A SURVEY ON THE IMPLICATIONS OF CHINA ON COMPETITIVENESS OF MALAYSIAN HIGH TECHNOLOGY INDUSTRIES

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ABSTRACT

This study examines the export competitiveness of the high technology industries of Malaysia using the revealed comparative advantage measure from 1993-2001 Overall, the results indicated that Malaysia has a comparative advantage in the high technology industries especially in electronic-telecommunication and computer exports compared to China. Indeed, China's overwhelming economic growth promises opportunities for Malaysia to export these high technology products. It was also found that in general, China is in the process of developing its competitiveness in the high technology industries as shown by the upward trend in the revealed comparative advantage indices. The study concludes with policy recommendations concerning the future development of these industries.

JEL classification: F1, F14

Keywords: Trade Specialization, Revealed Comparative Advantage, Export Structure, High Technology Industries.

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1. INTRODUCTION

Recent trends show that high technology industries are those expanding most strongly in international trade. According to a study by Sunil Mani (2000) developing countries have increased their participation in the technology content exports by nearly a quarter of the total manufacturing exports. The share of technology exports increased significantly from 8% in the year 1988 to 23% in the year 1997. However the trend was concentrated to few developing countries. It has also been noted that many economic difficulties of Southeast Asian are attributed to the failure to produce and export more skill and technology intensive products in the face of competition from China as well as India

Following the trend of the international trade on high technology products, countries like Korea, Singapore India, Malaysia and Thailand marked a shift in production away from the simple technology (labor intensive technology) towards more sophisticated technology lines of production particularly in electrical and electronics, non-electrical machinery and transport equipments. Studies have also associated significant productivity growth with these structural changes within manufacturing production and export trade. (Cooper Charles, 1995) In addition, many believe that these sectoral shifts will ultimately upgrade the technology of the firms.

A new challenge in the recent development of international trade is the accession of China in the World Trade Organization (WTO). China's wider integration with the world economy poses many challenges particularly to the export dependent countries of the developing economies. It is a well known fact that since the 1980s, China has been a tough competitor in the major exports for labor-intensive manufactures (including textiles, clothing, leather and electronics) to many ASEAN countries. Indeed with China's average annual Foreign Direct Investment (FDI) growth rate of 36.5 per cent for the period of 1990-1998 has threatened Malaysia as one of the attractive countries to investors. The FDI Confidence Index in 2001 indicated China as the second most attractive country while other ASEAN countries, except Thailand, remain relatively unattractive to investors.

In light to the above scenario, however, it is unclear whether the high technology industries suffer from the same phenomena as the labour intensive industries. This study has investigated the international competitiveness of Malaysian high technology export industries. Indeed the study also compared the performance of China and Malaysia in the high technology industries in terms of revealed comparative advantage. This attempt was triggered as a result of the research gap on the implication of China's trade liberalization to Malaysia, particularly in the high technology industrial exports. This study will be able to provide some insights on the future prospects and challenges of the high technology industries of Malaysia

2. LITERATURE REVIEW

A number of previous studies have investigated the implication of China's accession to WTO. However, the findings suggested mix evidence on its effect towards the developing countries. In fact, only few studies have concentrated on finely disaggregated export data.

For example, a study by Tham (2001) indicated that Malaysia still has the comparative advantage in a number of the high technology industries with the commitment of Japanese Direct Investment. The study also suggested that future development of these industries might suffer greatly as Japan struggles to restructure its own economy. Indeed the emergence of other ASEAN members in these industries pose greater challenges for Malaysia. Indeed, a study by Liu et al. (2000) confirms that China has remained competitive in the low technology and labour-intensive industries and in the process of developing competitive advantage in a range of medium and high technology industries. In fact, other studies (Adhikari and Yang, 2002, Ianchovichina and Martin, 2001), have also indicated the potential benefits that China might promise to the developing countries.

On the other hand, a number of researchers have also shows that China's openness as a threat to the other economies. For instance, Herschede F. (1991) concluded that ASEAN suffered the most by the entry of China in the Japanese market compared to NIEs, which maintained a better performance particularly in the exports of manufactured products to Japan. It was also found (Tyers et al. 1987, Voon, 1998, Mckibbin and Woo, 2003,) that many developing countries face stiff competition in a number of products as a result of the China's trade expansion and openness. However, it was found that the growing competition is more intense in the resource, low and medium skilled intensive industries

3. FRAMEWORK OF ANALYSIS

This study applied some of the descriptive statistics mainly in analyzing the contribution of the high technology industries and the trade progress in Malaysia and China. This in return provides an overview of the state of high technology industries in Malaysia and China.

Since the issue presented in this study deals with the competitiveness of Malaysia's export of high technology industries in relation to China, the Revealed Comparative Advantage (RCA) is used as a proxy to identify the state of competitiveness. This index is widely used in the empirical work as it assumed that a country's competitiveness is reflected in the trade pattern. In this study we will be adopting the Balassa's method to compute the RCA.

The mathematical expression of RCA is expressed below

$$RCA_{ij} = (x_{ij} / X_{it}) / (X_{wj} / X_{wt})$$

Where

x_{ij} = The value of country's export of product j

X_{it} = Total export of country i

* *w subscript denotes the world total*

This index will reveal whether a particular country does or does not have a comparative advantage by calculating the country's share in the export of a given product category relatively with the share in the world exports of the particular product. A product, which reveals RCA greater than 1, indicates that the country has the comparative advantage in that particular product. RCA below 1 indicates the country has a revealed comparative disadvantages.

4. DATA AND TIME FRAME

Export data was obtained from the United Nations, International Trade Center PC-TAS CD ROM. The export data used in this study was at 4 and 5 digits Standard International Trade Category (SITC) level. The time frame selected for the study was from 1993 to 2001. In addition the classification of high technology industries was based on the 8 important industries as indicated by Hatzichronoglou, T. (1997). For a detailed description of high technology industries, refer to Appendix A.

5. FINDINGS

5.1 OVERVIEW OF HIGH TECHNOLOGY INDUSTRIES

In the late 1970's and early 1980's Malaysia has emphasized on shifting the economy to a manufacturing base and this changes focuses on high-technology industries. The key strategic change occurred with the development of First National Science and Technology Policy in 1986. A number of institutions were established to stimulate technology based industries and industrial technology development such as Malaysian Technology Development Corporation (MTDC), Technology Park Malaysia (TPM), Malaysian Institute of Microelectronics Systems (MIMOS), Standards and Industrial Research Institute of Malaysia (SIRIM), Malaysian Institute for Nuclear Technology (MINT), and other private sector representatives such as Malaysian Industry Government Group for High-Technology (MIGHT) and the Malaysian Business Council. The goals were to ensure that Malaysia continuously achieve scientific and technological development to accelerate economic growth, industrial development and technologically

advanced society. Indeed, similar to Japan and South Korea, Malaysia has also spent heavily on infrastructure, information technology and modern facilities under the program called Vision 2020.

