  |
| Model size: Observations =     65, Parameters =  4, Deg.Fr.=    61 |
| Residuals:  Sum of squares= 67.30195004     , Std.Dev.=    1.05039 |
```

```
| Fit:      R-squared=*********, Adjusted R-squared =      -23.67620 |
| Diagnostic: Log-L =   -93.3621, Restricted(b=0) Log-L =    9.2674 |
|          LogAmemiyaPrCrt.=    .158, Akaike Info. Crt.=    2.996 |
+--------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant .5598817623     .74121751       .755  .4500
 TYPE     .8373491297E-01 .26121940       .321  .7485 .47692308
 SIZE    -.2542768094E-01 .14842675      -.171  .8640 1.3230769
 ACCESS   .1137638091     .20704719       .549  .5827 3.4076923

Normal exit from iterations. Exit status=0.

          +----------------------------------------+
          | Ordered Probit Model                   |
          | Maximum Likelihood Estimates           |
          | Dependent variable         TECHEXP     |
          | Weighting variable            ONE      |
          | Number of observations         65      |
          | Iterations completed           11      |
          | Log likelihood function   -58.01211    |
          | Restricted log likelihood -66.24525    |
          | Chi-squared               16.46628     |
          | Degrees of freedom              3      |
          | Significance level      .9097843E-03   |
          |   Cell frequencies for outcomes        |
          | Y Count Freq  Y Count Freq  Y Count Freq |
          | 0    3 .046  1   17 .261  2   39 .600  |
          | 3    6 .092                            |
          +----------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
       Index function for probability
 Constant -.9404611991    .86957965      -1.082  .2795
 TYPE      .4377222134    .32027883       1.367  .1717 .47692308
 SIZE     -.1605217638    .19841537       -.809  .4185 1.3230769
 ACCESS    .8889583961    .29559572       3.007  .0026 3.4076923
       Threshold parameters for index
 Mu( 1)   1.537403588     .39355539       3.906  .0001
 Mu( 2)   3.588202417     .46572044       7.705  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

        Predicted
------ ------------------ + -----
Actual    0   1   2   3 | Total
------ ------------------ + -----
 0        1   1   1   0 |   3
 1        1   3  13   0 |  17
 2        0   4  35   0 |  39
 3        0   0   6   0 |   6
------ ------------------ + -----
Total     2   8  55   0 |  65
--> skip$
--> ordered; lhs=techexp; rhs=one,type,size,
   protect,similar$
```

```
+-----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0               |
| Ordinary    least squares regression    Weighting variable = none |
| Dep. var. = Y=0/Not0 Mean=  .9538461538   , S.D.=  .2114510309    |
| Model size: Observations =      65, Parameters =  5, Deg.Fr.=    60 |
| Residuals:  Sum of squares= 67.30787482    , Std.Dev.=       1.05915 |
| Fit:        R-squared=*********, Adjusted R-squared =      -24.08967 |
| Diagnostic: Log-L =    -93.3649, Restricted(b=0) Log-L =      9.2674 |
|             LogAmemiyaPrCrt.=    .189, Akaike Info. Crt.=     3.027 |
+-----------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant .5864435454      .76276287        .769  .4420
 TYPE     .8192630754E-01  .26360291        .311  .7560  .47692308
 SIZE    -.2421535352E-01  .14982647       -.162  .8716  1.3230769
 PROTECT  .3135049184E-01  .17980478        .174  .8616  3.5923077
 SIMILAR  .7686699079E-01  .15501348        .496  .6200  3.2230769
```

Normal exit from iterations. Exit status=0.

```
+---------------------------------------------+
| Ordered Probit Model                        |
| Maximum Likelihood Estimates                |
| Dependent variable              TECHEXP     |
| Weighting variable                  ONE     |
| Number of observations               65     |
| Iterations completed                 12     |
| Log likelihood function       -58.01146     |
| Restricted log likelihood     -66.24525     |
| Chi-squared                    16.46757     |
| Degrees of freedom                    4     |
| Significance level          .2451839E-02    |
|   Cell frequencies for outcomes             |
| Y Count Freq  Y Count Freq  Y Count Freq    |
| 0    3 .046  1   17 .261  2   39 .600       |
| 3    6 .092                                 |
+---------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
        Index function for probability
 Constant -.9346323482     .95227782       -.981  .3264
 TYPE      .4374979930     .32014870       1.367  .1718  .47692308
 SIZE     -.1601854146     .19836789       -.808  .4194  1.3230769
 PROTECT   .4389083642     .26341691       1.666  .0957  3.5923077
 SIMILAR   .4489241510     .21102614       2.127  .0334  3.2230769
        Threshold parameters for index
 Mu( 1)   1.537959849      .39781704       3.866  .0001
 Mu( 2)   3.588453487      .46650268       7.692  .0000
```

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

```
          Predicted
------  ----------------- + -----
Actual    0   1   2   3   | Total
------  ----------------- + -----
```

```
 0      1  1  1  0 |   3
 1      1  3  13  0 |  17
 2      0  4  35  0 |  39
 3      0  0  6  0 |   6
------ ------------------ + -----
Total      2  8  55  0 |   65
--> skip$
--> ordered; lhs=techexp; rhs=one,type,size,
   lecap,precurx,access,active,mission$

+---------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0             |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=  .9682539683    , S.D.=  .1767314318    |
| Model size: Observations =      63, Parameters =   8, Deg.Fr.=     55 |
| Residuals:  Sum of squares= 63.61300368    , Std.Dev.=        1.07545 |
| Fit:        R-squared=*********, Adjusted R-squared =      -36.03016 |
| Diagnostic: Log-L =   -89.6981, Restricted(b=0) Log-L =     20.2977 |
|            LogAmemiyaPrCrt.=    .265, Akaike Info. Crt.=     3.102 |
+---------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant .3891523248     1.3520648        .288  .7735
 TYPE      .4928311912E-01 .30596451        .161  .8720 .49206349
 SIZE    -.1658308843E-01 .16803174       -.099  .9214 1.3492063
 LECAP    .2280940702E-01 .36747598        .062  .9505 3.4947090
 PRECURX  .1735385023E-02 .23666143        .007  .9941 2.8650794
 ACCESS   .8730454970E-01 .27213647        .321  .7484 3.4087302
 ACTIVE  -.3878423276E-01 .35648181       -.109  .9134 3.0428571
 MISSION  .8215152761E-01 .28790521        .285  .7754 3.8095238

Normal exit from iterations. Exit status=0.

          +----------------------------------------+
          | Ordered Probit Model                    |
          | Maximum Likelihood Estimates            |
          | Dependent variable            TECHEXP   |
          | Weighting variable              ONE     |
          | Number of observations           63     |
          | Iterations completed             17     |
          | Log likelihood function    -46.54823    |
          | Restricted log likelihood  -62.48774    |
          | Chi-squared                 31.87900    |
          | Degrees of freedom               7      |
          | Significance level        .4276739E-04  |
          |   Cell frequencies for outcomes         |
          |  Y Count Freq  Y Count Freq  Y Count Freq |
          | 0    2 .031  1   17 .269  2   38 .603   |
          | 3    6 .095                             |
          +----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
        Index function for probability
 Constant -4.353881618    1.7450713      -2.495  .0126
 TYPE      .1080442907    .39331070        .275  .7835 .49206349
 SIZE    -.3418543538    .24954806      -1.370  .1707 1.3492063
 LECAP    .3380794322    .47582479        .711  .4774 3.4947090
 PRECURX  .5255417199    .29522724       1.780  .0751 2.8650794
```

```
ACCESS  .3449889364   .41778909     .826  .4089 3.4087302
ACTIVE  .5010310473   .55703900     .899  .3684 3.0428571
MISSION .5949993951   .31857670    1.868  .0618 3.8095238
      Threshold parameters for index
Mu( 1)  2.244599222   .81877396    2.741  .0061
Mu( 2)  4.644213421   .90945676    5.107  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------ ---------------- + -----
Actual   0  1  2  3 | Total
------ ---------------- + -----
 0       0  2  0  0 |   2
 1       0 10  7  0 |  17
 2       0  3 34  1 |  38
 3       0  0  6  0 |   6
------ ---------------- + -----
Total    0 15 47  1 |  63
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
    electron,electric,telecom,automoti,resdev,
    lecap$

+------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0          |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=   .9692307692    , S.D.=   .1740358053    |
| Model size: Observations =     65, Parameters =  10, Deg.Fr.=     55 |
| Residuals:  Sum of squares= 165.6215807    , Std.Dev.=        1.73531 |
| Fit:       R-squared=*********, Adjusted R-squared =        -98.42075 |
| Diagnostic: Log-L =   -122.6288, Restricted(b=0) Log-L =      21.9250 |
|            LogAmemiyaPrCrt.=   1.245, Akaike Info. Crt.=      4.081 |
+------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
Constant  .8544061949     2.0293661      .421   .6737
YEARS     .6077829007E-03 .34449478E-01  .018   .9859 9.8153846
TYPE     -.3164370175E-01 .47822389     -.066   .9472 .47692308
SIZE      .5079774790E-01 .28922101      .176   .8606 1.3230769
ELECTRON -.1300615801     1.3344641     -.097   .9224 .40000000
ELECTRIC -.5575871857E-01 1.3529261     -.041   .9671 .30769231
TELECOM  -.1616156549     1.4095393     -.115   .9087 .16923077
AUTOMOTI -.1301029311     1.5178534     -.086   .9317 .92307692E-01
RESDEV    .6551463918E-01 .47048843      .139   .8893 .56923077
LECAP     .3667584367E-01 .52419688      .070   .9442 3.4897436

Normal exit from iterations. Exit status=0.

        +------------------------------------------+
        | Ordered Probit Model                      |
        | Maximum Likelihood Estimates              |
        | Dependent variable            MFPRO      |
        | Weighting variable            ONE        |
        | Number of observations          65       |
        | Iterations completed          19         |
        | Log likelihood function    -70.76461     |
```

```
| Restricted log likelihood    -79.33356   |
| Chi-squared                   17.13791   |
| Degrees of freedom                   9   |
| Significance level         .4659962E-01 |
|  Cell frequencies for outcomes           |
| Y Count Freq  Y Count Freq  Y Count Freq |
| 0    2 .030 1    7 .107 2   26 .400      |
| 3   27 .415 4    3 .046                 |
+------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
      Index function for probability
 Constant -.7998235827     1.5180261       -.527   .5983
 YEARS    .2595178992E-01 .27898550E-01    .930   .3523  9.8153846
 TYPE     .1857559035     .33273575        .558   .5767  .47692308
 SIZE     .1810879350     .17431686       1.039   .2989  1.3230769
 ELECTRON -1.328602880    .51773613      -2.566   .0103  .40000000
 ELECTRIC -1.088872575    .54825898      -1.986   .0470  .30769231
 TELECOM  -1.754602081    .60682966      -2.891   .0038  .16923077
 AUTOMOTI -1.394514144    1.0320419      -1.351   .1766  .92307692E-01
 RESDEV   .3241634121     .41621113        .779   .4361  .56923077
 LECAP    1.042464508     .46123108       2.260   .0238  3.4897436
      Threshold parameters for index
 Mu( 1)   1.039306135     .40760378       2.550   .0108
 Mu( 2)   2.458685256     .47663466       5.158   .0000
 Mu( 3)   4.213211087     .56116132       7.508   .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------ ---------------------- + -----
Actual    0   1   2   3   4   | Total
------ ---------------------- + -----
 0        0   0   2   0   0   |   2
 1        0   0   6   1   0   |   7
 2        0   0  14  12   0   |  26
 3        0   0   8  19   0   |  27
 4        0   0   0   3   0   |   3
------ ---------------------- + -----
Total     0   0  30  35   0   |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,automoti,resdev,
   expend,lecap$

