# HIGH TECHNOLOGY TRADE, ABSORPTIVE CAPABILITIES AND ECONOMIC GROWTH IN MALAYSIA

By

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**Chair : Law Siong Hook, PhD**
**School : Business and Economics**

For the past several decades, Malaysia has witnessed strong economic growth and has become one of the Asian newly industrialised countries. Although Malaysian Gross National Income per capita has steadily increasing throughout the years, nevertheless, the performance of economic growth is quite dismal – categorising Malaysia under middle income trap. Malaysia is in need of a breakthrough in income per capita and economic growth in order to leap out of middle income trap and to achieve high income nation target. High technology manufacturing and high technology trade have been growing fast in world trade and it is likely to project significant impact to economic growth. Therefore, the general objective of this study is to explore the role played by high technology trade in transforming the Malaysian economy. The study is conducted using ARDL and FMOLS (as robustness checking) on quarterly data from 1990 to 2015.

The involvement in high technology trade creates query on the factors that built a successful high technology trade especially in the case of transition economy like Malaysia. Thus, the first objective of the study is to explore the potential factors or determinants of high technology trade. Upon examination of the direct effect from the determinants of high technology trade, the study is also interested in the examination of the indirect effect of high technology trade to economic growth. As projection in GDP growth since the 1990s do not exhibit breakthrough, the study wonders upon the validation of missing absorptive capabilities that enhance high impact growth to the economy. Findings from the study successfully answered the first objective of the study. There is an indirect effect from absorptive capabilities as trade openness has significant impact when it interacts with research and development and foreign direct investment. Apart from research and development and foreign direct investment, the study also concludes direct effect that positively influences high technology trade from presence of infrastructure and financial development.

The study also intends to extend into disaggregate level by recognising the niche area for specific subsectors of high technology industry that are worth of resource allocation and policy implications. Five largest trading Malaysian sectors of high technology industry are chosen for the study, namely (1) Machinery and Transport Equipment, (2) Mineral Fuels, Lubricants, etc., (3) Manufactured Goods, (4) Chemicals, and, (5) Miscellaneous Manufactured Articles. Taking into account of trade openness as absorptive capabilities, the study discovers Chemicals has the most promising result under model (RD x TO), while Machinery and Transport Equipment has the most promising result under model (FDI x TO).

As the nature of high technology industry carries heavy weightage into research and development, being innovative is said to be one important score to sustainable growth. Only when a nation experiences sustainable growth, it has the ability to generate high impact growth to leap out of the middle income trap. This study is motivated by the view that high technology industry and its subsectors have the ability to generate high income for Malaysia to become a developed nation. Hence, the third objective of the study is to analyse the role that innovation plays in mediating the influence of high technology trade (selected subsectors) on economic growth. Empirical results on both aggregate and disaggregate level summarise that interaction between innovation with Chemicals sector has significant impact to economic growth in short run and long run – proving the existence of a high impact growth for the country to leap out of the middle income trap. Channelling the appropriate attention to policies that are developing the Chemicals sector and building up innovation culture in this sector is crucial. he abstract is a digest of the entire thesis and should be given the same consideration as the main text. It does not normally include any reference to the literature. Abbreviations or acronyms must be preceded by the full term at the first use.

An abstract should be between 300-500 words. It includes a brief statement of the problem, a concise description of the research method and design, a summary of major findings, including their significance or lack of it, and conclusions.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**PERDAGANGAN TEKNOLOGI TINGGI, KEUPAYAAN PENYERAPAN DAN PERTUMBUHAN EKONOMI DI MALAYSIA**

Oleh

**LAM FONG LITT LEONARD**

**Mac 2019**

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Malaysia, salah satu negara membangun di Asia, mempamerkan kadar pertumbuhan ekononmi yang mantap. Pendapatan negara kasar Malaysia sememangnya menunjukkan peningkatan dari semasa ke semasa, namun, prestasi pembangunan ekonomi tidak dapat mencapai kadar yang menberangsangkan. Oleh itu, Malaysia dikatakan terjebak dalam perangkap pendapatan pertengahan. Malaysia memerlukan inovasi dalam pembangunan ekonomi untuk merealisasikan impian menjadi negara maju. Industri teknologi tinggi dan perdagangan teknologi tinggi merupakan bidang perdagangan yang berkembang pesat di arena perdagangan dunia dan dikatakan berupaya menjana pertumbuhan ekonomi yang memberangsangkan. Justeru itu, objektif umum kajian ini adalah untuk memahami peranan yang dimainkan oleh perdagangan teknologi tinggi dalam pertumbuhan ekonomi Malaysia. Kajian ini akan menggunakan kaedah ARDL dan FMOLS (sebagai pemeriksaan teguh) dalam data suku tahunan dari tahun 1990 hingga 2015.