Government support in expediting high technology based enterprises has to some extent shifted the manufacturing activities in the high technology based industries. Table 1 below indicates the contribution (in percentage) of high technology exports in Malaysia and China to the total manufactured exports respectively from the year 1993-2001. Data illustrates the importance of high technology exports for Malaysia. Malaysia has gradually progressed the technological ladder and managed to concentrate in technology intensive activities. Malaysia's total share of high technology exports increased from 41% to nearly 57% between 1993 and 2001. Half of the total manufactured exports of Malaysia consists of high technology exports. Relatively China has also shown an increase in the total share of high technology exports between 1993 and 2001 from 6.9% to 20.5% but relatively lower than that of Malaysia.

(table 1 about here)

However, an important point to be noted here is the capability of the latecomer to industrialization (China) in expanding its export of high technology products. Both the countries showed a similar composition of high technology exports. Malaysia and China's high technology industries were concentrated in electronic-telecommunication[1] and computers-office machines products following the world trend of dynamic products. One particular difference is in the chemical industries where China's shares are relatively larger than that of Malaysia's. China has also shown improvement in the scientific instruments exports as its share increased from year to year.

In terms of export market it is evident that China has gradually expanded its high technology exports to the major markets. Table 2 and 3 show Malaysia and China's high technology exports to the European Union[2], US, Japan and the world. Malaysia has significant market share for computer, and electronics-telecommunication exports to all the three markets. It is more dominant in the electronics-telecommunication exports where Malaysia still has a large portion of exports to EU, US and Japan compared to China. At a disaggregated level the major markets in the EU for Malaysian electronic-telecommunication industries, mainly semiconductors, are United Kingdom - electronic microcircuits (SITC 7764), Netherlands – electronic microcircuits (SITC 7764) and Germany - diodes, transistors etc. (SITC 7763) and electronic microcircuits (SITC 7764). Same trend has been exhibited for the Japanese market where Malaysia shows relatively higher exports to Japan in electronics-telecommunications product. However, China is also showing progress in the electronics-telecommunication exports to these

[1] Include consumer electronics, telecommunication equipments and semiconductors

[2] EU consist of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden & United Kingdom

markets where their market shares are increasing in absolute value between 1993,1996 and 2001. These indicate China's ability to catch up in the high technology exports to those markets.

In the computer exports, China relatively exports more than Malaysia especially to EU and shows a dramatic improvement in the US market. Malaysia has only overtaken China marginally (in absolute value) compared to China. Disaggregated data on the computer exports of Malaysia revealed that the highest performing products to EU are storage & data processing units (SITC 7527) and parts, auto data processing machines (SITC 75997) to Netherlands and parts, auto data processing machines (SITC 75997) to United Kingdom. Indeed the close technological and industrial relations between Taiwan[2] and China are also affecting Malaysian progress in the computer exports. For instance, many Taiwanese investors and other major semiconductor manufacturers are rushing to strengthen their chip development, design and wafer plant in China[3].

(table 2 about here)

In comparison of the export to the world between Malaysia and China, data revealed that high technology exports of China to the world has increased significantly from US$ 5177587 to US$ 48944712 in 2001. China showed a great improvement in high technology exports and managed to overtake Malaysia in the year 2001. At disaggregated level by industries export, telecommunication exports are relatively larger in Malaysia compared to China. However, comparing the raw data between both the countries indicates a worrying trend of the high technology exports of Malaysia. Many of the high technology industries of China have shown a dramatic improvement and in some cases have outperformed Malaysia especially in the recent years. For example, China's computer exports have managed to capture a larger portion of the world export market in the year 2001. If this trend continues, Malaysia may face tough competition in securing its market for such industries.

(table 3 about here)

5.2 Revealed Comparative Advantage

Figure 1 provides a summary of the RCA index for the selected high technology products. The RCA suggested that Malaysia has comparative advantage in the production of telecommunication, computers-office machines and electrical equipments as shown by the RCA index, which is more than one. The

[3] Taiwan controls nearly 70% of the global production of motherboards & indirectly another 15% shipped complete PC sets. Its also produce 55% of all notebooks and design

scientific instruments, non-electrical, chemistry, aerospace and pharmaceutical industries are below the performance of the world suggesting comparative disadvantage for Malaysia.

(figure 1 about here)

In comparison, (Figure 2) China's comparative advantage remains in chemical and electrical products. One interesting point to note is that after 1998 there is a slow improvement in the computers-office machines and telecommunication exports. This indicates the attention that China has given to the computer and telecommunication sub-sectors as it represents the fast growing industries of the world following the overwhelming demand for electronics consumer goods. More importantly the expansion of China's sub-sector of computer and telecommunication will be a threat to Malaysia.

(figure 2 about here)

In addition, Malaysia's comparative advantages in the computer, electrical and telecommunication industries are highly vulnerable as the performance of these industries is very much dependent on the Foreign Direct Investment (FDI). Many of these industries are largely monopolized by foreign technologies. For example, Malaysia is notably the biggest exporter of split air conditioners and domestic refrigerator but the technology employed are largely foreign. This may indicate that shift in the Foreign Direct Investment will significantly jeopardize the export performance and competitiveness of Malaysia. With the recent flow of FDI to China it is notable that more foreign expertise has moved to China. Even to the extent that complementary industries, especially service industries such as information technology and logistics show a significant existence in China. For example, more foreign companies in the information technology service industries have invested in China as a result of the expansion of China. Based on table 4, China has remained the most favored country among investors as the amount of investment jumped to US 41,614 million in 1998-2000. On the other hand, Malaysia has significantly dropped in terms of rank from the second position in 1991-1993 to the 6th position in 1998-2000. Glancing through table 4 also indicates that Malaysia face competition from the other ASEAN members in securing FDI especially Singapore and Thailand. Realizing that Malaysian high technology exports are heavily dependent on FDI future failure to secure FDI may challenge the high technology exports of Malaysia.[4]

(table 4 about here)

[4] Although the government has diverted its effort to improve human capital, intellectual property management, investment in education, at this moment the only short cut to boost export of high technology is by attracting more FDI especially from the more willing countries such as US and Japan. Will the previous investment attracting strategies such as tax holidays and relaxing other barriers work remain a question mark as now China provides a bigger share of domestic market?

However at this point of time it can be concluded that on the whole, Malaysia still enjoys higher comparative advantage (which is indicated by higher RCA above 1.8 compared to China) for many of the high technology products namely electronics, telecommunications and computers-office machines. Indeed Malaysia has the first-mover advantage in computers-office machines and electronics-telecommunications industries relative to China and these industries can be categorized as a potential leader of Malaysia. With the establishment of Multimedia Super Corridor flagship, these industries would be able to prosper in the near future, as more know-how and research and development would supplement the future developments of the industries. Even if China's ability to lure foreign direct investment increased, Malaysia still promises a good ground for the investors particularly in the high technology industries since it requires a lot of engineering know-how and expertise. In addition technological industries will find Malaysia more attractive since Penang has stayed active for decades as a technological corridor for Malaysia. Perhaps with the better-developed infrastructure and communication networks (where China is lacking behind) Malaysia still is the favourable nation.