+----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0             |
| Ordinary    least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=  .9642857143   , S.D.=  .1872563352    |
| Model size: Observations =     56, Parameters = 11, Deg.Fr.=   45 |
| Residuals:  Sum of squares= 142.6179831   , Std.Dev.=     1.78025 |
| Fit:        R-squared=*********, Adjusted R-squared =    -89.38341 |
| Diagnostic: Log-L =  -105.6355, Restricted(b=0) Log-L =   14.8595 |
|             LogAmemiyaPrCrt.=   1.333, Akaike Info. Crt.=   4.166 |
+----------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
```

+---------+-------------+---------------+--------+---------+----------+

Constant	.8820522257	2.2440404	.393	.6943	
YEARS	.3737677518E-03	.39557596E-01	.009	.9925	9.5178571
TYPE	-.3513145863E-01	.53416435	-.066	.9476	.42857143
SIZE	.5302153335E-01	.31920226	.166	.8681	1.2142857
ELECTRON	-.1290544763	1.3798585	-.094	.9255	.41071429
ELECTRIC	-.4173520235E-01	1.4135349	-.030	.9764	.30357143
TELECOM	-.1702689557	1.4801124	-.115	.9084	.16071429
AUTOMOTI	-.1221033179	1.5941292	-.077	.9389	.89285714E-01
RESDEV	.7189846499E-01	.50957125	.141	.8878	.50000000
EXPEND	.5370827678E-10	.40412543E-08	.013	.9894	10243214.
LECAP	.2751406758E-01	.60655377	.045	.9638	3.5178571

Initial iterations cannot improve function.Status=3
Abnormal exit from iterations. If current results are shown
check convergence values shown below. This may not be a
solution value (especially if initial iterations stopped).
Gradient value: Tolerance= .1000D-05, current value= .7512D+09
Function chg. : Tolerance= .0000D+00, current value= .8442D+02
Parameters chg: Tolerance= .0000D+00, current value= .7512D+15
Smallest abs. parameter change from start value = .0000D+00
Note: At least one parameter did not leave start value.

```
+------------------------------------------+
| Ordered Probit Model                     |
| Maximum Likelihood Estimates             |
| Dependent variable             MFPRO     |
| Weighting variable               ONE     |
| Number of observations            56     |
| Iterations completed               1     |
| Log likelihood function    -84.41724     |
|  Cell frequencies for outcomes           |
| Y Count Freq  Y Count Freq  Y Count Freq |
| 0    2 .035   1    7 .125   2   20 .357  |
| 3   25 .446   4    2 .035                |
+------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Index function for probability					
Constant	.8820522257	1.3216763	.667	.5045	
YEARS	.3737677518E-03	.22818017E-01	.016	.9869	9.5178571
TYPE	-.3513145863E-01	.30467340	-.115	.9082	.42857143
SIZE	.5302153335E-01	.20315744	.261	.7941	1.2142857
ELECTRON	-.1290544763	.89094232	-.145	.8848	.41071429
ELECTRIC	-.4173520235E-01	.79842157	-.052	.9583	.30357143
TELECOM	-.1702689557	.69505812	-.245	.8065	.16071429
AUTOMOTI	-.1221033179	1.0604327	-.115	.9083	.89285714E-01
RESDEV	.7189846499E-01	.30535744	.235	.8139	.50000000
EXPEND	.5370827678E-10	.17537214E-08	.031	.9756	10243214.
LECAP	.2751406758E-01	.31421631	.088	.9302	3.5178571
Threshold parameters for index					
Mu(1)	.8116585113	.33364899	2.433	.0150	
Mu(2)	1.847802204	.39467462	4.682	.0000	
Mu(3)	3.606293009	.71548599	5.040	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

```
          Predicted
------ ---------------------- + -----
Actual    0  1  2  3  4 | Total
------ ---------------------- + -----
 0        0  0  2  0  0 |   2
 1        0  0  7  0  0 |   7
 2        0  0 20  0  0 |  20
 3        0  0 25  0  0 |  25
 4        0  0  2  0  0 |   2
------ ---------------------- + -----
Total     0  0 56  0  0 |  56
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
    electron,electric,telecom,automoti,resdev,
    lecap;
    test:B(2)+B(5)+B(6)+B(7)+B(8)=0$

+-----------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                    |
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = Y=0/Not0 Mean=   .9692307692    , S.D.=   .1740358053     |
| Model size: Observations =      65, Parameters =  10, Deg.Fr.=    55 |
| Residuals:  Sum of squares= 165.6215807    , Std.Dev.=        1.73531 |
| Fit:        R-squared=*********, Adjusted R-squared =       -98.42075 |
| Diagnostic: Log-L =   -122.6288, Restricted(b=0) Log-L =     21.9250 |
|             LogAmemiyaPrCrt.=    1.245, Akaike Info. Crt.=     4.081 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  .8544061949      2.0293661         .421   .6737
 YEARS     .6077829007E-03  .34449478E-01     .018   .9859  9.8153846
 TYPE      -.3164370175E-01 .47822389        -.066   .9472  .47692308
 SIZE      .5079774790E-01  .28922101         .176   .8606  1.3230769
 ELECTRON  -.1300615801     1.3344641        -.097   .9224  .40000000
 ELECTRIC  -.5575871857E-01 1.3529261        -.041   .9671  .30769231
 TELECOM   -.1616156549     1.4095393        -.115   .9087  .16923077
 AUTOMOTI  -.1301029311     1.5178534        -.086   .9317  .92307692E-01
 RESDEV    .6551463918E-01  .47048843         .139   .8893  .56923077
 LECAP     .3667584367E-01  .52419688         .070   .9442  3.4897436

Normal exit from iterations. Exit status=0.

         +----------------------------------------------+
         | Ordered Probit Model                         |
         | Maximum Likelihood Estimates                 |
         | Dependent variable              MFPRO        |
         | Weighting variable                ONE        |
         | Number of observations             65        |
         | Iterations completed               19        |
         | Log likelihood function     -70.76461        |
         | Restricted log likelihood   -79.33356        |
         | Chi-squared                  17.13791        |
         | Degrees of freedom                  9        |
         | Significance level        .4659962E-01       |
         |   Cell frequencies for outcomes              |
         | Y Count Freq  Y Count Freq  Y Count Freq     |
         | 0     2 .030  1     7 .107  2    26 .400     |
         | 3    27 .415  4     3 .046                   |
         | Wald test of  1 linear restrictions          |
```

```
           | Chi-squared =    6.28, Sig. level = .01219 |
           +-----------------------------------------+
+--------+-----------+-------------+-------+--------+--------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+--------+-----------+-------------+-------+--------+--------+
       Index function for probability
 Constant -.7998235827    1.5180261       -.527  .5983
 YEARS    .2595178992E-01 .27898550E-01    .930  .3523  9.8153846
 TYPE     .1857559035     .33273575        .558  .5767  .47692308
 SIZE     .1810879350     .17431686       1.039  .2989  1.3230769
 ELECTRON -1.328602880    .51773613      -2.566  .0103  .40000000
 ELECTRIC -1.088872575    .54825898      -1.986  .0470  .30769231
 TELECOM  -1.754602081    .60682966      -2.891  .0038  .16923077
 AUTOMOTI -1.394514144    1.0320419      -1.351  .1766  .92307692E-01
 RESDEV   .3241634121     .41621113        .779  .4361  .56923077
 LECAP    1.042464508     .46123108       2.260  .0238  3.4897436
       Threshold parameters for index
 Mu( 1)   1.039306135     .40760378       2.550  .0108
 Mu( 2)   2.458685256     .47663466       5.158  .0000
 Mu( 3)   4.213211087     .56116132       7.508  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------ --------------------- + -----
Actual    0   1   2   3   4 | Total
------ --------------------- + -----
  0       0   0   2   0   0 |   2
  1       0   0   6   1   0 |   7
  2       0   0  14  12   0 |  26
  3       0   0   8  19   0 |  27
  4       0   0   0   3   0 |   3
------ --------------------- + -----
Total     0   0  30  35   0 |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,resdev,priori,
   flexibi,determin$
Variable list contains a name not in the expected table.
Variable list: The unidentifiable string is PRIORI
RHS/RH1  variable in list  not in the variable names table.
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,resdev,prior,
   flexibi,determin$

+-----------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0         |
| Ordinary    least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=  .9692307692    , S.D.=  .1740358053    |
| Model size: Observations =       65, Parameters =  11, Deg.Fr.=    54 |
| Residuals:  Sum of squares= 165.3526815     , Std.Dev.=         1.74988 |
| Fit:        R-squared=*********, Adjusted R-squared =      -100.09747 |
| Diagnostic: Log-L =   -122.5760, Restricted(b=0) Log-L =      21.9250 |
|             LogAmemiyaPrCrt.=    1.275, Akaike Info. Crt.=     4.110 |
+-----------------------------------------------------------+
+--------+-----------+-------------+-------+--------+--------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
```

Constant	.7202012272	2.0199987	.357	.7214	
YEARS	-.3112429162E-03	.35852277E-01	-.009	.9931	9.8153846
TYPE	-.1855799058E-01	.49868686	-.037	.9703	.47692308
SIZE	.5372184672E-01	.29371456	.183	.8549	1.3230769
ELECTRON	-.1142504467E-01	.74344758	-.015	.9877	.40000000
ELECTRIC	.6666893748E-01	.85079536	.078	.9375	.30769231
TELECOM	-.1081746386E-01	.92975504	-.012	.9907	.16923077
RESDEV	.6073194404E-01	.47339954	.128	.8979	.56923077
PRIOR	-.2882382863E-01	.28690263	-.100	.9200	3.9000000
FLEXIBI	.2081462634E-01	.29656084	.070	.9440	2.7461538
DETERMIN	.5137917281E-01	.35173496	.146	.8839	3.8230769

Normal exit from iterations. Exit status=0.

Ordered Probit Model	
Maximum Likelihood Estimates	
Dependent variable	MFPRO
Weighting variable	ONE
Number of observations	65
Iterations completed	19
Log likelihood function	-70.78079
Restricted log likelihood	-79.33356
Chi-squared	17.10556
Degrees of freedom	10
Significance level	.7206067E-01

Cell frequencies for outcomes

Y	Count	Freq	Y	Count	Freq	Y	Count	Freq
0	2	.030	1	7	.107	2	26	.400
3	27	.415	4	3	.046			

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Index function for probability					
Constant	-1.744139826	1.6576854	-1.052	.2927	
YEARS	.2328597267E-01	.32281386E-01	.721	.4707	9.8153846
TYPE	.2305172310	.33808918	.682	.4954	.47692308
SIZE	.1705402002	.20475784	.833	.4049	1.3230769
ELECTRON	-.2199264925	.60682887	-.362	.7170	.40000000
ELECTRIC	.5404997374E-02	.64107433	.008	.9933	.30769231
TELECOM	-.4933927144	.66012232	-.747	.4548	.16923077
RESDEV	.2571020524	.46100214	.558	.5770	.56923077
PRIOR	.1302783118	.25125964	.519	.6041	3.9000000
FLEXIBI	.3095504001	.25379143	1.220	.2226	2.7461538
DETERMIN	.5752959810	.24825345	2.317	.0205	3.8230769
Threshold parameters for index					
Mu(1)	1.065941315	.47562796	2.241	.0250	
Mu(2)	2.519284240	.59591542	4.228	.0000	
Mu(3)	4.217245917	.64576499	6.531	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