Malaysia harus meneliti faktor-faktor penting untuk mencipta industri perdagangan teknologi tinggi yang berjaya supaya mampu memberi impak pembangunan ekonomi yang besar. Oleh itu, objektif pertama kajian ini adalah untuk mengenal pasti faktor-faktor perdagangan teknologi tinggi. Selain daripada kesan langsung daripada faktor-faktor perdagangan teknologi tinggi, kajian ini juga berminat dengan kesan tidak langsung yang mampu pempengaruhi perkembangan perdagangan industri ini. Semenjak tahun 1990-an, prestasi KDNK negara tidak menunjukkan sebarang pertumbuhan yang berimpak besar. Kajian ini berusaha untuk membuktikan peranan dan kepentingan keupayaan penyerapan sesebuah ekonomi. Sekiranya sesebuah ekonomi tidak mempunyai keupayaan penyerapan, maka usaha pembangunan negara yang dicurahkan tidak mampu memberikan kesan yang dijangkakan. Hasil kajian ini berjaya memberi jawapan kepada objektif pertama kajian ini. Kesan langsung daripada faktor-faktor perdagangan teknologi tinggi adalah daripada kewujudan infrastruktur dan pembangunan sistem kewangan. Kesan tidak langsung pula adalah daripada kehadiran keterbukaan perdagangan. Apabila keterbukaan perdagangan

berinteraksi dengan penyelidikan dan pembangunan, dan, pelaburan langsung asing, ianya mampu menjana perkembangan berimpak besar yang diilhamkan oleh Malaysia.

Setelah berjaya mengenal pasti faktor-faktor yang mempengaruhi perkembangan perdagangan teknologi tinggi pada tahap industri secara menyeluruh, kajian ini juga berniat untuk mengesan sektor teknologi tinggi yang mampu menjana perdagangan teknologi tinggi yang bermanfaat untuk perkembangan ekonomi. Kajian ini akan memilih lima sektor teknologi tinggi yang paling banyak didagangi oleh Malaysia selama ini untuk dianalisis, iaitu, (1) Jentera dan Peralatan Pengangkutan, (2) Bahan Bakar Minyak, Pelincir dan lain-lain, (3) Barangan Perkilangan, (4) Bahan Kimia, dan, (5) Pelbagai Barangan Perkilangan. Hasil kajian menunjukkan sektor Bahan Kimia mampu menjana impak perkembangan paling memuaskan apabila berinteraksi dengan penyelidikan dan pembangunan, dan, sektor Jentera dan Peralatan Pengangkutan mampu menjana impak perkembangan paling memuaskan apabila berinteraksi dengan pelaburan langusng asing.

Untuk mencapai impian menjadi sebuah negara maju, inovasi berterusan sememangnya wajib untuk menjana pembangunan impak besar berterusan. Sifat industri dan sektor teknologi tinggi sememangnya merangkumi proses inovasi berterusan, oleh itu, kajian ini mempercayai bahawa industri and sektor teknologi tinggi adalah pilihan bijak pembangunan sesebuah ekonomi. Objektif ketiga kajian ini adalah bertujuan untuk menganalisis peranan yang dimainkan oleh inovasi dalam perdagangan (industri dan sektor) teknologi tinggi terhadap pertumbuhan ekonomi Malaysia. Hasil kajian (menyeluruh dan spesifik) sekali lagi membuktikan bahawa sektor Bahan Kimia mampu menjana pertumbuhan impak besar kepada ekonomi negara, justeru, membawa Malaysia kepada status negara maju. Dasar-dasar kerajaan yang mengutamakan pembangunan sektor Bahan Kimia wajib dilaksanakan.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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# INTRODUCTION

## 1.1 Background of the Study

Malaysia welcomes the start of the new millennium with great confidence as Malaysia has one of the best economic records in Asia. According to World Economic Outlook, Malaysia's economy is the third largest in Southeast Asia and the 35th largest economy in the world in 2018. With a GNI per capita of US Dollars 10,620, Malaysia becomes the third wealthiest nation in Southeast Asia after Singapore and Brunei in 2017. Malaysia belongs to the upper-middle income group according to World Bank standard classification.

Committed to enter the world's exclusive club of high income countries, Malaysia is banking on innovative science and technology initiatives that are built on the New Economic Model (NEM), Government Transformation Programme (GTP), and Economic Transformation Programme (ETP). Government defines high income threshold at a GNI per capita of about 15,000 US Dollars, which follows the definition by the World Bank. International Monetary Fund (IMF) and World Bank have repeatedly called for structural reform and endogenous innovation to move the country up the value chain of manufacturing, hence, allowing Malaysia to leap out from the current middle income trap.