Indeed a large share of FDI flowing into China were concentrated in low technology manufacturing which is to develop products specifically for China's gargantuan domestic market. The economic survey of Singapore concludes that FDI inflow to China is not at the expense of Southeast Asian nations.

5.2.1 Disaggregating Telecommunication Exports

The electronics-telecommunication sectors can be subdivided into consumer electronics (SITC 76381 & 76383), telecommunication equipments (SITC 7641-43, 7648, 76491-92), and semiconductors (SITC 77625, 77627, 7763-64, 7768 and 89879). The disaggregated data of Malaysia's electronics-telecommunication (Figure 3) revealed that consumer electronics exports namely other sound reproduction apparatus (SITC 76383) were improving as a whole Wherelse for the telecommunication equipments exports microphones, loudspeakers and amplifiers (SITC 7642) and line telephone equipments (SITC 7641) were the leading industries with parts, line telephony equipments (SITC 76491), parts, microphones apparatus (SITC 76492) and TV and radio transmitters etc (SITC 7643) being the worst performers. In the semiconductors sector, diodes, transistors (SITC 7763), electronics microcircuits (SITC 7764) and electronics comp. crystals (SITC 7768) were the prominent sectors.

(figure 3 about here)

In China, the most promising high technology industries are other sound reproduction apparatus (SITC 76383), microphones, loudspeakers and amplifiers (SITC 7642), parts, microphones apparatus (SITC 76492) and printed circuits (SITC 7722) and others being below RCA 1(Figure 4). One point that is worth mentioning here is the progress of the sub-sector (SITC 76381) where the RCA index declined

after the year 1997 for Malaysia and in return soars in the case of China. This may imply that China is fast catching up relative to Malaysia in this particular sub-sector.

(figure 4 about here)

However the overall performance of electronic-telecommunication exports of Malaysia are impressive as 10 out of 17 telecommunication sub-sectors have a RCA above 1 compared to China with only 6 sub-sectors. This paper strongly supports that Malaysia still maintains its comparative advantage in the electronics-telecommunication sectors despite China's strong growth in exports. Malaysia should also further enhance its sectors as a measure to be ahead of others in the future, for example; investment should be attracted to the development of wafer plant, which is very essential for the semi-conductor sub- sector.[5]

5.2.2 Disaggregating Computer Exports

The dominant sub-sectors among the computer industries in Malaysia are parts, auto data processing machines (SITC 75997) where it gained competitive position through the year of study. The other sectors such as analog or hybrid computers (SITC 7521), storage units & data processing (SITC 7527) and digital computers (SITC 7522) only showed improvement after 1997(see Figure 5). In contrast, China shows comparative advantage in auto typewriter, word processing machines (SITC 75113) and after 1995 in electrostatic copier (SITC 75132) and input and output units (SITC 7526). However by looking at the progress of its RCA in sub-sector auto typewriter, word processing machines (SITC 75113), it indicates that the sector is less stable (see Figure 6). The individual profile of specialization between Malaysia and China are in different sub-sectors, which poses more advantage for Malaysia to progress, as China may not be the close competitor. However as a whole the total computer exports results shows only a marginal difference between Malaysia and China. It can be said that in the near future China would potentially overtake Malaysia. Indeed the progress of China in the computer exports will accelerate with its geographical and increasingly symbiotic relationship with Taiwan and South Korea.[6]

(figure 5 & 6 about here)

From the above discussion it can be noted that relatively Malaysia showed highest comparative advantage in the electronic-telecommunications industries compared to China. Realizing this Malaysia's export development model should emphasize on the regional collaboration with China as it had become

[5] In Malaysia wafer fabrication plant exists in Kulim High Technology Park, a joint venture with a foreign partner in 1997.However China's effort to close the technological gap has made the government to develop and attract more than 400 semiconductor design centers and currently 7 wafer plants are under construction.

[6] While Hong Kong's strength lies in services like finance, airlines and shipping, Taiwan has the advantage of being a global player with its own brands for manufacturer of computers and its component parts. Indeed Chinese government's incentives have encouraged more Taiwanese to invest in the Mainland. Furthermore, to win contracts US companies are forces to transfer sophisticated technology to the Chinese joint venture partners

more significant to Asian economies. The electronic-telecommunications industries should wisely promote and access the available market opportunities and benefit from China's prosperity and stability. Despite the decreasing price of telecommunication products, the demand for these products is expected to grow further in the future with the development of other industries and the acceleration of the China's economic growth. Indeed telecommunication is also a supplement industry for the development of other industries of China. Malaysia should widen ties and scope of mutual cooperation in the telecommunication products to reap the benefit.

6. POLICY DEVELOPMENT FOR SUSTAINING COMPARATIVE ADVANTAGE

The performance of export were very much dependent on the foreign direct investment especially in Malaysia. However associating FDI and export competitiveness falls beyond the policy of making Malaysia as the hub for investors. It is important that government policy towards resource availability, openness, human capital and technical advancement be more proactive. Indeed these changes are highly influential factors for the competitiveness of the high technology products. The factors listed below are not only important to create better environment for the investors but also essential component of the new era of knowledge-based economy.

6.1 Developing Diversity in Key Industries

Comparing the labor cost of selected Asian countries (Table 5) there is no doubt that China has its cost advantage with low labor cost (472 and 729 between 1980-84 and 1995-99 respectively). Malaysia on the other hand has a higher labor cost especially in the recent years compared to China, Thailand, Indonesia and Philippines. However, one priority that Malaysia should consider, to be ahead of China, is to enhance its products in terms of diversity in aspects of design and quality. In fact manufacturing value added in Malaysia is far better (increase by 49.8% between 1980-84 and 1995-99) compared to China (-5.7%). This should be an area of opportunity for Malaysia to utilize and explore.

(table 5 about here)

Despite China's expanding market for electrical and electronics, the poor quality of the products makes it an unfavorable choice among consumers. Many studies also suggest that true competitiveness lie on the nation's ability to yield greater value-added industries in order to upgrade itself from labor-intensive industries to high technology intensive industries. Indeed Malaysia would be able to compete despite similar export profiles and similar competitive nature of trade structure if diversity could be developed in the manufactured products. Malaysia should also attract investment that will create a lot of value. Quality and standards play an important role in building international competitiveness especially competency in industrial, engineering and product designing. By working closely with the global players Malaysia

would be able to establish a reputation for quality control, low costs and technological superiority. For example, Thailand's experience in auto parts could be a good lesson on how they have managed to capture the market for auto parts. In Thailand, local suppliers of car parts work closely with the Japanese carmakers and today Thailand made parts are shipped worldwide as they have established a high quality. In this case even if China enjoys a lower cost base internationally it will find it difficult to compete with Thailand, as China is not known for quality. Indeed establishing precision and high quality would mean securing higher export market share. In addition manufactures would also be able to climb up the value chain by learning and being more innovative. An early start may mean leaving the competitors such as China behind the race for competitiveness. In Malaysia, under the National Action Plan on Industrial Technology Development strategies were focused on setting up a National Center for Product Design and Development that could encourage the development of specialized quality of the emerging industries. With regard to the prospect industries, telecommunication and computers would certainly need to be included.[7]

Furthermore, Malaysia can fast become a significant player in the Chinese market if cooperation and economic ties is been established between the nations. Recent visit by Prime Minister, Abdullah Ahmad Badawi has marked the effort of future economic cooperation and one area of interest should be the industries specified earlier.