Predicted

Actual	0	1	2	3	4	Total

```
0        0  0   2   0   0 |   2
1        0  0   7   0   0 |   7
2        0  0  14  12   0 |  26
3        0  0   9  18   0 |  27
4        0  0   3   0   0 |   3
------ ------------------- + -----
Total    0  0  35  30   0 |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,help,graft2,idexp$

+-----------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0        |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=  .9692307692   , S.D.=  .1740358053    |
| Model size: Observations =     65, Parameters =  10, Deg.Fr.=    55 |
| Residuals:  Sum of squares= 166.5075731    , Std.Dev.=       1.73995 |
| Fit:        R-squared=*********, Adjusted R-squared =     -98.95260 |
| Diagnostic: Log-L =  -122.8022, Restricted(b=0) Log-L =    21.9250 |
|             LogAmemiyaPrCrt.=   1.251, Akaike Info. Crt.=    4.086 |
+-----------------------------------------------------------+
+--------+-------------+--------------+--------+--------+---------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+--------+-------------+--------------+--------+--------+---------+
 Constant .8655779999      1.3830895        .626  .5314
 YEARS     .4225773032E-03 .38932131E-01    .011  .9913 9.8153846
 TYPE     -.3084051789E-01 .51580447       -.060  .9523 .47692308
 SIZE      .6313989198E-01 .30316658        .208  .8350 1.3230769
 ELECTRON -.2904787534E-01 .76237176       -.038  .9696 .40000000
 ELECTRIC  .5107350116E-01 .88722365        .058  .9541 .30769231
 TELECOM  -.3359026957E-01 .91899348       -.037  .9708 .16923077
 HELP     -.1167875138E-01 .12775863       -.091  .9272 1.4000000
 GRAFT2    .4525962402E-03 .13303771        .003  .9973 2.4307692
 IDEXP     .1297636516E-01 .34465206        .038  .9700 3.6615385

Normal exit from iterations. Exit status=0.

          +---------------------------------------+
          | Ordered Probit Model                  |
          | Maximum Likelihood Estimates          |
          | Dependent variable           MFPRO    |
          | Weighting variable             ONE    |
          | Number of observations          65    |
          | Iterations completed            16    |
          | Log likelihood function  -74.53839    |
          | Restricted log likelihood -79.33356   |
          | Chi-squared              9.590348     |
          | Degrees of freedom              9     |
          | Significance level        .3846544    |
          |   Cell frequencies for outcomes       |
          | Y Count Freq  Y Count Freq  Y Count Freq |
          | 0    2 .030 1    7 .107 2   26 .400   |
          | 3   27 .415 4    3 .046               |
          +---------------------------------------+
+--------+-------------+--------------+--------+--------+---------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+--------+-------------+--------------+--------+--------+---------+
        Index function for probability
 Constant 1.146344427      .89142441       1.286  .1985
 YEARS     .1686514734E-01 .37375773E-01    .451  .6518 9.8153846
```

```
TYPE    -.1516596979    .37302855     -.407  .6843 .47692308
SIZE    .2307627333    .18715209     1.233  .2176 1.3230769
ELECTRON -.1521640621    .59740646     -.255  .7989 .40000000
ELECTRIC .1707293714    .65501845      .261  .7944 .30769231
TELECOM -.2620297105    .55178598     -.475  .6349 .16923077
HELP    -.7206143017E-01 .99403642E-01  -.725  .4685 1.4000000
GRAFT2   .1397366935    .11755435     1.189  .2346 2.4307692
IDEXP    .1170158418    .21496772      .544  .5862 3.6615385
      Threshold parameters for index
Mu( 1)  .9590733570    .38343935     2.501  .0124
Mu( 2)  2.303189655    .44801010     5.141  .0000
Mu( 3)  3.920309295    .51152491     7.664  .0000
```

```
Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

        Predicted
------ ---------------------- + -----
Actual    0  1  2  3  4 | Total
------ ---------------------- + -----
 0        0  0  2  0  0 |   2
 1        0  0  6  1  0 |   7
 2        0  0 11 15  0 |  26
 3        0  0 14 13  0 |  27
 4        0  0  3  0  0 |   3
------ ---------------------- + -----
Total     0  0 36 29  0 |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,precurx$
```

```
+---------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0            |
| Ordinary   least squares regression   Weighting variable = none |
| Dep. var. = Y=0/Not0 Mean=  .9692307692   , S.D.=  .1740358053 |
| Model size: Observations =     65, Parameters =  8, Deg.Fr.=   57 |
| Residuals:  Sum of squares= 166.8209215   , Std.Dev.=     1.71076 |
| Fit:       R-squared=*********, Adjusted R-squared =    -95.62699 |
| Diagnostic: Log-L =  -122.8633, Restricted(b=0) Log-L =   21.9250 |
|           LogAmemiyaPrCrt.=  1.190, Akaike Info. Crt.=    4.027 |
+---------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
Constant  .9219891053     1.0399977       .887  .3753
YEARS     .7049504321E-03 .34624394E-01   .020  .9838 9.8153846
TYPE     -.2415628891E-01 .48278627      -.050  .9601 .47692308
SIZE      .5774009223E-01 .28553080       .202  .8397 1.3230769
ELECTRON -.3090238827E-01 .70554501      -.044  .9651 .40000000
ELECTRIC  .4579896450E-01 .78688064       .058  .9536 .30769231
TELECOM  -.4518453392E-01 .83154376      -.054  .9567 .16923077
PRECURX  -.6483535347E-02 .28577942      -.023  .9819 2.8743590
```

```
Normal exit from iterations. Exit status=0.

        +------------------------------------------+
        | Ordered Probit Model                     |
        | Maximum Likelihood Estimates             |
        | Dependent variable            MFPRO      |
```

```
| Weighting variable            ONE    |
| Number of observations          65    |
| Iterations completed           15    |
| Log likelihood function     -75.67237    |
| Restricted log likelihood    -79.33356    |
| Chi-squared               7.322395    |
| Degrees of freedom              7   |
| Significance level          .3961014    |
|   Cell frequencies for outcomes          |
| Y Count Freq  Y Count Freq  Y Count Freq  |
| 0    2 .030  1    7 .107  2   26 .400   |
| 3   27 .415  4    3 .046               |
+------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
        Index function for probability
 Constant  1.256541347    .87054763       1.443   .1489
 YEARS     .2672932564E-01 .36207511E-01   .738   .4604  9.8153846
 TYPE     -.1999836578E-01 .35793840      -.056   .9554  .47692308
 SIZE      .1500906487    .16779630        .894   .3711  1.3230769
 ELECTRON -.2914110924    .42496592       -.686   .4929  .40000000
 ELECTRIC -.6464541822E-01 .48442018      -.133   .8938  .30769231
 TELECOM  -.5221273987    .41207804      -1.267   .2051  .16923077
 PRECURX   .2147168195    .24460226        .878   .3800  2.8743590
        Threshold parameters for index
 Mu( 1)    .9231660447    .36918047       2.501   .0124
 Mu( 2)   2.238333423     .44163226       5.068   .0000
 Mu( 3)   3.831121263     .50220726       7.629   .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

          Predicted
------  ---------------------- + -----
Actual    0   1   2   3   4  | Total
------  ---------------------- + -----
 0        0   0   2   0   0  |   2
 1        0   0   6   1   0  |   7
 2        0   0  15  11   0  |  26
 3        0   0  13  14   0  |  27
 4        0   0   3   0   0  |   3
------  ---------------------- + -----
Total     0   0  39  26   0  |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,automoti,mission,
   explicit$

+-----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0               |
| Ordinary   least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=  .9682539683    , S.D.=  .1767314318    |
| Model size: Observations =      63, Parameters =  10, Deg.Fr.=    53 |
| Residuals:  Sum of squares= 160.8925316    , Std.Dev.=       1.74233 |
| Fit:        R-squared=*********, Adjusted R-squared =     -96.19243 |
| Diagnostic: Log-L =   -118.9276, Restricted(b=0) Log-L =      20.2977 |
|             LogAmemiyaPrCrt.=   1.258, Akaike Info. Crt.=     4.093 |
+-----------------------------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	1.032584196	2.0366557	.507	.6122	
YEARS	.5641031252E-03	.35667759E-01	.016	.9874	9.9523810
TYPE	-.2244635622E-01	.48472887	-.046	.9631	.49206349
SIZE	.5589855473E-01	.29899300	.187	.8517	1.3492063
ELECTRON	-.1755894995	1.4136618	-.124	.9011	.38095238
ELECTRIC	-.1238188284	1.5154166	-.082	.9349	.31746032
TELECOM	-.2156167295	1.5554886	-.139	.8898	.17460317
AUTOMOTI	-.1603882672	1.5805929	-.101	.9192	.95238095E-01
MISSION	-.2304119764E-01	.44309469	-.052	.9585	3.8095238
EXPLICIT	.6691026866E-01	.40847110	.164	.8699	1.6825397

Normal exit from iterations. Exit status=0.

Ordered Probit Model	
Maximum Likelihood Estimates	
Dependent variable	MFPRO
Weighting variable	ONE
Number of observations	63
Iterations completed	18
Log likelihood function	-69.79802
Restricted log likelihood	-77.53158
Chi-squared	15.46712
Degrees of freedom	9
Significance level	.7887846E-01

Cell frequencies for outcomes

Y	Count	Freq	Y	Count	Freq	Y	Count	Freq
0	2	.031	1	7	.111	2	25	.396
3	26	.412	4	3	.047			

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Index function for probability					
Constant	.2365695946	1.4166243	.167	.8674	
YEARS	.3741917921E-01	.28830677E-01	1.298	.1943	9.9523810
TYPE	-.4226252753E-01	.29502760	-.143	.8861	.49206349
SIZE	.2147025459	.17474549	1.229	.2192	1.3492063
ELECTRON	-1.489480556	.63056034	-2.362	.0182	.38095238
ELECTRIC	-1.420677223	.75238264	-1.888	.0590	.31746032
TELECOM	-1.979417263	.76556581	-2.586	.0097	.17460317
AUTOMOTI	-1.457883802	.90191054	-1.616	.1060	.95238095E-01
MISSION	.5624874262	.39219490	1.434	.1515	3.8095238
EXPLICIT	.4307209837	.30830587	1.397	.1624	1.6825397
Threshold parameters for index					
Mu(1)	1.014435721	.40204553	2.523	.0116	
Mu(2)	2.382512651	.46147497	5.163	.0000	
Mu(3)	4.131127329	.60918144	6.781	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

Predicted

Actual	0	1	2	3	4	Total

```
 0      0  0  2  0  0 |   2
 1      0  0  5  2  0 |   7
 2      0  0 10 15  0 |  25
 3      0  0 10 16  0 |  26
 4      0  0  0  3  0 |   3
------ ---------------------- + -----
Total   0  0 27 36  0 |  63
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,automoti,precurx$

+---------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0             |
| Ordinary    least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=  .9692307692   , S.D.=  .1740358053   |
| Model size: Observations =      65, Parameters =  9, Deg.Fr.=    56 |
| Residuals:  Sum of squares= 166.7780615    , Std.Dev.=        1.72574 |
| Fit:       R-squared=*********, Adjusted R-squared =      -97.32720 |
| Diagnostic: Log-L =   -122.8550, Restricted(b=0) Log-L =     21.9250 |
|          LogAmemiyaPrCrt.=   1.221, Akaike Info. Crt.=     4.057 |
+---------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant .9626690945     1.4127254       .681   .4956
 YEARS    .6926654888E-03 .34928853E-01    .020  .9842 9.8153846
 TYPE    -.2626305317E-01 .48947391       -.054  .9572 .47692308
 SIZE     .5979874642E-01 .29198437        .205  .8377 1.3230769
 ELECTRON -.7699449919E-01  1.2867602      -.060  .9523 .40000000
 ELECTRIC  .1286397661E-02  1.3045536       .001  .9992 .30769231
 TELECOM  -.8971709391E-01  1.3328087      -.067  .9463 .16923077
 AUTOMOTI -.6210118542E-01  1.4443449      -.043  .9657 .92307692E-01
 PRECURX  -.5396922928E-02  .28938833      -.019  .9851 2.8743590

Normal exit from iterations. Exit status=0.