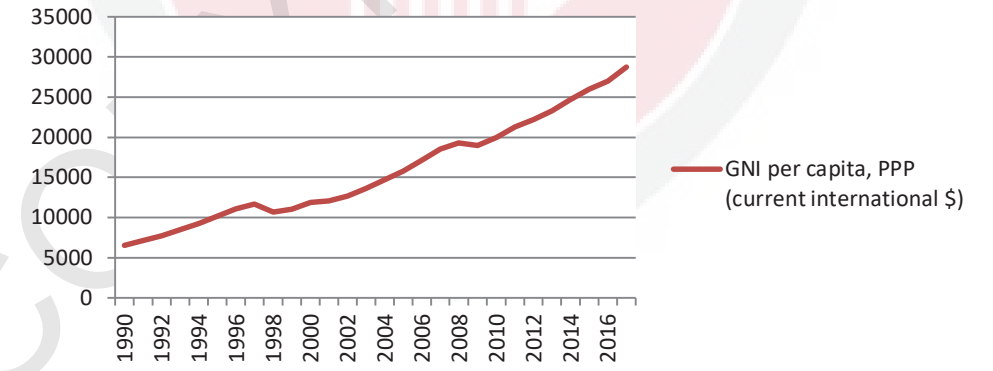


**Figure 1.1: GNI per capita of Malaysia (year 1990 – 2017)**
(Source: World Development Indicators)

The middle income trap is generally associated with the notion that countries are stuck in a certain range of income distribution and could not reach high income status (Cherif and Hasanov, 2015). Figure 1.1 shows that Malaysia's GNI per capita has a steady growth pattern. The GNI per capita is recorded as 6,530 PPP Dollars in 1990, 11,880 PPP Dollars in 2000, 20,020 PPP Dollars in 2010, and 28,681 PPP Dollars in 2017. The progress of GNI per capita throughout the years

was steady but the increase was marginal. Malaysia transitioned into what the World Bank has defined as an upper middle income country in 1979. Subsequently, it slide back to lower middle income status, and, although it has regained upper middle income status in 1991, nevertheless, it has not been able to join the group of high income countries (Felipe, Abdon and Kumar, 2012).

One possible explanation for middle income trap is due to the productivity slowdown as gains from low-cost labour and foreign technology imitation diminish in moving through the stages of development. When a low income country becomes a middle income country, new sources of growth such as benefits from low cost labour and productivity gains from sectoral reallocation from agriculture to manufacturing are needed. Moving away from labour-intensive manufacturing to sustain increases in productivity and per capita income requires innovation – the use of new ideas, methods, processes, and technologies in production – rather than imitation (Aghion and Howitt, 1992). In short, innovation-driven growth is the key to get out from middle income trap.

According to Acemoglu, Aghion and Zilibotti (2006) if countries do not switch from an investment-based strategy to an innovation-based strategy before a certain level of development, they may get stuck in a "trap" without reaching the World Technology Frontier. Thus, government intervention to increase investment and faster adoption of existing technologies are desirable at the early stages of development (Gerschenkron, 1962). Middle income trap could also be characterised by a misallocation of talents and limited access to infrastructure. Agenor and Canuto (2012) highlighted that investment in advanced infrastructure would increase productivity. By adopting learning-by-doing and knowledge network effects, productivity gains are increasing, which will eventually move the economy to high-growth equilibrium.

A country needs to constantly produce new goods by adopting and developing new technologies to create sustainable growth. Lucas (1993) argued that learning-by-doing or learning-on-the-job is one of the most important channels of accumulating knowledge and human capital in this process. Producing the same set of goods would rapidly lead to stagnation in production, while, introducing new goods and tasks would allow managers and workers to continually learn and move up the “quality ladder”. Lucas (1993) further argued that the country has to do this on a large scale and must be a large exporter. Hence, trading in innovation-based goods will benefit a country from being stuck at the middle income trap. Malaysia has a relatively small market within the region, thus, exploring into markets beyond its borders is crucial in order to sustain growth.

All of these efforts into innovation, constant learning and related trade policies would not be successful without the presence of a nation’s absorptive capability. The term ‘absorptive capability’ by Abramovitz (1986), which involves, “…various efforts and capabilities that developing countries have to develop in order to catch-up, such as improving education, infrastructures and, more

importantly, technological capabilities" (Fagerberg and Godinho, 2005: 523). Studies on the national system of innovation have focused into the capability of the economy to adopt and develop new technology (Mowery and Oxley, 1995; Kim, 1980; Haddad and Harrison, 1993; Harbi, Amamou and Anderson, 2009).