6.2 Clustering of Industries

According to Porter, (1998), the competitiveness of the nations is determined by productivity growth. How a nation uses its human, capital and natural resources will determine a firm's competitiveness in the same industries. Cluster development holds the key for productivity growth and competitiveness. Porter suggested that locating critical masses of linked industries and institutions in one place help firms to enjoy competitive success. Clustering benefits the industry by providing efficient concentration of supplier, efficient access for information, close relationship and coordination, enhanced diffusion of knowledge on best practices and stimulate innovation. For example, Australia successfully developed clusters in growing grapes for wines and countries like Portugal, China and Romania are famous footwear clusters for production of lower to medium price range shoes.

In this respect Malaysia should be more proactive in establishing cluster developments. In Malaysia the Second Industrial Master Plan adopted a cluster based industrial development to sustain the growth of the manufacturing sector. One promising cluster development in Malaysia is the creation of the Multimedia Super Corridor where it promises to be renowned, vibrant and strategic regional hub for

[7] MIGHT, a non-profit company providing a platform for government and industry collaboration focused on aerospace, advanced materials, telecommunications, pharmaceuticals, low emission vehicles, housing and construction sectors for national development.

information technology trade and services, educational services, medical services and telecommunication. However of late, high-technology investors are shying away from Cyberjaya forcing the government to market its project as affordable alternative for call centers, back office operations and low tech administrative subsidiaries. Furthermore, the adoption of cluster based industrial development does not show significant concomitant growth of the supporting industries that will fuel the engine of growth for the economy. In fact SMEs contribution as the key suppliers to the locally based larger firms and the export market should be fully integrated along the manufacturing value chain. Lack of coordination and linkages between industry, research institution and government has served as the blocking agent for the cluster development.

6.3 Information, Communication and Technology

Recent literatures tend to emphasize the role of Information, Communication and Technology (ICT) as the driving force for economic and industrial performance. A report by Ferranti de David, et al. (2002), clearly indicated the influence of ICT on the structure of trade. Indeed this basic result shows a high fit of regression between ICT index (including communications, computer penetration, and access to the Internet) with income per capita. Investment in technology and research and development has to be improved to reap the benefits of international competitiveness. Example, learning from the world's broadband leader such as South Korea (it has invested $850 million in broadband infrastructure and promise another $850 million over the next four years) would improve the competitiveness of the Malaysian industries. Many other countries (Singapore, Japan and Canada) are aggressively progressing in establishing and making broadband infrastructure available to the industries and public. In Australia the information economy is seen as the key ingredient to business survival. Indeed improvements in ICT infrastructure are critical to productivity. For example, through video conferencing, people work faster and more efficiently. In addition deploying broadband means a cheaper solution for entrepreneur and business. The ICT development is also crucial in fostering knowledge worker where these types of workers are highly needed as Malaysia moves towards technology driven industries

Competitiveness can be viewed in the sense of lowering production costs, which focuses on improving efficiency and productivity. Lower wage rate is not the only attraction that promises growth but also the productivity driven economy and in these aspect Malaysia has the advantage of overriding China and other ASEAN economies. Referring to Table 6, comparatively Malaysia is ranked number three as a whole, promising better establishment of ICT. Since Malaysia has better ICT establishment, its success in altering its export structure towards high skill activities or its capability in developing high technology industries is ahead of China. Of course the other caveats apply to the development of the high technology industries such as Asian crisis, sluggish US market, and SARS.

(table 6 about here)

Many business models for example, Dell and AirAsia have proved that ICT could be used as the tool for global competition with the establishment of global marketing through Internet and at the same time keeping the cost at the lowest. Information technology has proved even more potent in stimulating the productivity growth. However, it takes a few years to get down the learning curve and figure out ways to use it. For example, many companies in the US are only now making full use of computers and software bought during the tech-spending boom that ended in 2000. Emphasizing Malaysian policies to gear up the usage of IT would provide an earlier start for productivity growth. Despite productivity growth, ICT improvements are also a key element in attracting FDI which serves as the short cut for Malaysia's export competitiveness.

6.4 Nourishing Human Capital Through Education

Roles of education, training and dissemination of information is vital for the process of industrialization especially for the high tech industries. The continued surge for productivity through education is a key factor in strengthening a firm's profit even as growth remained tepid. For example, with the rapid expansion of competition, pricing power remains non-existent in many sectors yet ever improving productivity has enabled firms to squeeze costs and rebuild their bottom line. Even, the Corporate Sector Survey in 1998/1999 (cited by Malaysia, 2000) has indicated that firms employing workers with higher education (diploma/degree) are able to withstand the economic crisis better than those who are not. The progress of these high tech industries of Malaysia may suffer because of the weak human resource base, in particular a lack of well-qualified secondary and tertiary educated workers. One essential policy issue would be building up a well-defined infrastructure for education and the development of a science oriented society in line with the industrial needs. Indeed recent studies suggested that required skills of employees in four main industrial clusters that are highly dependent on knowledge such as computers & semiconductor, telecommunication, instrumentation, health and medical products have risen greatly. With proper supply of skilled labor, Malaysia (in which China is lagging behind) could develop an attractive atmosphere for the flow of FDI in the high tech industries. The best contribution the government can make is to work on knowledge producing agendas. Progressive measures in facilitating the creation of knowledge based economy through information highway and smart schools should be given top priority for economic growth as well as for the development of high technology industries. Strengthening of the vocational and technical training schools should be emphasized to a great extend in facilitating the growth of the high technology industries.

Table 7 shows a comparison between countries on the status of student literacy and enrolment. Malaysia has done fairly well in the adults and young literacy rate compared to other countries. However these raw data may be insufficient to say that Malaysia has the needed human resources to fulfill the needs of the high tech industries. In addition high literacy and enrolment rate do not reflect the quality of education that is available and recent rapid expansion of new educational institutions (colleges, universities and training institutes) does not promise a great return if the quality of graduates deteriorates and if a large portion of the programs available in these institution are focused towards non-science and technical subjects. Another alarming situation for Malaysia and other Asian countries compared to China is the low level of tertiary student enrolment in science math and engineering where China has a higher percentage (53%) of enrollment.