         +--------------------------------------------+
         | Ordered Probit Model                       |
         | Maximum Likelihood Estimates               |
         | Dependent variable              MFPRO      |
         | Weighting variable               ONE       |
         | Number of observations            65       |
         | Iterations completed              16       |
         | Log likelihood function     -75.52314      |
         | Restricted log likelihood   -79.33356      |
         | Chi-squared                  7.620847      |
         | Degrees of freedom                  8      |
         | Significance level           .4713547      |
         |   Cell frequencies for outcomes            |
         |  Y Count Freq  Y Count Freq  Y Count Freq  |
         |  0    2 .030 1    7 .107 2   26 .400       |
         |  3   27 .415 4    3 .046                   |
         +--------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant 1.569803254     .91012672      1.725  .0846
 YEARS    .2668472454E-01 .36345926E-01    .734  .4628 9.8153846
 TYPE    -.3527036096E-01 .36052725       -.098  .9221 .47692308
```

```
SIZE     .1654320051     .17209496       .961  .3364  1.3230769
ELECTRON -.6492865827    .48178925     -1.348  .1778  .40000000
ELECTRIC -.4119885669    .55453679      -.743  .4575  .30769231
TELECOM  -.8666104953    .45036336     -1.924  .0543  .16923077
AUTOMOTI -.4893061197    .80505301      -.608  .5433  .92307692E-01
PRECURX  .2229224434     .24813176       .898  .3690  2.8743590
        Threshold parameters for index
Mu( 1)   .9225246488     .37445074      2.464  .0138
Mu( 2)   2.229303479     .43813401      5.088  .0000
Mu( 3)   3.840611790     .51019245      7.528  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

          Predicted
------ ------------------------ + -----
Actual    0   1   2   3   4  | Total
------ ------------------------ + -----
 0        0   0   2   0   0  |   2
 1        0   0   6   1   0  |   7
 2        0   0  15  11   0  |  26
 3        0   0  13  14   0  |  27
 4        0   0   2   1   0  |   3
------ ------------------------ + -----
Total     0   0  38  27   0  |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,automoti,help,graft2,idexp$

+-------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                |
| Ordinary    least squares regression    Weighting variable = none |
| Dep. var. = Y=0/Not0 Mean=  .9692307692    , S.D.=  .1740358053   |
| Model size: Observations =     65, Parameters =  11, Deg.Fr.=  54 |
| Residuals:  Sum of squares= 166.4735410    , Std.Dev.=    1.75580 |
| Fit:        R-squared=*********, Adjusted R-squared =  -100.78276 |
| Diagnostic: Log-L =  -122.7956, Restricted(b=0) Log-L =   21.9250 |
|             LogAmemiyaPrCrt.=   1.282, Akaike Info. Crt.=   4.117 |
+-------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant .9050090969     1.5885285       .570  .5689
 YEARS    .6497164977E-03 .39529218E-01   .016  .9869  9.8153846
 TYPE     -.3164714400E-01 .52073661     -.061  .9515  .47692308
 SIZE     .6501009143E-01 .30803801       .211  .8329  1.3230769
 ELECTRON -.9234037547E-01 1.4403170     -.064  .9489  .40000000
 ELECTRIC -.1194278330E-01 1.5070921     -.008  .9937  .30769231
 TELECOM  -.9570088496E-01 1.5125534     -.063  .9496  .16923077
 AUTOMOTI -.7997002522E-01 1.5384940     -.052  .9585  .92307692E-01
 HELP     -.1134849846E-01 .12907943     -.088  .9299  1.4000000
 GRAFT2   -.3224448543E-03 .13507566     -.002  .9981  2.4307692
 IDEXP    .1851251317E-01 .36373573       .051  .9594  3.6615385

Normal exit from iterations. Exit status=0.

          +---------------------------------------------+
          | Ordered Probit Model                        |
          | Maximum Likelihood Estimates                |
```

```
| Dependent variable           MFPRO   |
| Weighting variable            ONE   |
| Number of observations         65   |
| Iterations completed          18   |
| Log likelihood function    -74.44742   |
| Restricted log likelihood  -79.33356   |
| Chi-squared             9.772296   |
| Degrees of freedom            10   |
| Significance level        .4606927   |
|   Cell frequencies for outcomes          |
| Y Count Freq  Y Count Freq  Y Count Freq  |
| 0    2 .030 1    7 .107 2   26 .400  |
| 3   27 .415 4    3 .046              |
+------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant 1.335625462    .94382789     1.415  .1570
 YEARS    .1813634361E-01 .37561727E-01   .483  .6292 9.8153846
 TYPE    -.1542755234    .37941478     -.407  .6843 .47692308
 SIZE     .2391734961    .18571516     1.288  .1978 1.3230769
 ELECTRON -.4667871808    .77713039     -.601  .5481 .40000000
 ELECTRIC -.1441700044    .84947542     -.170  .8652 .30769231
 TELECOM -.5695282481    .67203441     -.847  .3967 .16923077
 AUTOMOTI -.4011317707   1.0003887      -.401  .6884 .92307692E-01
 HELP    -.7025065396E-01 .10007552     -.702  .4827 1.4000000
 GRAFT2   .1353347670    .13094657     1.034  .3014 2.4307692
 IDEXP    .1455897598    .22142993      .657  .5109 3.6615385
       Threshold parameters for index
 Mu( 1)   .9597007345    .39425613     2.434  .0149
 Mu( 2)  2.295142693     .44937364     5.107  .0000
 Mu( 3)  3.927425160     .53125260     7.393  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------ ---------------------- + -----
Actual    0  1  2  3  4 | Total
------ ---------------------- + -----
 0        0  0  2  0  0 |   2
 1        0  0  6  1  0 |   7
 2        0  0 11 15  0 |  26
 3        0  0 14 13  0 |  27
 4        0  0  2  1  0 |   3
------ ---------------------- + -----
Total     0  0 35 30  0 |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,automoti,resdev,prior,
   flexibi,determin$

+--------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                 |
| Ordinary   least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=  .9692307692    , S.D.=  .1740358053    |
| Model size: Observations =     65, Parameters =  12, Deg.Fr.=   53 |
| Residuals:  Sum of squares= 165.3438819    , Std.Dev.=      1.76627 |
```

```
| Fit:      R-squared=*********, Adjusted R-squared =      -101.99948 |
| Diagnostic: Log-L =   -122.5743, Restricted(b=0) Log-L =      21.9250 |
|           LogAmemiyaPrCrt.=    1.307, Akaike Info. Crt.=      4.141 |
+--------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant .7252919038    2.2693047       .320  .7493
 YEARS   -.3066506195E-03 .36199121E-01  -.008  .9932 9.8153846
 TYPE    -.1877022407E-01 .50506688     -.037  .9704 .47692308
 SIZE     .5390891399E-01 .29871658      .180  .8568 1.3230769
 ELECTRON -.1849496044E-01 1.5740274    -.012  .9906 .40000000
 ELECTRIC .5980725164E-01 1.5939915      .038  .9701 .30769231
 TELECOM -.1839848159E-01 1.7555521     -.010  .9916 .16923077
 AUTOMOTI -.9209265606E-02 1.8023233    -.005  .9959 .92307692E-01
 RESDEV   .6120705874E-01 .48679497      .126  .8999 .56923077
 PRIOR   -.2800346348E-01 .33111717     -.085  .9326 3.9000000
 FLEXIBI  .2113625088E-01 .30588390      .069  .9449 2.7461538
 DETERMIN .5070880708E-01 .37849355      .134  .8934 3.8230769

Normal exit from iterations. Exit status=0.

          +----------------------------------------------+
          | Ordered Probit Model                         |
          | Maximum Likelihood Estimates                 |
          | Dependent variable               MFPRO       |
          | Weighting variable                 ONE       |
          | Number of observations              65       |
          | Iterations completed                21       |
          | Log likelihood function      -70.43908       |
          | Restricted log likelihood    -79.33356       |
          | Chi-squared                   17.78897       |
          | Degrees of freedom                  11       |
          | Significance level        .8660809E-01       |
          |   Cell frequencies for outcomes              |
          |  Y Count Freq  Y Count Freq  Y Count Freq    |
          |  0    2 .030   1    7 .107   2   26 .400     |
          |  3   27 .415   4    3 .046                   |
          +----------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
       Index function for probability
 Constant -1.262941701    1.6350623     -.772  .4399
 YEARS    .2391086500E-01 .31533480E-01  .758  .4483 9.8153846
 TYPE     .2130099966     .33672050      .633  .5270 .47692308
 SIZE     .1878347108     .19710966      .953  .3406 1.3230769
 ELECTRON -.9234809650    .90940859    -1.015  .3099 .40000000
 ELECTRIC -.6809189314    .95739237     -.711  .4769 .30769231
 TELECOM  -1.247877409    .93303228    -1.337  .1811 .16923077
 AUTOMOTI -.9250952747    1.3698674     -.675  .4995 .92307692E-01
 RESDEV   .3031198991     .45872376      .661  .5087 .56923077
 PRIOR    .2167975871     .28420648      .763  .4456 3.9000000
 FLEXIBI  .3447327617     .25343830     1.360  .1738 2.7461538
 DETERMIN .5068215604     .28716497     1.765  .0776 3.8230769
       Threshold parameters for index
 Mu( 1)   1.064250106     .47154778     2.257  .0240
 Mu( 2)   2.503690743     .61191018     4.092  .0000
 Mu( 3)   4.242755587     .62931881     6.742  .0000
```

```
Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

        Predicted
------ ----------------------- + -----
Actual    0  1  2   3   4 | Total
------ ----------------------- + -----
 0        0  0  2   0   0 |   2
 1        0  0  6   1   0 |   7
 2        0  0 14  12   0 |  26
 3        0  0  9  18   0 |  27
 4        0  0  1   2   0 |   3
------ ----------------------- + -----
Total     0  0 32  33   0 |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,automoti,active$

+-------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                 |
| Ordinary    least squares regression    Weighting variable = none  |
| Dep. var. = Y=0/Not0 Mean=  .9692307692    , S.D.=  .1740358053    |
| Model size: Observations =      65, Parameters =  9, Deg.Fr.=   56 |
| Residuals:  Sum of squares= 165.8274779    , Std.Dev.=     1.72082 |
| Fit:      R-squared=*********, Adjusted R-squared =      -96.76677 |
| Diagnostic: Log-L =  -122.6692, Restricted(b=0) Log-L =    21.9250 |
|           LogAmemiyaPrCrt.=  1.215, Akaike Info. Crt.=     4.051 |
+-------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
Constant .8032074933      1.7387621        .462  .6441
YEARS    .8643625815E-03 .33820431E-01    .026  .9796 9.8153846
TYPE    -.3650544927E-01 .46987937       -.078  .9381 .47692308
SIZE     .4760746270E-01 .29609956        .161  .8723 1.3230769
ELECTRON -.1039272635     1.2949007       -.080  .9360 .40000000
ELECTRIC -.1996449366E-01 1.2987471       -.015  .9877 .30769231
TELECOM  -.9730210940E-01 1.3260064       -.073  .9415 .16923077
AUTOMOTI -.6986748335E-01 1.4353918       -.049  .9612 .92307692E-01
ACTIVE   .6009318263E-01 .48724014        .123  .9018 3.0384615

Normal exit from iterations. Exit status=0.