Van Den Bosch, van Wijk and Volberda (2003) divided the dimension of absorptive capabilities into: (1) recognizing the value; (2) assimilating and; (3) applying new external knowledge to commercial ends. There are important interactions between technological productions and capacity-building activities, such as educational attainment and local R&D efforts, because imported technology will only boost production when an economy is at a threshold level. Imported technologies may boost production via knowledge transfer that could induce innovation activities in the country. Therefore, this threshold level must have passed the three dimensions mentioned above in order for the country to handle and allow for the efficient use of any involved technologies (Mayer, 2001). It is a measure of an organisation's ability to learn.

Gill and Kharas (2007) argued that three transformations were required for emerging Asian countries to further increase their growth, namely (1) transformation from diversification to more specialisation in production and employment; (2) transformation from a focus on investment to a focus on innovation; (3) a shift from equipping workers with skills to adjust to new technologies in order to prepare them to shape new products and processes. They stressed that economic growth in these countries would be sluggish without any steady progress in these three transformations. Thus, the emerging Asian countries would be caught in a middle income trap, as is the current situation for many middle income countries in the Middle East and Latin America (Gill and Kharas, 2007).

Currently, Malaysia is in transition. Economic transformation has to do with the government being more efficient, and that fosters the process of absorbing quality investment in areas such as design, research and development, and advanced electronics in order to create jobs that generate higher income to the citizens. Venturing into new markets is crucial to cater to the massive production accompanied by enormous job creation from the industry. Thus, trade certainly could expand the scales of production beyond local consumers or domestic market. With more production, more jobs will be created, and more incomes will be generated. Therefore, Malaysia has to be highly competitive in areas such as high technology and knowledge intensive sectors.

## 1.2 An Overview of Malaysian High Technology Trade

The term "high technology" is widely used to refer to any firm or industry that embodies products or services with the most innovative and advanced technologies (Seyoum, 2004). Such firms often display a common reliance on sophisticated scientific and technological expertise and rely heavily on research and development (R&D) expenditure relative to turnover (Keeble and Wilkinson, 2000). High technology trade involves exports and imports of products under the Standard International Trade Classification (SITC – Rev. 1)[1] and the Organisation for Economic Co-operation and Development (OECD) defined it as the manufacture of technical products with high R & D intensity. These sectors include food; beverages and tobacco; crude materials, inedible; mineral fuels, lubricants, etc.; animals and vegetables oils and fats; chemicals; manufactured goods; machinery and transport equipment; miscellaneous manufactured articles; and, miscellaneous transactions and commodities.

Table 1.1 shows the performance of high technology exports of Malaysia from 1990 until 2016. Starting from 1990, high technology exports recorded an export value of RM 79,646.4 million, which contributed 38.2% of total export. Comparing the progress a decade later, high technology exports recorded value of RM 373,270.3 million, implying a contribution of 60% of total exports, which has been the highest so far. High technology exports were at RM 638,822.5 million in 2010, which contributed to 44.5% of total exports. Lastly, in 2016, high technology exports recorded at RM 786,964.2 million which contributed to 43% of total exports.

High technology exports of Malaysia has shown a progressive pattern and are expanding every year in terms of exports value but inconsistent trend in terms of its contribution to total export. It has successfully contributed to an average of half to the nation's total export for the last three decades (1996 – 2016). According to European Statistical Office (Eurostat), Malaysia is among the top three countries in the world which has highest percentage of high technology trade to total trade, leaving behind the Philippines and Singapore. In other words, high technology sectors have created more employment opportunities, and have, therefore, upgraded the per capita income of citizens. High technology trade has been the lifeblood for the nation. Towards the transformation into a high income country, Malaysia will continue its legacy in the exploration and diversification of high technology trade.

[1] Full list could be obtained at http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an4.pdf

**Table 1.1: Malaysia's High Technology Export Performance (1990 – 2016)**

| Year | High Technology Exports (RM million) | High Technology Exports (% to total export) |
|---|---|---|
| 1990 | 79,646.4 | 38.2 |
| 1991 | 94,496.6 | 38.2 |
| 1992 | 103,656.7 | 38.9 |
| 1993 | 121,237.5 | 41.1 |
| 1994 | 153,921.2 | 44.3 |
| 1995 | 184,986.5 | 46.1 |
| 1996 | 197,026.1 | 44.4 |
| 1997 | 220,890.4 | 49.0 |
| 1998 | 286,563.1 | 54.9 |
| 1999 | 321,559.5 | 58.9 |
| 2000 | 373,270.3 | 59.6 |
| 2001 | 334,283.8 | 58.1 |
| 2002 | 357,430.0 | 57.9 |
| 2003 | 397,884.4 | 58.5 |
| 2004 | 481,253.0 | 55.7 |
| 2005 | 536,233.7 | 54.6 |
| 2006 | 589,240.3 | 53.8 |
| 2007 | 604,299.6 | 52.3 |
| 2008 | 663,013.5 | 39.9 |
| 2009 | 552,518.1 | 46.6 |
| 2010 | 638,822.5 | 44.5 |
| 2011 | 697,861.9 | 43.4 |
| 2012 | 702,641.2 | 43.7 |
| 2013 | 719,992.4 | 43.6 |
| 2014 | 765,416.9 | 43.9 |
| 2015 | 777,355.1 | 42.8 |
| 2016 | 786,964.2 | 43.0 |