(table 7 about here)

To gain competitiveness in the high tech industries Malaysia should find ways to increase its tertiary enrolment in these subjects. China will have an added advantage and higher capability in supplying workforce to the high tech industries in the future considering the high enrolment in science and technical subjects. In maintaining and gaining the competitive edge on high tech areas, strategies in development of human capital should focus on the shift in the education policy from focusing on basic education to a focus on supply of high tech human capital and from learning to performing. In other words, learning by performing in real business environments and in a systemic network rather than in a vacuum or formal training institution is vital. The industrial and vocational institutions should establish a network with the industries for better synergy and in future to reduce the demand supply deficits of the high tech industries. For example, a study by Rajah Rasiah (2001), indicated that Penang and Klang Valley[8] failed to enjoy sufficient supplies of high tech human capital because of lack of effective coordination of supply and demand of high human capital. Building technological capability in Malaysia owes its existence to an early nurturing of its human capital and strong commitment by the government to support a new education system that fosters creativity, innovation and critical thinking. Malaysia has realized the importance of technology and has begun making large investments in this area however it is virtually impossible to gain without having a better higher education. In order to move into higher manufacturing industries, strategies and policies in Malaysia should focus on four distinct areas. There is an urgent need to:

1. Place greater emphasis on enrolment of tertiary students in science, mathematics and engineering and tertiary level curriculum should emphasis on basic and applied science and technology
2. Enhance coordination and linkages between the higher education institution and industries

[8] Export oriented MNCs began relocating on a large scale in Malaysia following the opening of Free Trade Zones and Licensed Manufacturing Warehouse. Penang is the larges in terms of firm numbers, employment and value added, followed by Klang Valley.

3. Expand creation of knowledge workers by emphasizing in quality of education rather than quantity. This includes quality of students, quality of teachers, learning aids, school facilities and others.
4. Provide vocational and technical education and training with the motive to supplant the industrial needs rather than for the purpose of encouragement

6.5 Managing Technology Commercialization and Intellectual Property

Given today's competitive environment the development of new products and processes will be the lifeline of the success of export industries. Opportunities should be created through academic research especially by encouraging the partnership between universities, research institutions and the private sector. Potential research projects in any of these institutions should be identified and given the support necessary to facilitate the flow of innovation and new ideas. Innovations are the indicators of the high tech industries competitiveness. Two key factors contribute to the innovation in high tech industries. One being the notion as whether businesses, government and cultures encourage the high tech development and, second being the socioeconomic infrastructure such as physical, human resource and financial support for modern technology based economy. Based on Table 8, it is evident that Korea and Singapore (high patent grants and royalties) have an understanding of the relationship between innovativeness and exporting meaning to say that they intended to improve competitiveness by being more innovative. Malaysia needs to foster more innovativeness and thus improve its competitiveness especially among the local companies and the Small Medium Enterprises (SME).

(table 8 about here)

Apart from being innovative Malaysia must also spring to the mind of investors as the center of technology venture capital. Malaysia is capable of channeling much investment capital into tech startups with better intellectual property protection. One move towards encouraging venture capital to invest in Malaysia is by improving the law that will safeguard intellectual property. Even Russia with her handful of skilled technical talent and supply of unemployed engineers has experienced little investment in high tech because of Russian law, which doesn't safeguard intellectual property. China might also been unfavorable for investors of high technology industries as the effect of the low protection of intellectual property in the country.

6.6 Research and Development

Technological effort is vital to Malaysia, even though it is clear that they are not “innovating” at the frontier. Another policy issue concerning the survival of export industries is the strength of research and development activities in Malaysia. So far Malaysia has learned to use the imported new technology and equipment from the more advanced countries. However, it is time to upgrade Malaysia from the assembly stage to manufacturing, designing and development of new products. In this respect China is unique because of its size, industrial tradition, background and overseas ethnic linkages such as Taiwan and Korea. It can combine its uniqueness into its own policy to restructure and develop domestic enterprises.

Enhancing total factor productivity by improving technological know-how, innovation, gains of specialization, increased efficiency as well as workers education, skills and experience is vital. The Corporate Sector Survey in 1998/1999 has shed some light on the firm level total factor productivity. Results of the survey suggested that firms, which reported higher TFP, are those that conducted training and R&D, semi-automated and utilized new machinery. The survey also suggested that firms, which withstood the economic crises, are those that have higher TFP and those that spent more on training and Research and Development (R&D).

Comparing the R& D expenditure and the number of scientist and engineers (Table 9) it is clear that Malaysia is still lagging behind many of the other nations such as China and Singapore. The government should focus on shaping the national system of innovation, and provide more proactive R & D infrastructure to enable the progress of the exporting industries. Furthermore apart from depending on the Multinational Companies local talent should be cultivated.

(table 9 about here)

6.7 Development of Small Medium Enterprise

Malaysia should also focus on the development of the Small Medium Enterprise (SME) realizing that their out of date export oriented economic models are vulnerable to the depressed global demand. It is acceptable to conclude that vibrant and healthy economy depends on the competitive advantage of the strong and dynamic SME sectors. In addition, these SMEs play an important role in a sub-contracting or supply chain relationship to large organizations. Participation of SMEs is an important part of our national economic development realizing the flexibility of SMEs over the Multinational Corporations. Better integration with the world is vital for the development of exporting SME of Malaysia. In recent

years with disgusting financial status and shoddy corporate governance the SME may become drivers of the 21st century economy. For instance, as an ideal long-term strategy SMEs in Korea have started cultivating their own brand despite simply being the supplier of chaebol (large industrial conglomerates). Encouragement should be given for the SME to develop and adopt the best international practices in strategic management and advance technology. Seoul is spending $75 million over three years to give small business online access to share some of the business tools (same tools that the big companies use) in the area of planning, management and accounting. This was implemented in an attempt to increase efficiency, to hook SMEs into the bigger company supply chains, which are largely powered by internet and to improve productivity

7. CONCLUSION

Looking at the trend of development in the high technology industries it is evident that Malaysia still has the comparative advantage over China in many of the electronic-telecommunication and computers sub-sectors. Indeed with proper strategic alliance, China's economic growth promises a huge market potential for Malaysia in the high technology industries especially in the areas where Malaysia has its comparative advantage. However long term outlook comes with a caveat especially with a favourable flow of FDI from Taiwan and Korea, which would improve technology content of the Chinese manufacturing industries[9]. From the long-term perspective it is important that Malaysia improves its high technology industries with the complement of better education, development of SME, managing product diversity and improving ICT in an attempt to provide high quality products. The new economic policy of Malaysia seems to considerably emphasize the importance of the above-mentioned variables. However, proper implementation and management would be a critical factor for the success.

[9] In a survey of 245 companies, out of which 146 were conglomerates, China is expected to overtake Korea in technological competitiveness within 4 years in electronics and information technology sectors. Factors contributing to the success are fast technology transfer from MNC, aggressive government led technology developments and excellent research pools. (Federation of Korean Industries cited by Yeon J. S., in Korea Times)

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TABLES

TABLE 1: STRUCTURE OF HIGH TECHNOLOGY EXPORTS OF MALAYSIA AND CHINA (Percentage of total manufactured exports)