        +---------------------------------------------+
        | Ordered Probit Model                         |
        | Maximum Likelihood Estimates                  |
        | Dependent variable              MFPRO     |
        | Weighting variable              ONE     |
        | Number of observations            65    |
        | Iterations completed             16    |
        | Log likelihood function      -72.60225    |
        | Restricted log likelihood    -79.33356    |
        | Chi-squared                 13.46263    |
        | Degrees of freedom               8    |
        | Significance level         .9689236E-01 |
        |   Cell frequencies for outcomes          |
        | Y Count Freq  Y Count Freq  Y Count Freq   |
        | 0    2 .030 1    7 .107 2   26 .400   |
        | 3   27 .415 4    3 .046             |
```

```
          +-----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant .7689765983E-01 1.1010914      .070  .9443
 YEARS    .2185790933E-01 .31681906E-01   .690  .4902 9.8153846
 TYPE    -.2543152890E-01 .29997251      -.085  .9324 .47692308
 SIZE     .7691517750E-01 .17590295       .437  .6619 1.3230769
 ELECTRON -.9526383588    .50778768     -1.876  .0606 .40000000
 ELECTRIC -.5550920302    .54474667     -1.019  .3082 .30769231
 TELECOM -.9150248178     .48974798     -1.868  .0617 .16923077
 AUTOMOTI -.4826836320    .83052154      -.581  .5611 .92307692E-01
 ACTIVE   .8626969273     .42089025      2.050  .0404 3.0384615
       Threshold parameters for index
 Mu( 1)  1.016376586    .40189943      2.529  .0114
 Mu( 2)  2.397750585    .51117825      4.691  .0000
 Mu( 3)  4.081096382    .53623862      7.611  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

          Predicted
------  ----------------------- + -----
Actual     0   1   2   3   4  | Total
------  ----------------------- + -----
  0        0   0   2   0   0  |   2
  1        0   0   6   1   0  |   7
  2        0   0  13  13   0  |  26
  3        0   0  14  13   0  |  27
  4        0   0   2   1   0  |   3
------  ----------------------- + -----
Total      0   0  37  28   0  |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   mgrlctrb,techctrb,fortech,fortrain,written$

+-----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary    least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=  .9692307692    , S.D.=  .1740358053    |
| Model size: Observations =       65, Parameters =  9, Deg.Fr.=    56 |
| Residuals:  Sum of squares= 165.6530192    , Std.Dev.=        1.71991 |
| Fit:        R-squared=*********, Adjusted R-squared =       -96.66391 |
| Diagnostic: Log-L =   -122.6350, Restricted(b=0) Log-L =     21.9250 |
|             LogAmemiyaPrCrt.=    1.214, Akaike Info. Crt.=     4.050 |
+-----------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant .7532457413     1.7690911       .426  .6703
 YEARS    .2606038816E-02 .33582306E-01   .078  .9381 9.8153846
 TYPE    -.2196546562E-01 .46202227      -.048  .9621 .47692308
 SIZE     .3305164842E-01 .27516593       .120  .9044 1.3230769
 MGRLCTRB .3379139148E-01 .37389819       .090  .9280 2.5923077
 TECHCTRB .1214983243E-01 .43460333       .028  .9777 3.5794872
 FORTECH -.2449645216E-01 .35583375      -.069  .9451 3.8923077
 FORTRAIN .7906742520E-02 .31882122       .025  .9802 3.6000000
 WRITTEN  .1041651015     .74937004       .139  .8894 .89230769
```

Normal exit from iterations. Exit status=0.

```
+-------------------------------------------+
| Ordered Probit Model                      |
| Maximum Likelihood Estimates              |
| Dependent variable              MFPRO     |
| Weighting variable              ONE       |
| Number of observations          65        |
| Iterations completed            18        |
| Log likelihood function    -65.34667      |
| Restricted log likelihood  -79.33356      |
| Chi-squared                27.97379       |
| Degrees of freedom              8         |
| Significance level       .4792572E-03     |
|   Cell frequencies for outcomes           |
| Y Count Freq  Y Count Freq  Y Count Freq  |
| 0    2 .030 1    7 .107 2   26 .400       |
| 3   27 .415 4    3 .046                   |
+-------------------------------------------+
```

```
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
        Index function for probability
 Constant -2.460406775    1.8780887     -1.310  .1902
 YEARS    .3526167301E-01 .29071911E-01  1.213  .2252 9.8153846
 TYPE     -.2967682761    .33778955     -.879   .3796 .47692308
 SIZE     .5788709376E-01 .23505830      .246   .8055 1.3230769
 MGRLCTRB -.1702993126    .24068144     -.708   .4792 2.5923077
 TECHCTRB 1.006665249     .31368951      3.209  .0013 3.5794872
 FORTECH  .6550752193E-01 .24417057      .268   .7885 3.8923077
 FORTRAIN .1515284097     .22716398      .667   .5047 3.6000000
 WRITTEN  .9626288186     .74308619      1.295  .1952 .89230769
        Threshold parameters for index
 Mu( 1)   1.171625483     .41005784      2.857  .0043
 Mu( 2)   2.846239155     .48788611      5.834  .0000
 Mu( 3)   4.679033136     .59043793      7.925  .0000
```

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

```
          Predicted
------ ---------------------- + -----
Actual   0  1  2  3  4 | Total
------ ---------------------- + -----
 0       0  1  1  0  0 |   2
 1       0  3  4  0  0 |   7
 2       0  0 16 10  0 |  26
 3       0  0  7 20  0 |  27
 4       0  0  1  2  0 |   3
------ ---------------------- + -----
Total    0  4 29 32  0 |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   access$
```

```
+------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0          |
| Ordinary   least squares regression   Weighting variable = none |
```

```
| Dep. var. = Y=0/Not0 Mean=  .9692307692   , S.D.=  .1740358053   |
| Model size: Observations =    65, Parameters =  5, Deg.Fr.=   60 |
| Residuals:  Sum of squares= 166.6979698   , Std.Dev.=    1.66682 |
| Fit:      R-squared=*********, Adjusted R-squared =     -90.72798 |
| Diagnostic: Log-L =  -122.8394, Restricted(b=0) Log-L =   21.9250 |
|         LogAmemiyaPrCrt.=  1.096, Akaike Info. Crt.=    3.934 |
+------------------------------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	.7572886197	1.2050753	.628	.5297	
YEARS	.1891700903E-02	.31749892E-01	.060	.9525	9.8153846
TYPE	-.1341679524E-01	.42422391	-.032	.9748	.47692308
SIZE	.4709932617E-01	.24811326	.190	.8494	1.3230769
ACCESS	.4033730539E-01	.32978081	.122	.9026	3.4076923

Normal exit from iterations. Exit status=0.

```
+----------------------------------------------+
| Ordered Probit Model                         |
| Maximum Likelihood Estimates                 |
| Dependent variable              MFPRO        |
| Weighting variable                ONE        |
| Number of observations             65        |
| Iterations completed               12        |
| Log likelihood function     -75.51051        |
| Restricted log likelihood   -79.33356        |
| Chi-squared                  7.646108        |
| Degrees of freedom                  4        |
| Significance level           .1054365        |
|   Cell frequencies for outcomes              |
| Y Count Freq  Y Count Freq  Y Count Freq     |
| 0    2 .030 1    7 .107 2   26 .400          |
| 3   27 .415 4    3 .046                      |
+----------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
	Index function for probability				
Constant	.1433340711	.77995259	.184	.8542	
YEARS	.2487231655E-01	.34786450E-01	.715	.4746	9.8153846
TYPE	.1067102049	.30313385	.352	.7248	.47692308
SIZE	.1921848553	.17417359	1.103	.2698	1.3230769
ACCESS	.4079558809	.20526473	1.987	.0469	3.4076923
	Threshold parameters for index				
Mu(1)	.9154491796	.34317282	2.668	.0076	
Mu(2)	2.206886592	.41519275	5.315	.0000	
Mu(3)	3.843986128	.45795598	8.394	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

Predicted

Actual	0	1	2	3	4	Total
0	0	0	2	0	0	2
1	0	0	7	0	0	7
2	0	0	13	13	0	26

```
 3      0  0  12  15   0 |    27
 4      0  0   2   1   0 |     3
------ ---------------------- + -----
Total    0  0  36  29   0 |    65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
    electron,electric,telecom,automoti,access$

+----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=  .9692307692   , S.D.=  .1740358053    |
| Model size: Observations =      65, Parameters =   9, Deg.Fr.=     56 |
| Residuals:  Sum of squares= 165.7035023    , Std.Dev.=        1.72017 |
| Fit:        R-squared=*********, Adjusted R-squared =      -96.69367 |
| Diagnostic: Log-L =   -122.6449, Restricted(b=0) Log-L =     21.9250 |
|            LogAmemiyaPrCrt.=   1.215, Akaike Info. Crt.=     4.051 |
+----------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant  .8290477223      1.4823172        .559   .5760
 YEARS     .1447276402E-02  .34024550E-01     .043   .9661  9.8153846
 TYPE     -.3234950561E-01  .46622892       -.069   .9447  .47692308
 SIZE      .5514429951E-01  .28334902        .195   .8457  1.3230769
 ELECTRON -.1526936534      1.3629921       -.112   .9108  .40000000
 ELECTRIC -.7895206628E-01  1.3813331       -.057   .9544  .30769231
 TELECOM  -.1818721934      1.4454229       -.126   .8999  .16923077
 AUTOMOTI -.1422473385      1.5182926       -.094   .9254  .92307692E-01
 ACCESS    .5802309298E-01  .37168003        .156   .8759  3.4076923

Normal exit from iterations. Exit status=0.

          +------------------------------------------+
          | Ordered Probit Model                      |
          | Maximum Likelihood Estimates              |
          | Dependent variable              MFPRO     |
          | Weighting variable                ONE     |
          | Number of observations             65     |
          | Iterations completed               16     |
          | Log likelihood function     -72.97946     |
          | Restricted log likelihood   -79.33356     |
          | Chi-squared                  12.70821     |
          | Degrees of freedom                  8     |
          | Significance level           .1222915     |
          |   Cell frequencies for outcomes           |
          |  Y Count Freq  Y Count Freq  Y Count Freq |
          | 0    2 .030  1    7 .107  2    26 .400    |
          | 3   27 .415  4    3 .046                  |
          +------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant  .8765539406      .72120016       1.215   .2242
 YEARS     .2752269785E-01  .33323975E-01    .826   .4089  9.8153846
 TYPE      .4308242394E-01  .33549736        .128   .8978  .47692308
 SIZE      .1984536409      .17641050       1.125   .2606  1.3230769
 ELECTRON -1.414981523      .58679323      -2.411   .0159  .40000000
 ELECTRIC -1.151914831      .60195895      -1.914   .0557  .30769231
```

```
 TELECOM -1.820733686    .60927001     -2.988  .0028 .16923077
 AUTOMOTI -1.278957708    .86604976     -1.477  .1397 .92307692E-01
 ACCESS  .6215382440    .22290945     2.788  .0053 3.4076923
        Threshold parameters for index
 Mu( 1)  .9906555217    .41225167     2.403  .0163
 Mu( 2)  2.329999957    .50185395     4.643  .0000
 Mu( 3)  4.047485157    .56901808     7.113  .0000
```

```
Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------ ---------------------- + -----
Actual    0  1  2  3  4 | Total
------ ---------------------- + -----
 0       0  0  2  0  0 |   2
 1       0  0  6  1  0 |   7
 2       0  0 15 11  0 |  26
 3       0  0 10 17  0 |  27
 4       0  0  1  2  0 |   3
------ ---------------------- + -----
Total    0  0 34 31  0 |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,automoti,protect,
   similar$
```

```
+--------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                 |
| Ordinary    least squares regression    Weighting variable = none   |
| Dep. var. = Y=0/Not0 Mean=  .9692307692   , S.D.=  .1740358053      |
| Model size: Observations =     65, Parameters =  10, Deg.Fr.=    55 |
| Residuals:  Sum of squares= 164.4068593   , Std.Dev.=       1.72893 |
| Fit:       R-squared=*********, Adjusted R-squared =      -97.69156 |
| Diagnostic: Log-L =  -122.3896, Restricted(b=0) Log-L =    21.9250 |
|          LogAmemiyaPrCrt.=   1.238, Akaike Info. Crt.=    4.074 |
+--------------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant .7274038786     1.5307405       .475  .6346
 YEARS    .2784969284E-02 .34509102E-01    .081  .9357 9.8153846
 TYPE    -.3012781080E-01 .46866694      -.064  .9487 .47692308
 SIZE     .4932800784E-01 .28550132       .173  .8628 1.3230769
 ELECTRON -.1153212030    1.3760137      -.084  .9332 .40000000
 ELECTRIC -.4723973339E-01 1.3926912     -.034  .9729 .30769231
 TELECOM -.1026918434     1.4783460      -.069  .9446 .16923077
 AUTOMOTI -.9021764465E-01 1.5365897     -.059  .9532 .92307692E-01
 PROTECT  .9765676601E-01 .30199073       .323  .7464 3.5923077
 SIMILAR -.3128926884E-01 .27989419      -.112  .9110 3.2230769