(Source: Malaysia External Trade Statistics)

Figure 1.2 shows Malaysia's high technology trade by high technology group of products from 1990 until 2015. It is evident that Malaysia has participated in all ten sectors listed under the SITC-Rev. 1 definition. Amongst all the sectors, only five sectors contribute to a larger composition of high technology trade. These five sectors are: (1) Machinery and Transport Equipment, (2) Mineral Fuels, Lubricants, etc., (3) Manufactured Goods, (4) Chemicals, and, (5) Miscellaneous Manufactured Articles. These five selected sectors have contributed to almost 85%of the total high technology trade. Therefore, it is the interest of this study to focus on these highly performed sectors.

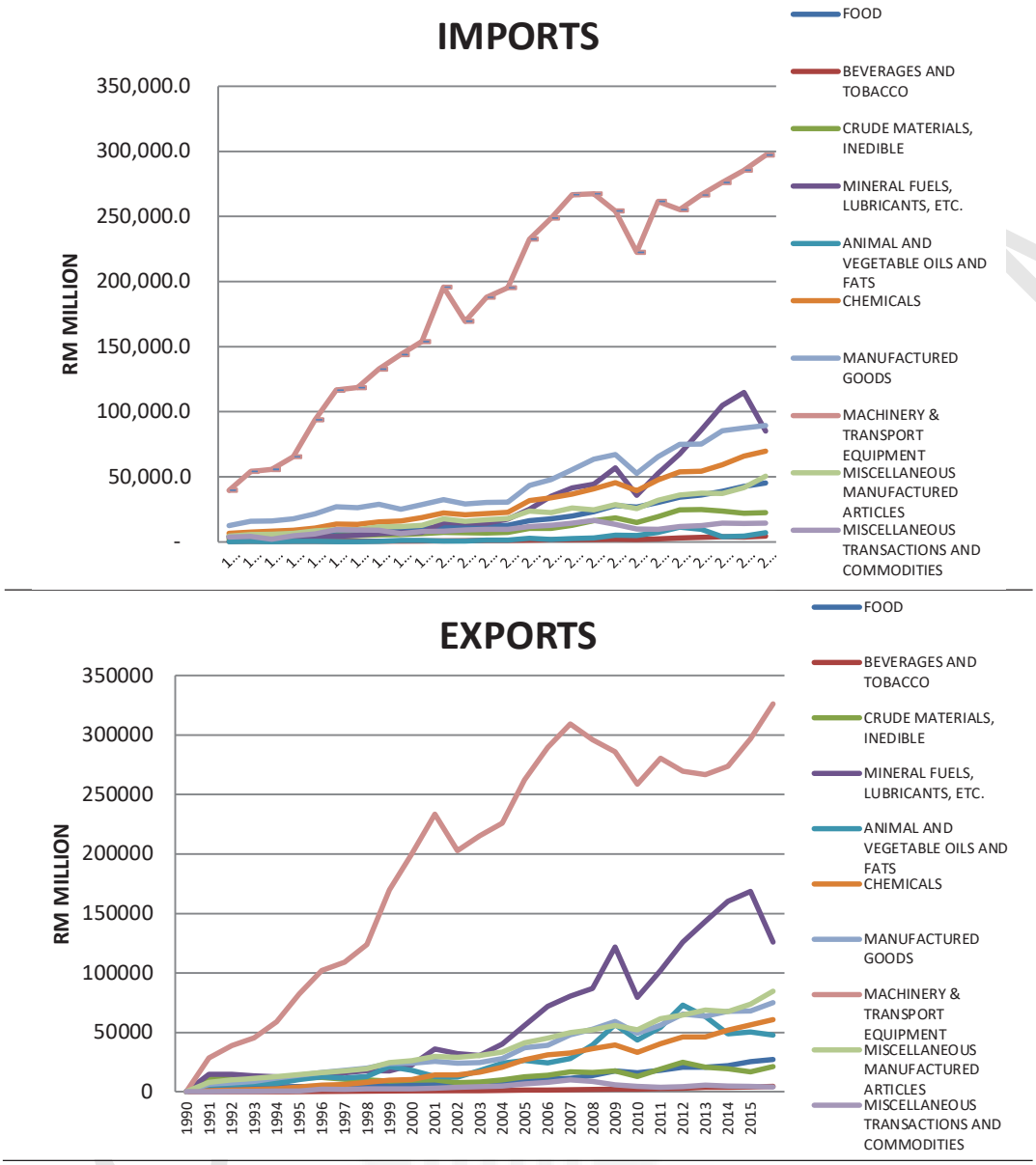


**Figure 1.2: Malaysia's high technology trade by products groups in RM million (1990-2015)**
(Source: Department of Statistics Malaysia)