Country/Year	PRODUCTS								
	Total High Tech	Aerospace	Chemical	Computers -office machines	Electrical	Non-Electrical	Pharm.	Scientific	Telecom
Malaysia									
1993	40.53	2.18	0.10	8.21	0.40	0.11	0.02	1.13	28.39
1994	43.53	3.34	0.09	10.49	0.43	0.06	0.02	1.04	28.05
1995	45.29	2.12	0.17	11.92	0.40	0.06	0.03	1.03	29.56
1996	43.76	1.32	0.17	11.42	0.30	0.07	0.02	1.01	29.45
1997	48.28	0.96	0.19	15.50	0.30	0.07	0.03	1.25	29.98
1998	54.14	1.64	0.25	18.87	0.27	0.09	0.03	1.12	31.86
1999	58.15	0.80	0.21	23.03	0.35	0.11	0.03	1.01	32.61
2000	58.84	0.21	0.23	23.99	0.55	0.09	0.03	1.22	32.52
2001	57.38	0.36	0.28	21.04	0.49	0.11	0.02	1.75	33.33
China									
1993	6.93	0.18	1.12	1.75	0.30	0.05	0.49	0.86	2.18
1994	8.01	0.11	1.05	2.12	0.35	0.04	0.50	0.81	3.02
1995	10.06	0.08	1.38	3.16	0.31	0.05	0.57	0.96	3.55
1996	12.07	0.09	1.31	4.48	0.34	0.07	0.57	1.12	4.09
1997	12.72	0.04	1.26	5.06	0.36	0.06	0.49	1.27	4.18
1998	14.90	0.09	1.25	6.46	0.38	0.06	0.52	1.33	4.81
1999	16.71	0.17	1.13	6.77	0.49	0.08	0.48	1.41	6.17
2000	18.48	0.11	0.97	7.45	0.48	0.09	0.39	1.53	7.45
2001	20.46	0.07	0.95	8.96	0.50	0.08	0.41	1.25	8.24

Note: pharm refers to pharmaceutical and telecom refers to electronic-telecommunication
Source: Author's calculation based on COMTRADE database

TABLE 2: MARKET PROFILE OF HIGH TECHNOLOGY EXPORTS (MALAYSIA)

(Value in US DOLLARS THOUSAND)

PRODUCT	EU			US			JAPAN			WORLD		
	1993	1996	2001	1993	1996	2001	1993	1996	2001	1993	1996	2001
Aerospace	46850	11958	47828	397656	367755	67374	185	146	13563	725262	792982	255460
Chemical	230	18779	52881	2974	4351	8098	172	1639	32697	32549	103212	196091
Computer	291387	1195302	1996955	843412	1897000	4949817	179840	520307	1508530	2730691	6856989	14980678
Electrical	31813	35515	42384	41238	18946	34231	2090	7643	51705	133145	180264	350518
Non-Electrical	14424	2279	6808	2084	4580	9477	608	6214	3165	35293	43712	75422
Pharm	73	555	3142	-	-	938	-	-	118	5478	14525	17692
Scientific	111824	152094	313360	123232	197489	457997	61444	78262	160725	376076	760055	1249593
Telecom	1580291	2541864	3983219	3742636	5261700	6080379	809935	2028496	2127236	9440470	17685590	23733363
Total												

Source: Author's calculation

TABLE 3: MARKET PROFILE OF HIGH TECHNOLOGY EXPORTS (CHINA)

(Value in US DOLLARS THOUSAND)

PRODUCT	EU			US			JAPAN			WORLD		
	1993	1996	2001	1993	1996	2001	1993	1996	2001	1993	1996	2001
Aerospace	3867	7856	47815	8080	8789	41203	62	125	1338	137933	116904	177964
Chemical	174571	343069	495747	153703	178985	243486	106613	253189	358515	834295	1688509	2275966
Computer	375508	1314749	4629178	379190	1487307	4814200	160768	674090	1974892	1304600	5772315	21424048
Electrical	12749	29817	138175	56992	94982	140330	4908	21950	123410	222490	433295	1198842
Non- Electrical	3442	9054	30791	7572	17113	50176	1381	24516	53179	38975	89741	199518
Pharm	131926	276846	268057	22738	52044	193592	26684	43631	36805	365684	737961	990345
Scientific	84777	250654	606575	175113	319329	782901	132630	486376	543188	645883	2012691	2979818
Telecom	207916	609139	3282833	428232	1257200	4773416	141855	680989	1893685	1627727	4413280	19698211

Source: Author's calculation

TABLE 4: TOP 10 FDI DESTINATIONS IN DEVELOPING ASIA (ANNUAL AVERAGE, US MILLION)

Rank	Country	1991-1993	Rank	Country	1998-2000
1	People's Rep of China	14,346	1	People's Rep of China	41,614
2	Malaysia	4,729	2	Hong Kong, China	33,768
3	Singapore	3,926	3	Korea, Rep. of	8,009
4	Hong Kong, China	2,082	4	Singapore	7,866
5	Thailand	1,978	5	Thailand	3,839
6	Indonesia	1,754	6	Malaysia	3,466
7	Taipei, China	1,022	7	Taipei, China	2,692
8	Korea, Rep. of	832	8	India	2,373
9	Philippines	670	9	Vietnam	1,491
10	Vietnam	537	10	Philippines	1,190
	Total	31,877		Total	106,309
	(Percentage of World Total)	17.3		(Percentage of World Total)	9.7

Source: Asian Development Report (2003)

TABLE 5: LABOR COSTS AND VALUE ADDED PER WORKER IN MANUFACTURING (US$ PER YEAR)

	Labor Costs (Wage)			Value added		
Countries	1980-1984	1995-1999	% Increase	1980-1984	1995-1999	% Increase
Malaysia	2519	3429	36.1	8454	12661	49.8
Thailand	2305	2705	17.4	11072	19946	80.1
Indonesia	898	1008	12.2	3807	5139	35.0
Philippines	1240	2450	97.6	5266	10781	104.7
Singapore	5576	21534	286.2	16442	40674	147.4
Republic of Korea	3153	10743	240.7	11617	40916	252.2
China	472	729	54.4	3061	2885	-5.7

Source: World Bank, World Development Indicator, 2000

TABLE 6: TECHNOLOGY DIFFUSION AND CREATION

Country	Telephone mainlines (per 1,000 people)		Cellular subscribers (per 1,000 people)		Internet users (per 1,000 people	
	1990	2001	1990	2001	1990	2001
Hong Kong, China (SAR)	450	580	24	859	1.3 (a)	386.8
Singapore	346	471	17	724	1.6(a)	411.5
Korea, Rep. Of	306	486	2	621	0.2	521.1
Brunei Darussalam	136	259	7	401	..	102.3
Malaysia	89	198	5	314	(.) (b)	273.1
Thailand	24	99	1	123	0.0	57.7
Philippines	10	42	0	150	..	25.6
China	6	137	(.)	110	..	25.7
Viet Nam	1	38	0	15	..	12.4
Indonesia	6	35	(.)	31	..	19.1
India	6	38	0	6	(.) (b)	6.8
Myanmar	2	6	0	(.)	..	0.2

Source:UNDP, Human Development Report, 2003

a. Data refer to 1991.

b. Data refer to 1992.