Normal exit from iterations. Exit status=0.
```

```
       +------------------------------------------+
       | Ordered Probit Model                     |
       | Maximum Likelihood Estimates             |
       | Dependent variable              MFPRO    |
       | Weighting variable              ONE      |
       | Number of observations            65     |
```

```
| Iterations completed              18   |
| Log likelihood function     -70.95132  |
| Restricted log likelihood   -79.33356  |
| Chi-squared                 16.76448   |
| Degrees of freedom                9    |
| Significance level      .5253442E-01   |
|   Cell frequencies for outcomes        |
| Y Count Freq  Y Count Freq  Y Count Freq  |
| 0    2 .030 1    7 .107 2   26 .400   |
| 3   27 .415 4    3 .046               |
+----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
       Index function for probability
 Constant .4715868824     .81300258       .580  .5619
 YEARS    .3492468807E-01 .37638485E-01   .928  .3535 9.8153846
 TYPE     .5841715078E-01 .32699339       .179  .8582 .47692308
 SIZE     .1875942405     .17524580      1.070  .2844 1.3230769
 ELECTRON -1.308984618    .60561525     -2.161  .0307 .40000000
 ELECTRIC -1.050710366    .62291699     -1.687  .0916 .30769231
 TELECOM  -1.532165478    .63179549     -2.425  .0153 .16923077
 AUTOMOTI -1.086849204   1.0060598      -1.080  .2800 .92307692E-01
 PROTECT  .6342248413     .21163464      2.997  .0027 3.5923077
 SIMILAR  .4725221508E-01 .19835700       .238  .8117 3.2230769
       Threshold parameters for index
 Mu( 1)   1.085222713     .58292356      1.862  .0626
 Mu( 2)   2.445326748     .67826562      3.605  .0003
 Mu( 3)   4.223846721     .73775242      5.725  .0000


Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

         Predicted
------ ----------------------- + -----
Actual    0   1   2   3   4  | Total
------ ----------------------- + -----
 0        1   0   1   0   0  |   2
 1        0   0   7   0   0  |   7
 2        0   0  13  13   0  |  26
 3        0   1   6  20   0  |  27
 4        0   0   1   2   0  |   3
------ ----------------------- + -----
Total     1   1  28  35   0  |  65
--> skip$
--> ordered; lhs=mfpro; rhs=one,years,type,size,
   electron,electric,telecom,automoti,lecap,
   precurx,access,active,mission$

+----------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0              |
| Ordinary    least squares regression    Weighting variable = none  |
| Dep. var. = Y=0/Not0 Mean=  .9682539683   , S.D.=  .1767314318   |
| Model size: Observations =     63, Parameters =  13, Deg.Fr.=    50 |
| Residuals:  Sum of squares= 159.6882771    , Std.Dev.=      1.78711 |
| Fit:       R-squared=*********, Adjusted R-squared =      -101.25285 |
| Diagnostic: Log-L =  -118.6909, Restricted(b=0) Log-L =     20.2977 |
|           LogAmemiyaPrCrt.=   1.349, Akaike Info. Crt.=     4.181 |
+----------------------------------------------------------------+
```

```
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant .7589842126     2.4053667       .316  .7524
 YEARS   -.9415497365E-03 .37855572E-01   -.025  .9802 9.9523810
 TYPE     .1467458160E-01 .55075520        .027  .9787 .49206349
 SIZE     .6103564113E-01 .31921836       .191  .8484 1.3492063
 ELECTRON -.2128733014    1.4518213       -.147  .8834 .38095238
 ELECTRIC -.1008956245    1.4590720       -.069  .9449 .31746032
 TELECOM  -.2075054733    1.5583608       -.133  .8941 .17460317
 AUTOMOTI -.1594218768    1.6300805       -.098  .9221 .95238095E-01
 LECAP    .4125730406E-01 .62329259       .066  .9472 3.4947090
 PRECURX  -.7517294322E-01 .42016139      -.179  .8580 2.8650794
 ACCESS   .8086561457E-01 .49853612       .162  .8711 3.4087302
 ACTIVE   .8218647910E-01 .66573703       .123  .9017 3.0428571
 MISSION  -.4224349031E-01 .49609650      -.085  .9321 3.8095238
```

Normal exit from iterations. Exit status=0.

```
+----------------------------------------+
| Ordered Probit Model                    |
| Maximum Likelihood Estimates            |
| Dependent variable          MFPRO       |
| Weighting variable           ONE        |
| Number of observations        63        |
| Iterations completed          22        |
| Log likelihood function    -65.00077    |
| Restricted log likelihood  -77.53158    |
| Chi-squared                 25.06162    |
| Degrees of freedom            12        |
| Significance level       .1453357E-01   |
|   Cell frequencies for outcomes         |
|  Y Count Freq  Y Count Freq  Y Count Freq |
| 0   2 .031  1   7 .111  2   25 .396     |
| 3  26 .412  4   3 .047                  |
+----------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
      Index function for probability
 Constant -2.823357664    1.8921529      -1.492  .1357
 YEARS    .3091674888E-01 .32842484E-01   .941  .3465 9.9523810
 TYPE     .2703457611     .39301297       .688  .4915 .49206349
 SIZE     .2207772866     .18284816      1.207  .2273 1.3492063
 ELECTRON -2.066486589    .72923380     -2.834  .0046 .38095238
 ELECTRIC -1.574210538    .75506821     -2.085  .0371 .31746032
 TELECOM  -2.231482705    .77332922     -2.886  .0039 .17460317
 AUTOMOTI -1.781240804    1.0833629     -1.644  .1001 .95238095E-01
 LECAP    .8179552431     .45011669      1.817  .0692 3.4947090
 PRECURX  -.4336472282    .32311781     -1.342  .1796 2.8650794
 ACCESS   .4458479518     .30190993      1.477  .1397 3.4087302
 ACTIVE   .7162545368     .54935713      1.304  .1923 3.0428571
 MISSION  .2892764364     .43720507       .662  .5082 3.8095238
      Threshold parameters for index
 Mu( 1)   1.156647182     .49874188      2.319  .0204
 Mu( 2)   2.633363289     .55973067      4.705  .0000
 Mu( 3)   4.560238014     .71421771      6.385  .0000
```

Frequencies of actual & predicted outcomes

Predicted outcome has maximum probability.

	Predicted					
Actual	0	1	2	3	4	Total
0	0	1	1	0	0	2
1	0	2	4	1	0	7
2	0	1	15	9	0	25
3	0	0	10	16	0	26
4	0	0	0	3	0	3
Total	0	4	30	29	0	63

APPENDIX 8: RESULTS OF CENSORED REGRESSION (PERFORMANCE)

```
--> RESET
--> RESET
--> LOAD;file="A:\fariza2.lpj"$
An end of file error has occurred reloading from the file.
--> skip$
--> tobit; lhs=general; rhs=one,type,size,knoac, lecap,precurx,
   mission, access, active ; limits=1,5$

+-----------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression              |
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = GENERAL  Mean=  3.651162791    , S.D.=  .6297454276       |
| Model size: Observations =     43, Parameters =  9, Deg.Fr.=    34 |
| Residuals:  Sum of squares= 6.999188887    , Std.Dev.=        .45372 |
| Fit:        R-squared=  .579788, Adjusted R-squared =        .48091 |
| Model test: F[  8,     34] =    5.86,    Prob value =         .00010 |
| Diagnostic: Log-L =    -21.9831, Restricted(b=0) Log-L =    -40.6235 |
|            LogAmemiyaPrCrt.=   -1.391, Akaike Info. Crt.=      1.441 |
+-----------------------------------------------------------------------+
+---------+-------------+----------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+----------------+--------+---------+----------+
 Constant  1.533973555     .67666906       2.267   .0234
 TYPE     -.3784506891     .18593856      -2.035   .0418  .25581395
 SIZE     -.4993041759E-01 .87067775E-01   -.573   .5663  1.2790698
 KNOAC    -.8970138999E-01 .19874488       -.451   .6517  3.6930233
 LECAP    -.5383494594     .22976549      -2.343   .0191  3.4883721
 PRECURX  -.3023310710     .13374638      -2.260   .0238  2.6279070
 MISSION   .4640809351     .16204888       2.864   .0042  3.7674419
 ACCESS    .3131597103     .12494259       2.506   .0122  3.3779070
 ACTIVE    .8225743349     .23800765       3.456   .0005  3.0093023

Normal exit from iterations. Exit status=0.

          +---------------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates                |
          | Dependent variable              GENERAL     |
          | Weighting variable                  ONE     |
          | Number of observations               43     |
          | Iterations completed                  4     |
          | Log likelihood function       -25.24788     |
          | Threshold values for the model:             |
          | Lower=    1.0000    Upper=    5.0000        |
          +---------------------------------------------+
+---------+-------------+----------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+----------------+--------+---------+----------+
       Primary Index Equation for Model
 Constant  1.536284421     .62899974       2.442   .0146
 TYPE     -.4040283718     .17339677      -2.330   .0198  .25581395
 SIZE     -.5386796062E-01 .81285237E-01   -.663   .5075  1.2790698
 KNOAC    -.5634808656E-01 .18674083       -.302   .7628  3.6930233
```

```
LECAP   -.5673081674    .21438806     -2.646  .0081 3.4883721
PRECURX -.3237813986    .12488625     -2.593  .0095 2.6279070
MISSION  .4758240192    .15052908      3.161  .0016 3.7674419
ACCESS   .3281392773    .11640716      2.819  .0048 3.3779070
ACTIVE   .8082973267    .22196806      3.642  .0003 3.0093023
     Disturbance standard deviation
Sigma    .4208398965    .47170648E-01  8.922  .0000


--> skip$
--> tobit; lhs=general; rhs=one,type,size,knoac, lecap,precurx,
   mission, access, active ; limits=1,5$

+-----------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression          |
| Ordinary   least squares regression   Weighting variable = none   |
| Dep. var. = GENERAL  Mean=  3.651162791   , S.D.=  .6297454276    |
| Model size: Observations =     43, Parameters =  9, Deg.Fr.=   34 |
| Residuals:  Sum of squares= 6.999188887    , Std.Dev.=      .45372 |
| Fit:        R-squared=  .579788, Adjusted R-squared =       .48091 |
| Model test: F[  8,     34] =    5.86,   Prob value =        .00010 |
| Diagnostic: Log-L =    -21.9831, Restricted(b=0) Log-L =  -40.6235 |
|             LogAmemiyaPrCrt.=  -1.391, Akaike Info. Crt.=    1.441 |
+-----------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
Constant 1.533973555     .67666906      2.267  .0234
TYPE    -.3784506891     .18593856     -2.035  .0418 .25581395
SIZE    -.4993041759E-01 .87067775E-01  -.573  .5663 1.2790698
KNOAC   -.8970138999E-01 .19874488      -.451  .6517 3.6930233
LECAP   -.5383494594     .22976549     -2.343  .0191 3.4883721
PRECURX -.3023310710     .13374638     -2.260  .0238 2.6279070
MISSION  .4640809351     .16204888      2.864  .0042 3.7674419
ACCESS   .3131597103     .12494259      2.506  .0122 3.3779070
ACTIVE   .8225743349     .23800765      3.456  .0005 3.0093023

Normal exit from iterations. Exit status=0.