The development of high technology products is in accordance with the national policy of Malaysia. In response to the Fourth Industrial Revolution (Industry 4.0), the Industry4WRD was launched on October 31st, 2018 under the governance of the Ministry of International Trade and Industry (MITI). The three main visions of the policy are (1) to form strategic partnership for smart manufacturing and related services in Asia Pacific, (2) to become the total solutions provider for advanced technology, and finally, (3) to become the primary destination for high technology industry. These visions are aimed to create innovation capacity and

high skilled jobs to the nation. Hence, it is believed that high technology industry could be the stepping stone for achieving high income status.

## 1.3 An Overview of Malaysian Innovation Performance

Investment into research and development (R&D) has become one of the main integral factors to stimulate the process of becoming a knowledge-based economy. Therefore, in order to remain competitive in the world, Malaysia needs to constantly generate and establish new sources of growth. One of the measures is to increase the nation's capability by adopting and developing science and technology through research and development and innovation. Malaysian Investment Development Authority (MIDA), as the principal investment promotion agency of the country, has approved a total of seven research and development projects with investments worth RM 266 million in 2016. These investments are expected to generate 687 high income jobs for Malaysians.

Malaysia's progress can be gauged on how it scored under the Pillar 12: Innovation of The Global Competitiveness Report of 2013 – 2017. Malaysia's capacity for innovation has moved up two notches from 15$^{th}$ place in 2013-2014 to 13$^{th}$ place in 2016-2017 (refer to Table 1.2). Subsequently, the score has also improved from 4.9 to 5.4. The quality of Scientific Research Institutions has moved up four positions from 27$^{th}$ place in 2013-2014 to 23$^{rd}$ place in 2016-2017; the score has also improved from 4.9 to 5.3. Overall, under the Pillar 12: Innovation criteria, Malaysia's ranking has also moved up three positions from 25$^{th}$ in 2013-2014 to 22$^{nd}$ in 2016-2017. Additionally, the score has also improved from 4.4 to 4.7.

The transition into an innovation driven economy requires skills, competencies, and capabilities to meet the needs of knowledge-intensive and industries-based skills. This is especially true in the case of high technology industry, where there is an urgent need of human capital to enhance technological capability and capacity (Xu, 2000; Harbi, Amamou and Anderson, 2009). Looking back at Table 1.2, the ranking for availability of scientist and engineers has improved significantly from 19$^{th}$ place in 2013-2014 to 7$^{th}$ place in 2016-2017. Similarly, the scoring has also improved from 4.9 to 5.3. However, the utility patents granted per million population had moved down five positions from 31$^{st}$ in 2013-2014 to 36$^{th}$ in 2016-2017. The scoring has also decreased from 12.1 to 11.3. These statistics show that although investments in education and training have increased over the last few years, nevertheless, there is still a shortage of highly skilled and quality talents.

**Table 1.2: Pillar 12: Innovation of the Global Competitiveness Report 2013 - 2017**

| Criteria | 2013 - 2014 | | 2016 - 2017 | |
|---|---|---|---|---|
| | Rank | Score | Rank | Score |
| Pillar 12: Innovation | 25 | 4.4 | 22 | 4.7 |
| Capacity for Innovation | 15 | 4.9 | 13 | 5.4 |
| Quality of Scientific Research Institutions | 27 | 4.9 | 23 | 5.3 |
| Company Spending on R&D | 17 | 4.6 | 8 | 5.2 |
| University-Industry Collaboration in R&D | 16 | 5.0 | 11 | 5.2 |
| Government Procurement of Advanced Technology Products | 4 | 4.8 | 3 | 5.0 |
| Availability of Scientist and Engineers | 19 | 4.9 | 7 | 5.3 |
| Utility Patents Granted per Million Population | 31 | 12.1 | 36 | 11.3 |

(Source: MIDA)