TABLE 7: EDUCATION INDICATORS IN SELECTED ASIAN ECONOMICS

	Adult literacy rate (% age 15 and above)		**Youth literacy rate** (% age 15-24)		**Net primary enrolment ratio** (%) [a]			**Net secondary enrolment ratio** (%) [a,]			**Tertiary students in science, math and engineering** (as % of all tertiary students)
	1990	2001	1990	2001	1990-91	2000-01		1990-91	2000-01		1994-97
Hong Kong, China (SAR)	89.7	93.5	98.2	99.4	..	..		..	..		..
Singapore	88.8	92.5	99.0	99.8	..	..		..	..		..
Korea, Rep. of	95.9	97.9	99.8	99.8	104	99	c	86	91	c	34
Brunei Darussalam	85.5	91.6	97.9	99.4	91 b	..		..	..		6
Malaysia	80.7	87.9	94.8	97.7	..	98	c	..	70	c	..
Thailand	92.4	95.7	98.1	99.0	..	85	c	..	..		21
Philippines	91.7	95.1	97.3	98.8	98	93	c	..	53	c	..
China	78.3	85.8	95.3	97.9	97	93	d,c	..	..		53
Viet Nam	90.4	92.7	94.1	95.4	..	95		..	62		..
Indonesia	79.5	87.3	95.0	97.9	98	92	c	38	48	d,c	28
India	49.3	58.0	64.3	73.3	..	..		..	..		25
Cambodia	62.0	68.7	73.5	79.7	..	95		..	17		23
Myanmar	80.7	85.0	88.2	91.2	..	83		..	37		37

Source: UNDP, Human Development Report, 2003

a. Data refer to the 1990/91 or 2000/01 school years. The net enrolment ratio is the ratio of enrolled children of the official age for the education level indicated to the total population of that age. Net enrolment ratios exceeding 100% reflect discrepancies between these two data sets.

b. Data refer to the 1991/92 school years.

c. Preliminary UNESCO Institute for Statistics estimates, subject to further revision

d.Data refer to the 1999/2000 school year.

TABLE 8: PATENTS, ROYALTIES AND LICENSE FEES FOR SELECTED COUNTRIES

Country	**Patents granted to residents (per million people)**	**Receipts of royalties and license fees (US$ per person)**
	1999	2001
Hong Kong, China (SAR)	4	16.0
Singapore	12	..
Korea, Rep. of	931	14.6
Brunei Darussalam	..	..
Malaysia	..	0.9
Thailand	..	0.1
Philippines	(.)	(.)
China	2	0.1
Viet Nam	(.)	..
Indonesia	0	..
India	1	0.1
Myanmar	..	(.)

Source:UNDP, Human Development Report, 2003

a.Note: Some of the data refer to the most recent year available during the period specified.

TABLE 9: R & D EXPENDITURE AND NUMBER OF SCIENTISTS AND ENGINEERS

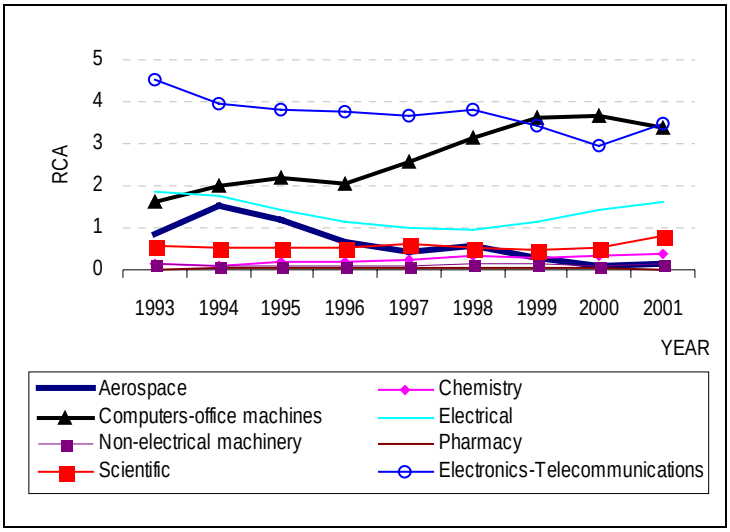
Country	Research and development (R&D) expenditures (as % of GDP)	Scientists and engineers in R&D (per million people)
	1996-2000[a]	1996-2000[a]
Hong Kong, China (SAR)	0.4	93(e)
Singapore	1.9	4,140
Korea, Rep. Of	2.7	2,319
Malaysia	0.4	160
Thailand	0.1	74
Philippines	..	156 (e)
China	1.0	545
Viet Nam	..	274(e)
Indonesia	..	130(e)
India	1.2	157

Source: UNDP, Human Development Report, 2003

Note: Some of the data refer to the most recent year available during the period specified.