        +-------------------------------------------+
        | Limited Dependent Variable Model - CENSORED |
        | Maximum Likelihood Estimates              |
        | Dependent variable           GENERAL      |
        | Weighting variable              ONE       |
        | Number of observations           43       |
        | Iterations completed           4          |
        | Log likelihood function    -25.24788      |
        | Threshold values for the model:           |
        | Lower=    1.0000   Upper=    5.0000       |
        +-------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
     Primary Index Equation for Model
Constant 1.536284421     .62899974      2.442  .0146
TYPE    -.4040283718     .17339677     -2.330  .0198 .25581395
```

```
SIZE    -.5386796062E-01  .81285237E-01   -.663  .5075 1.2790698
KNOAC   -.5634808656E-01  .18674083       -.302  .7628 3.6930233
LECAP   -.5673081674      .21438806      -2.646  .0081 3.4883721
PRECURX -.3237813986      .12488625      -2.593  .0095 2.6279070
MISSION  .4758240192      .15052908       3.161  .0016 3.7674419
ACCESS   .3281392773      .11640716       2.819  .0048 3.3779070
ACTIVE   .8082973267      .22196806       3.642  .0003 3.0093023
      Disturbance standard deviation
Sigma    .4208398965      .47170648E-01   8.922  .0000


--> skip$
--> tobit; lhs=general; rhs=one,type,size,knoac, lecap,precurx,
   mission, access, active ; limits=1,5$

+-----------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression              |
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = GENERAL  Mean=   3.651162791    , S.D.=  .6297454276      |
| Model size: Observations =      43, Parameters =  9, Deg.Fr.=     34 |
| Residuals:  Sum of squares= 6.999188887    , Std.Dev.=        .45372 |
| Fit:        R-squared=  .579788, Adjusted R-squared =         .48091 |
| Model test: F[  8,     34] =    5.86,    Prob value =         .00010 |
| Diagnostic: Log-L =    -21.9831, Restricted(b=0) Log-L =    -40.6235 |
|             LogAmemiyaPrCrt.=   -1.391, Akaike Info. Crt.=     1.441 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
Constant 1.533973555      .67666906       2.267  .0234
TYPE    -.3784506891      .18593856      -2.035  .0418 .25581395
SIZE    -.4993041759E-01  .87067775E-01   -.573  .5663 1.2790698
KNOAC   -.8970138999E-01  .19874488       -.451  .6517 3.6930233
LECAP   -.5383494594      .22976549      -2.343  .0191 3.4883721
PRECURX -.3023310710      .13374638      -2.260  .0238 2.6279070
MISSION  .4640809351      .16204888       2.864  .0042 3.7674419
ACCESS   .3131597103      .12494259       2.506  .0122 3.3779070
ACTIVE   .8225743349      .23800765       3.456  .0005 3.0093023

Normal exit from iterations. Exit status=0.

          +---------------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates                |
          | Dependent variable              GENERAL     |
          | Weighting variable                  ONE     |
          | Number of observations               43     |
          | Iterations completed                  4     |
          | Log likelihood function       -25.24788     |
          | Threshold values for the model:             |
          | Lower=    1.0000    Upper=    5.0000        |
          +---------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
      Primary Index Equation for Model
```

```
Constant 1.536284421     .62899974      2.442  .0146
TYPE   -.4040283718      .17339677     -2.330  .0198 .25581395
SIZE   -.5386796062E-01 .81285237E-01  -.663   .5075 1.2790698
KNOAC  -.5634808656E-01 .18674083      -.302   .7628 3.6930233
LECAP  -.5673081674     .21438806      -2.646  .0081 3.4883721
PRECURX -.3237813986    .12488625      -2.593  .0095 2.6279070
MISSION .4758240192     .15052908       3.161  .0016 3.7674419
ACCESS  .3281392773     .11640716       2.819  .0048 3.3779070
ACTIVE  .8082973267     .22196806       3.642  .0003 3.0093023
        Disturbance standard deviation
Sigma   .4208398965     .47170648E-01   8.922  .0000


--> skip$
--> tobit; lhs=hmanres; rhs=one,type,size,knoac, lecap,precurx,
   mission, access, active ; limits=1,5$

+-------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression          |
| Ordinary    least squares regression    Weighting variable = none |
| Dep. var. = HMANRES  Mean=  3.166666667   , S.D.=  .8131975914    |
| Model size: Observations =      63, Parameters =  9, Deg.Fr.=  54 |
| Residuals:  Sum of squares= 18.01431016   , Std.Dev.=      .57758 |
| Fit:       R-squared=  .560627, Adjusted R-squared =       .49553 |
| Model test: F[  8,    54] =   8.61,   Prob value =         .00000 |
| Diagnostic: Log-L =  -49.9561, Restricted(b=0) Log-L =   -75.8619 |
|             LogAmemiyaPrCrt.=   -.964, Akaike Info. Crt.=   1.872 |
+-------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
Constant .1266575462     .74370066        .170  .8648
TYPE   -.1814647004      .16757656     -1.083  .2789 .49206349
SIZE   -.3307749828E-01 .91685854E-01  -.361  .7183 1.3492063
KNOAC   .7403619269      .20433767      3.623  .0003 3.7777778
LECAP   .3064317874E-01 .20637173        .148  .8820 3.4947090
PRECURX .1772094292      .12713558      1.394  .1634 2.8650794
MISSION -.1531116320     .16864475      -.908  .3639 3.8095238
ACCESS  -.2203692373     .14755130     -1.494  .1353 3.4087302
ACTIVE  .3604048302      .25334200      1.423  .1549 3.0428571

Normal exit from iterations. Exit status=0.

         +---------------------------------------------+
         | Limited Dependent Variable Model - CENSORED |
         | Maximum Likelihood Estimates                |
         | Dependent variable              HMANRES     |
         | Weighting variable                  ONE     |
         | Number of observations               63     |
         | Iterations completed                  4     |
         | Log likelihood function       -52.92137     |
         | Threshold values for the model:             |
         | Lower=    1.0000    Upper=    5.0000        |
         +---------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
```

```
+---------+-------------+---------------+--------+---------+----------+
      Primary Index Equation for Model
 Constant .9384749104E-01 .70967706       .132  .8948
 TYPE    -.1792179054     .15971205     -1.122  .2618 .49206349
 SIZE    -.4562926452E-01 .87776158E-01  -.520  .6032 1.3492063
 KNOAC    .7569184030     .19514401      3.879  .0001 3.7777778
 LECAP    .1008832252E-01 .19717206       .051  .9592 3.4947090
 PRECURX  .1805680269     .12127165      1.489  .1365 2.8650794
 MISSION -.1493148257     .16091969      -.928  .3535 3.8095238
 ACCESS  -.2301530879     .14091347     -1.633  .1024 3.4087302
 ACTIVE   .3802890736     .24180015      1.573  .1158 3.0428571
      Disturbance standard deviation
 Sigma    .5504394055     .50364390E-01 10.929  .0000


--> skip$
--> tobit; lhs=business; rhs=one,type,size,knoac, lecap,precurx,
   mission, access, active ; limits=1,5$

+-----------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression        |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = BUSINESS Mean=  3.630952381    , S.D.=  .5057275637    |
| Model size: Observations =      63, Parameters =  9, Deg.Fr.=    54 |
| Residuals:  Sum of squares= 9.169052957    , Std.Dev.=        .41206 |
| Fit:        R-squared=  .421771, Adjusted R-squared =         .33611 |
| Model test: F[  8,     54] =    4.92,    Prob value =         .00013 |
| Diagnostic: Log-L =    -28.6832, Restricted(b=0) Log-L =     -45.9384 |
|             LogAmemiyaPrCrt.=   -1.640, Akaike Info. Crt.=     1.196 |
+-----------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant 1.885829522     .53058088      3.554  .0004
 TYPE    -.1354089580     .11955471     -1.133  .2574 .49206349
 SIZE    -.1290876353     .65411749E-01 -1.973  .0484 1.3492063
 KNOAC   -.2579440310E-01 .14578131      -.177  .8596 3.7777778
 LECAP   -.3368175490     .14723248     -2.288  .0222 3.4947090
 PRECURX -.2017412740E-02 .90702768E-01  -.022  .9823 2.8650794
 MISSION  .3304174760     .12031680      2.746  .0060 3.8095238
 ACCESS   .7661189605E-01 .10526802       .728  .4667 3.4087302
 ACTIVE   .5739148454     .18074264      3.175  .0015 3.0428571

Normal exit from iterations. Exit status=0.

          +-----------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates             |
          | Dependent variable          BUSINESS     |
          | Weighting variable              ONE      |
          | Number of observations           63      |
          | Iterations completed              4      |
          | Log likelihood function     -30.68986    |
          | Threshold values for the model:          |
          | Lower=    1.0000   Upper=    5.0000      |
          +-----------------------------------------+
```

```
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
        Primary Index Equation for Model
 Constant  1.895726207     .49857189       3.802  .0001
 TYPE     -.1396660946     .11239424      -1.243  .2140  .49206349
 SIZE     -.1325978418     .61543909E-01  -2.155  .0312 1.3492063
 KNOAC    -.2259272042E-01 .13699586       -.165  .8690 3.7777778
 LECAP    -.3452531107     .13855456      -2.492  .0127 3.4947090
 PRECURX  -.6407574787E-02 .85316426E-01   -.075  .9401 2.8650794
 MISSION   .3316355161     .11304432       2.934  .0033 3.8095238
 ACCESS    .8326658599E-01 .99099001E-01    .840  .4008 3.4087302
 ACTIVE    .5744269100     .16980968       3.383  .0007 3.0428571
        Disturbance standard deviation
 Sigma     .3871376722     .34964987E-01  11.072  .0000


--> skip$
--> tobit; lhs=performa; rhs=one,type,size,knoac, lecap,precurx,
    mission, access, active ; limits=1,5$

+-----------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression              |
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = PERFORMA Mean=   3.453488372    , S.D.=   .5504968405     |
| Model size: Observations =       43, Parameters =  9, Deg.Fr.=     34 |
| Residuals:  Sum of squares= 4.072969686    , Std.Dev.=         .34611 |
| Fit:        R-squared=  .679998, Adjusted R-squared =          .60470 |
| Model test: F[  8,     34] =    9.03,    Prob value =          .00000 |
| Diagnostic: Log-L =    -10.3426, Restricted(b=0) Log-L =     -34.8403 |
|             LogAmemiyaPrCrt.=   -1.932, Akaike Info. Crt.=       .900 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  1.318981270     .51618817       2.555  .0106
 TYPE     -.3313008132     .14184081      -2.336  .0195  .25581395
 SIZE     -.1027907074     .66418518E-01  -1.548  .1217 1.2790698
 KNOAC     .2035752839     .15160994       1.343  .1794 3.6930233
 LECAP    -.3813997580     .17527361      -2.176  .0296 3.4883721
 PRECURX  -.4275655504E-01 .10202668       -.419  .6752 2.6279070
 MISSION   .2401170590     .12361688       1.942  .0521 3.7674419
 ACCESS    .5313413128E-01 .95310827E-01    .557  .5772 3.3779070
 ACTIVE    .6505301891     .18156103       3.583  .0003 3.0093023

Normal exit from iterations. Exit status=0.