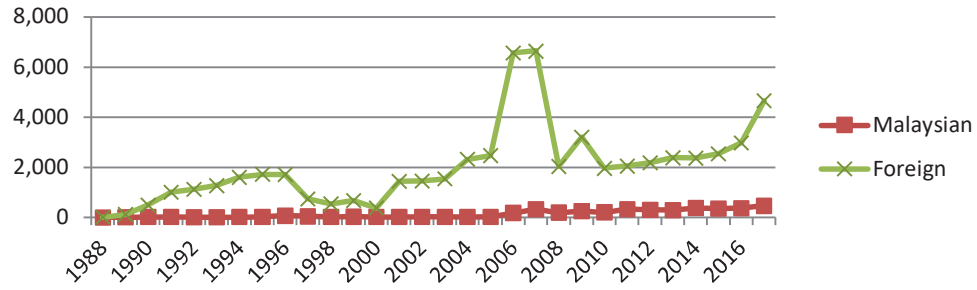


**Figure 1.3: Granted Patents and Utility Innovations (1988 – 2017)**
(Source: MyIPO, July 10th, 2018)

Following the creation of Intellectual Property Corporation of Malaysia (MyIPO), an increasing number of patents has been given to local companies. However, it merely reached 10% of total patents granted. Figure 1.3 shows that U.S. patents issued to Malaysians have risen by twenty-fold during the period of 1988 and 2017. Most of the U.S. patents are granted to multinational companies (MNCs) that are located in the country. Leaving aside individually-owned patents, only four local organisations were granted five or more patents each between 2003 and 2007, namely; Silterra, Malaysian Palm Oil Board (MPOB), Harn Marketing, and Universiti Putra Malaysia (UPM). Interestingly, these patents were granted mainly because of its connection with high technology products – chemistry and metallurgy, operational technology, electricity, and physics.

Large multinational companies (MNCs) continue to dominate in the Malaysian economy (Chandran Govindaraju and Wong, 2011). On an average basis,

approximately 5.5% of total firms in Malaysia are actively engaged in innovation activities. These are mostly multinational firms that conduct high-end researches in Malaysia, such as Hewlett Packard, Motorola, Intel, and Dyson. Research activities generally involved electrical and electronics (E&E), chemicals, food and beverages, rubber and plastics, and automotive products. Apart from these multinational firms, several other large companies are engaged in semiconductor device manufacturing and active solid-state devices such as Agilent Tech. and Chartered Semiconductor can also be seen. However, small and medium-sized companies, which made up around 95% of the total firms in Malaysia, have minimal linkages with larger firms. The significant presence of multinational companies offer the country with strong export-oriented platforms, which are only limited to transmitting technological capabilities to home-grown companies and in proliferating the connection with the domestic economy. In order to enter into an innovation-led and high income economy, technological learning by domestic enterprises with their foreign subsidiaries needs to be broadened.

The Malaysian government continues to place emphasis on research and development as reflected in the 11th Malaysia Plan 2016 – 2020. The plan focuses on translating innovation to wealth by improving coordination, sharing and testing of ideas. This enables Malaysia to bring creative outputs to the market and improve the national innovation ecosystem. Indeed, this is in line with the policy of the National Science, Technology and Innovation which aims for Malaysia to become a high income economy.

## 1.4 Problem Statement

Generally in recent decades, the high technology manufacturing and high technology trade have been the fastest growing area of world trade which is likely to have significant impact on the overall economic development of the nations. This is supported by the new growth model which has suggested that a country could increase its total productivity by increasing its investment in R&D or innovation (Grossman and Helpman, 1991; Barro and Sala-i-Martin, 1995). Reflecting on the discussion in the background of the study, we observed that Malaysia's GNI per capita is steadily increasing throughout the years, nevertheless, the performances of the economic growth is quite dismal. Even though, the Malaysian government has put in an enormous effort into economic planning to increase the economic growth, however, it only managed to sustain the growth on an average of 5% since the 1990s.

Malaysia's economy is in need of a breakthrough in the income per capita and economic growth in order to achieve high income nation status that encompasses all aspects of life, from economic prosperity, social well-being, educational world-class, political stability and physiological balance. For this, the Malaysian government has accentuated on the role that high technology trade could play in enhancing the economic growth. Recent performance of the high technology trade has proved the importance of the industry in generating high impact growth to an

economy and we believe that this could help Malaysia to leap out of the middle income trap.

The expansion of high technology trade offers the country opportunities to improve productivity and enhances job creation to further increase income per capita of the citizens. Therefore, first, this study is interested to examine the potential factors or the determinants of high technology trade. Upon examination of the direct effect from the determinants of high technology trade, the study is also interested in the examination of the indirect effect of high technology trade to economic growth. As projection in GDP growth since the 1990s do not exhibit breakthrough, the study wonders upon the validation of missing absorptive capabilities that enhance high impact growth to the economy. Given the facts that (1) the nature of high technology industry embodies high research and development intensity, and, (2) Malaysian economy still depends heavily on foreign technology through foreign direct investment, the study investigates the interaction in between research and development and foreign direct investment with the presence of absorptive capabilities.