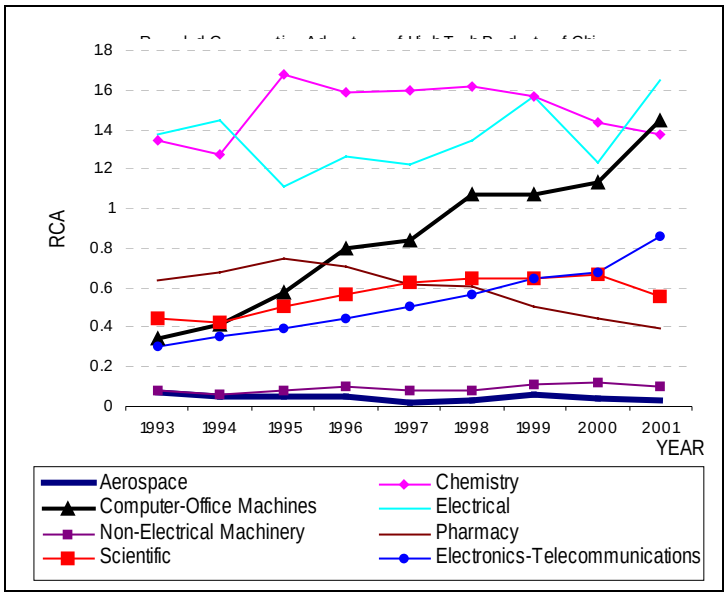
FIGURES

FIGURE 1: REVEALED COMPARATIVE ADVANTAGE OF HIGH TECHNOLOGY PRODUCTS OF MALAYSIA



Source: Author's calculation

FIGURE 2: REVEALED COMPARATIVE ADVANTAGE OF HIGH TECHNOLOGY PRODUCTS OF CHINA



Source: Author's calculation

FIGURE 3: DECOMPOSITION OF ELECTRONICS-TELECOMMUNICATIONS RCA OF MALAYSIA

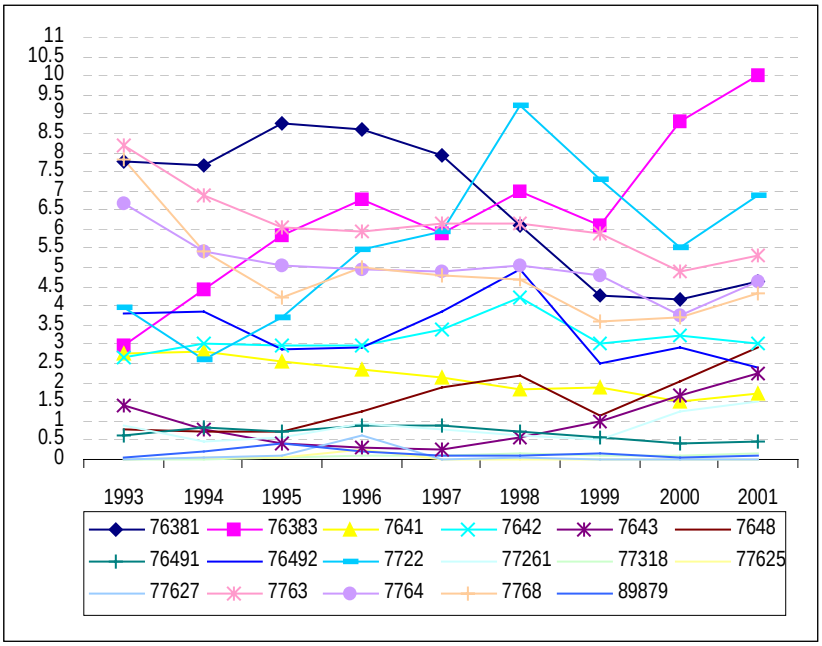


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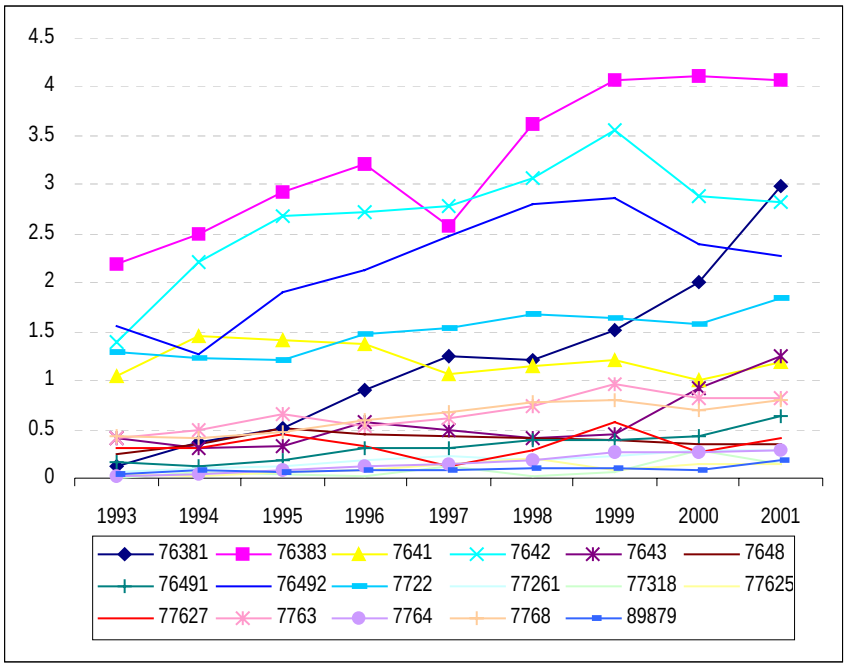
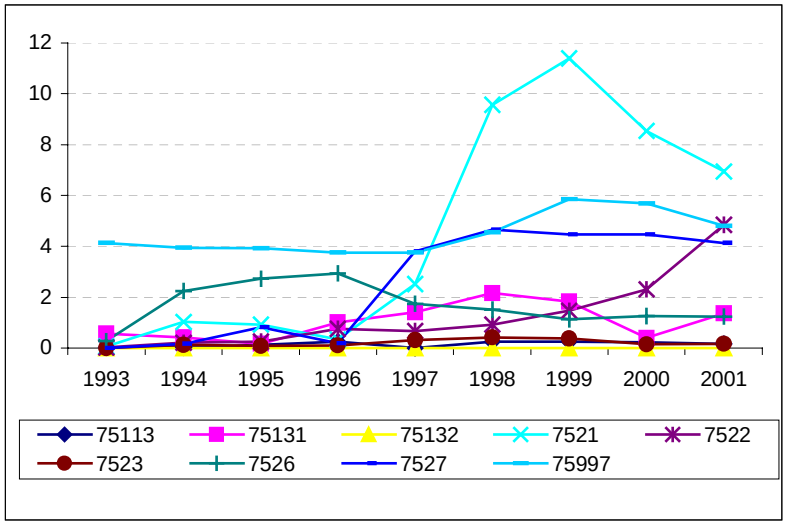
FIGURE 4: DECOMPOSITION OF ELECTRONIC- TELECOMMUNICATIONS EXPORTS RCA OF CHINA



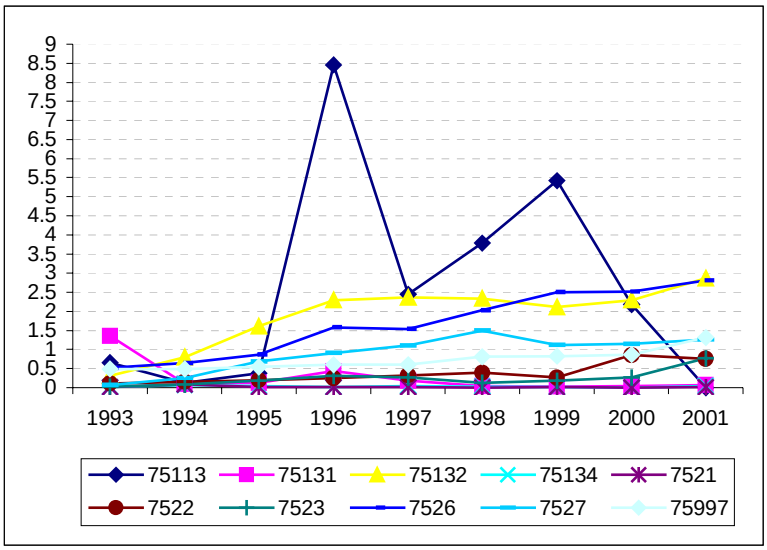
Source: Author's calculation

FIGURE 5: DECOMPOSITION OF COMPUTER EXPORTS RCA OF MALAYSIA



Source: Author's calculation

FIGURE 6: DECOMPOSITION OF COMPUTER EXPORTS RCA OF CHINA



Source: Author's calculation

APPENDIX A

High Technology Industries

	Product	SITC
1.	Aerospace	[7921+7922+7923+7924+7925+79293 +(714-71489-71499)+87411]
2.	Computers-office machines-office machines	[75113+75131+75132+75134+(752-7529)+75997]
3.	Electronics-telecommunications	[76381+76383+(764-76493-76499) +7722+77261+77318+77625+7763+7764+7768+89879]
4.	Pharmacy	[5413+5415+5416+5421+5422]
5.	Scientific instruments	[774+8711+8713+8714+8719+87211+(874-87411-8742)+88111+88121 +88411+88419+89961+89963+++89967]
6.	Electrical machinery	[77862+77863+77864+77865+7787+77844]
7.	Chemistry	[52222+52223+52229+52269+525+57433+591]
8.	Non-electrical machinery	[71489+71499+71871+71877+72847+7311+73131+73135 +73144+73151+73153+73161+73165+73312+73314+73316 +73733+73735

Source: Hatzichronoglou, T. (1997)