        +---------------------------------------------+
        | Limited Dependent Variable Model - CENSORED |
        | Maximum Likelihood Estimates                |
        | Dependent variable              PERFORMA    |
        | Weighting variable                   ONE    |
        | Number of observations                43    |
        | Iterations completed                   4    |
        | Log likelihood function        -10.34256    |
        | Threshold values for the model:             |
```

```
          | Lower=   1.0000    Upper=   5.0000      |
          +--------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
       Primary Index Equation for Model
 Constant 1.318981270     .45900063       2.874  .0041
 TYPE    -.3313008132     .12612653      -2.627  .0086  .25581395
 SIZE    -.1027907074    .59060132E-01   -1.740  .0818 1.2790698
 KNOAC    .2035752839     .13481335       1.510  .1310 3.6930233
 LECAP   -.3813997580     .15585537      -2.447  .0144 3.4883721
 PRECURX -.4275655504E-01 .90723335E-01   -.471  .6374 2.6279070
 MISSION  .2401170590     .10992159       2.184  .0289 3.7674419
 ACCESS   .5313413128E-01 .84751515E-01    .627  .5307 3.3779070
 ACTIVE   .6505301891     .16144622       4.029  .0001 3.0093023
      Disturbance standard deviation
 Sigma    .3077665110    .33187316E-01    9.274  .0000


--> skip$
--> tobit; lhs=general; rhs=one,type,size,knoac, lecap,precurx,
   mission, access, active, culture ; limits=1,5$

+-----------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression              |
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = GENERAL  Mean=   3.651162791    , S.D.=   .6297454276     |
| Model size: Observations =      43, Parameters =  10, Deg.Fr.=     33 |
| Residuals:  Sum of squares= 6.987004335     , Std.Dev.=        .46014 |
| Fit:        R-squared=  .580520, Adjusted R-squared =          .46612 |
| Model test: F[  9,     33] =    5.07,    Prob value =          .00025 |
| Diagnostic: Log-L =    -21.9457, Restricted(b=0) Log-L =     -40.6235 |
|             LogAmemiyaPrCrt.=   -1.343, Akaike Info. Crt.=      1.486 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant 1.648308506     .83551877       1.973  .0485
 TYPE    -.3725382949     .19017423      -1.959  .0501  .25581395
 SIZE    -.4871394258E-01 .88445667E-01   -.551  .5818 1.2790698
 KNOAC   -.9539720855E-01 .20295166       -.470  .6383 3.6930233
 LECAP   -.5272982233     .23752783      -2.220  .0264 3.4883721
 PRECURX -.3021131186     .13564254      -2.227  .0259 2.6279070
 MISSION  .4564587112     .16738593       2.727  .0064 3.7674419
 ACCESS   .3145686749     .12684714       2.480  .0131 3.3779070
 ACTIVE   .8211301131     .24145160       3.401  .0007 3.0093023
 CULTURE -.3364330606E-01 .14024339       -.240  .8104 3.1860465

Normal exit from iterations. Exit status=0.

          +--------------------------------------------+
          | Limited Dependent Variable Model - CENSORED |
          | Maximum Likelihood Estimates               |
          | Dependent variable             GENERAL     |
          | Weighting variable                 ONE     |
          | Number of observations              43     |
```

```
            | Iterations completed              4   |
            | Log likelihood function      -25.23671    |
            | Threshold values for the model:             |
            | Lower=   1.0000    Upper=   5.0000      |
            +--------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
       Primary Index Equation for Model
 Constant  1.601306849      .76438137       2.095   .0362
 TYPE    -.4003362178      .17500786      -2.288   .0222  .25581395
 SIZE    -.5299263822E-01  .81434918E-01   -.651   .5152  1.2790698
 KNOAC   -.5956535130E-01  .18786617       -.317   .7512  3.6930233
 LECAP   -.5605121938      .21896620      -2.560   .0105  3.4883721
 PRECURX -.3235029450      .12481632      -2.592   .0095  2.6279070
 MISSION  .4713115394      .15342144       3.072   .0021  3.7674419
 ACCESS   .3287560553      .11639995       2.824   .0047  3.3779070
 ACTIVE   .8072377165      .22195200       3.637   .0003  3.0093023
 CULTURE -.1933716070E-01  .12931951       -.150   .8811  3.1860465
       Disturbance standard deviation
 Sigma    .4205870862      .47156633E-01   8.919   .0000


--> skip$
--> tobit; lhs=hmanres; rhs=one,type,size,knoac, lecap,precurx,
   mission, access, active, culture ; limits=1,5$

+------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression            |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = HMANRES  Mean=   3.166666667    , S.D.=  .8131975914     |
| Model size: Observations =       63, Parameters =  10, Deg.Fr.=    53 |
| Residuals:  Sum of squares= 16.62137679    , Std.Dev.=        .56001 |
| Fit:        R-squared=  .594601, Adjusted R-squared =         .52576 |
| Model test: F[  9,     53] =    8.64,    Prob value =          .00000 |
| Diagnostic: Log-L =    -47.4211, Restricted(b=0) Log-L =     -75.8619 |
|             LogAmemiyaPrCrt.=   -1.012, Akaike Info. Crt.=      1.823 |
+------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  1.135108178      .86540043       1.312   .1896
 TYPE    -.8605316301E-01  .16866817       -.510   .6099  .49206349
 SIZE    -.1601412940E-01  .89264705E-01   -.179   .8576  1.3492063
 KNOAC    .7157830692      .19846467       3.607   .0003  3.7777778
 LECAP    .1227263199      .20480876        .599   .5490  3.4947090
 PRECURX  .2208725041      .12499703       1.767   .0772  2.8650794
 MISSION -.2303566549      .16757209      -1.375   .1692  3.8095238
 ACCESS  -.2349458476      .14322988      -1.640   .1009  3.4087302
 ACTIVE   .3081108965      .24688541       1.248   .2120  3.0428571
 CULTURE -.2794830995      .13261295      -2.108   .0351  3.3253968

Normal exit from iterations. Exit status=0.

            +--------------------------------------------+
            | Limited Dependent Variable Model - CENSORED |
```

```
| Maximum Likelihood Estimates              |
| Dependent variable            HMANRES     |
| Weighting variable              ONE       |
| Number of observations           63       |
| Iterations completed              4       |
| Log likelihood function     -50.20439     |
| Threshold values for the model:           |
| Lower=   1.0000    Upper=   5.0000        |
+-------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
      Primary Index Equation for Model
 Constant  1.172040879     .81847826       1.432  .1522
 TYPE    -.7716786456E-01 .15926004       -.485  .6280  .49206349
 SIZE    -.2833776779E-01 .84617010E-01   -.335  .7377  1.3492063
 KNOAC     .7312996704     .18765451       3.897  .0001  3.7777778
 LECAP     .1066373987     .19354996        .551  .5817  3.4947090
 PRECURX   .2279570977     .11818554       1.929  .0538  2.8650794
 MISSION  -.2323434872     .15840847      -1.467  .1424  3.8095238
 ACCESS   -.2458406084     .13547688      -1.815  .0696  3.4087302
 ACTIVE    .3258915489     .23324721       1.397  .1624  3.0428571
 CULTURE  -.2987065380     .12590062      -2.373  .0177  3.3253968
      Disturbance standard deviation
 Sigma     .5284048369     .48310086E-01  10.938  .0000


--> skip$
--> tobit; lhs=business; rhs=one,type,size,knoac, lecap,precurx,
    mission, access, active, culture ; limits=1,5$

+-----------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression              |
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = BUSINESS Mean=   3.630952381    , S.D.=  .5057275637      |
| Model size: Observations =      63, Parameters =  10, Deg.Fr.=     53 |
| Residuals:  Sum of squares= 8.251316970    , Std.Dev.=         .39457 |
| Fit:        R-squared=  .479647, Adjusted R-squared =          .39128 |
| Model test: F[  9,     53] =    5.43,    Prob value =          .00003 |
| Diagnostic: Log-L =    -25.3611, Restricted(b=0) Log-L =      -45.9384 |
|             LogAmemiyaPrCrt.=   -1.713, Akaike Info. Crt.=      1.123 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  1.067273606     .60974079       1.750  .0801
 TYPE     -.2128541753     .11883963      -1.791  .0733  .49206349
 SIZE     -.1429379132     .62893811E-01  -2.273  .0230  1.3492063
 KNOAC    -.5843828646E-02 .13983354       -.042  .9667  3.7777778
 LECAP    -.4115611186     .14430344      -2.852  .0043  3.4947090
 PRECURX  -.3745858082E-01 .88069964E-01   -.425  .6706  2.8650794
 MISSION   .3931169959     .11806735       3.330  .0009  3.8095238
 ACCESS    .8844368057E-01 .10091640        .876  .3808  3.4087302
 ACTIVE    .6163616519     .17394965       3.543  .0004  3.0428571
 CULTURE   .2268554725     .93435966E-01   2.428  .0152  3.3253968
```

Normal exit from iterations. Exit status=0.

```
+--------------------------------------------+
| Limited Dependent Variable Model - CENSORED |
| Maximum Likelihood Estimates               |
| Dependent variable          BUSINESS       |
| Weighting variable               ONE       |
| Number of observations            63       |
| Iterations completed               4       |
| Log likelihood function    -27.19883       |
| Threshold values for the model:            |
| Lower=   1.0000    Upper=   5.0000         |
+--------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
      Primary Index Equation for Model
 Constant  1.043472113     .56765733      1.838  .0660
 TYPE     -.2210746067     .11081506     -1.995  .0460 .49206349
 SIZE     -.1475671369     .58665168E-01 -2.515  .0119 1.3492063
 KNOAC    -.1307028190E-02 .13015220      -.010  .9920 3.7777778
 LECAP    -.4244674414     .13477166     -3.150  .0016 3.4947090
 PRECURX  -.4402688573E-01 .82154445E-01  -.536  .5920 2.8650794
 MISSION   .3972111410     .10990111      3.614  .0003 3.8095238
 ACCESS    .9659991160E-01 .94182793E-01  1.026  .3050 3.4087302
 ACTIVE    .6187741638     .16183764      3.823  .0001 3.0428571
 CULTURE   .2366039370     .87387365E-01  2.708  .0068 3.3253968
      Disturbance standard deviation
 Sigma     .3670611978     .33128744E-01 11.080  .0000
```

```
--> skip$
--> tobit; lhs=performa; rhs=one,type,size,knoac, lecap,precurx,
    mission, access, active, culture ; limits=1,5$
```

```
+-----------------------------------------------------------------------+
| Limited Dependent Variable Model - CENSORED   Regression              |
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = PERFORMA Mean=  3.453488372   , S.D.=  .5504968405        |
| Model size: Observations =     43, Parameters =  10, Deg.Fr.=     33  |
| Residuals:  Sum of squares= 3.961030834   , Std.Dev.=         .34646  |
| Fit:        R-squared=  .688793, Adjusted R-squared =         .60392  |
| Model test: F[  9,    33] =    8.12,    Prob value =         .00000  |
| Diagnostic: Log-L =    -9.7434, Restricted(b=0) Log-L =     -34.8403  |
|             LogAmemiyaPrCrt.=   -1.911, Akaike Info. Crt.=     .918   |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  1.665530268     .62909295      2.648  .0081
 TYPE     -.3133803587     .14318920     -2.189  .0286 .25581395
 SIZE     -.9910357420E-01 .66594010E-01 -1.488  .1367 1.2790698
 KNOAC     .1863112697     .15280981      1.219  .2228 3.6930233
 LECAP    -.3479034843     .17884348     -1.945  .0517 3.4883721
 PRECURX  -.4209594172E-01 .10213028      -.412  .6802 2.6279070
 MISSION   .2170141143     .12603105      1.722  .0851 3.7674419
```

ACCESS	.5740470008E-01	.95507899E-01	.601	.5478	3.3779070
ACTIVE	.6461527558	.18179783	3.554	.0004	3.0093023
CULTURE	-.1019727908	.10559443	-.966	.3342	3.1860465

Normal exit from iterations. Exit status=0.

```
+--------------------------------------------+
| Limited Dependent Variable Model - CENSORED |
| Maximum Likelihood Estimates                |
| Dependent variable         PERFORMA         |
| Weighting variable              ONE         |
| Number of observations           43         |
| Iterations completed              4         |
| Log likelihood function   -9.743396         |
| Threshold values for the model:             |
| Lower=  1.0000   Upper=  5.0000             |
+--------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Primary Index Equation for Model					
Constant	1.665530268	.55110907	3.022	.0025	
TYPE	-.3133803587	.12543912	-2.498	.0125	.25581395
SIZE	-.9910357420E-01	.58338856E-01	-1.699	.0894	1.2790698
KNOAC	.1863112697	.13386713	1.392	.1640	3.6930233
LECAP	-.3479034843	.15667361	-2.221	.0264	3.4883721
PRECURX	-.4209594172E-01	.89469965E-01	-.471	.6380	2.6279070
MISSION	.2170141143	.11040794	1.966	.0493	3.7674419
ACCESS	.5740470008E-01	.83668510E-01	.686	.4927	3.3779070
ACTIVE	.6461527558	.15926173	4.057	.0000	3.0093023
CULTURE	-.1019727908	.92504692E-01	-1.102	.2703	3.1860465
Disturbance standard deviation					
Sigma	.3035078191	.32728090E-01	9.274	.0000	