Traditionally, human capital is used as the proxy for absorptive capabilities. This study adds two new proxies for absorptive capabilities, which are trade openness and economic freedom, to investigate the indirect effect of the Malaysian high technology trade through the interaction with research and development and foreign direct investment. Extending the study into a disaggregate level, this study specifies into the niche area for specific subsectors of high technology industry that are worth of resource allocation and policy implications.

Previous literatures have highlighted the significance of trade openness or trade liberalisation (on an aggregate level) to economic growth. Since none of the previous literature has examined the role of high technology trade (on aggregate and disaggregate level), this study intends to contribute to the literature gap by fulfilling the importance of high technology industry (and selected subsectors) in order to generate high impact growth to leap Malaysia out of middle income trap. Sustained economic growth in the industry can only be achieved with the presence of continuous innovation effort that creates new high technology product in the market. Thus, this study extends the indirect effect via the interaction of innovation to selected subsectors of high technology industry that creates the sustained economic growth. Eventually, the study stressed the effect of high technology trade to boost economic growth in order to achieve high income nation.

## 1.5 Objectives of the Study

The primary objective of this study is to explore the role played by high technology trade leading to the growth of the Malaysian economy.

The specific objectives are:

1. To investigates the direct and indirect effect of absorptive capabilities (human capital, trade openness and economic freedom) in influencing high technology trade through the channel of research and development (R&D) and foreign direct investment (FDI).
2. To examine the factors that influence high technology trade (selected subsectors) at a disaggregate level.
3. To analyse the role that innovation plays in mediating the influence of high technology trade (selected subsectors) on economic growth.

## 1.6 Significance of the Study

The successful development of high technology sectors plays an important role in the creation of national welfare. Successful examples of early starters as high income countries, such as Hong Kong, Singapore and South Korea, serve as an inspiration to carefully study the importance of venturing into high technology industries. While previous studies emphasized largely on the determinants trade flows and its growth impact in an aggregated form, none of the literature focuses on the determinants of high technology trade and its growth impact in specific. This study estimates the direct effect and indirect effect on the determinants of high technology trade and also the nexus between high technology trade and economic growth. Observing the disappointing performance of GNI per capita and GDP growth of Malaysia, this study suggests that the role of absorptive capabilities could be the reason why economic growth could not reach to a higher level. Three absorptive capabilities, namely, human capital, trade openness and economic freedom, were used to interact with research and development and foreign direct investment to examine the missing indirect effect that boosts the performance of high technology trade.

This study also extends the application of direct (determinants of high technology trade) and indirect effect (absorptive capabilities) into a disaggregate level. Amongst all ten sectors listed under SITC Rev. 1 classification, only five sectors contribute to a larger composition, and made up of almost 85% of high technology trade in Malaysia. These five sectors are: (1) Machinery and Transport Equipment, (2) Mineral Fuels, Lubricants, etc., (3) Manufactured Goods, (4) Chemicals, and, (5) Miscellaneous Manufactured Articles. No previous studies have extend into disaggregate level yet, thus, this study, for the first time, helps to decide which high technology product that Malaysia is enjoying comparative advantage and worth of policy implications.

While numerous studies correlate the importance of trade to economic growth (Samuelson, 1971; Stiglitz, 1970; Deardorff, 1986; Barro and Sala-i-Martin, 1992), none of the literatures focused on high technology trade. This study serves as the pioneering study that views the importance of high technology trade in pushing Malaysia to become a high income status country. In order to achieve substantial growth high enough to leap Malaysia out of middle income trap, the role of innovation should not be underestimated. Continuous effort in research and development is needed to ensure the development in high technology industry, which eventually produces high impact growth to the economy. Therefore, this study also offers the first insight into the role of innovation in high technology trade (generally) and selected subsectors (specifically) to economic growth.

## 1.7 Organisation of the Study

Chapter 1 highlights the background of the study, an overview of Malaysian high technology trade and innovation performances, problem statement, objective of the study and significance of the study. Chapter 2 reviews some of the related literatures. This chapter consists of two parts, namely, theoretical reviews and empirical reviews on high technology trade, absorptive capabilities and economic growth. The final section of Chapter 2 summarises reviews and highlight the research gap to justify the three research objective of this study. Chapter 3 presents model specification, research methodology, description on variables used and expected sign, and data sources. Chapter 4 discusses the empirical findings from the main analysis as well as the robustness or sensitivity analysis and diagnostic tests. Chapter 5 provides an overview of the study, summary of the main findings, policy recommendations, limitations of the study and some suggestions on future research direction.

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