

Selangor Industrial Master Plan Study



Connecting Clusters

Commissioned by Invest Selangor

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Glossary

Abbreviation	Definitions
CAGR	Compounded Annual Growth Rate
DOSM	Department of Statistics, Malaysia
EPU	Economic Planning Unit
FELDA	Federal Land Development Authority
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IoT	Internet of Things
KETTHA	Kementerian Tenaga, Teknologi Hijau dan Air
KLIA	Kuala Lumpur International Airport
MARDI	Malaysian Agriculture Research and Development Institute
MATRADE	Malaysia External Trade Development Corporation
MDeC	Multimedia Development Corporation
MIDA	Malaysia Investment Development Authority
MIDF	Malaysian Industrial Development Finance
MIGHT	Malaysia Industry - Government Group for High Technology
MITI	Ministry of International Trade and Industry
MOH	Ministry of Health
MOSTI	Ministry of Science, Technology and Innovation Malaysia
MPC	Malaysia Productivity Corporation
MPOB	Malaysian Palm Oil Board
OECD	Organization for Economic Cooperation and Development
PKA	Port Klang Authority
SFAM	Semiconductor Fabrication Association Malaysia
SHRDC	Selangor Human Resource Development Centre
SIRIM	Standards and Industrial Research Institute of Malaysia
SME	Small and Medium-Sized Enterprises
SSIC	Selangor State Investment Centre
TPPA	Trans-Pacific Partnership Agreement
WTO	World Trade Organization

Background and Research Objective

1.0 Background and Research Objective

In December, 2014, Invest Selangor (formerly known as Selangor State Investment Corporation) requested Monash University Malaysia to assist the State in formulating an Industrial Development Plan. This is achieved by conducting a study of five (5) business clusters in the State, including the identification of new infrastructure investments and upgrades. These clusters include: (1) Electrical and Electronic, (2) Food, (3) Life Sciences, (4) Machinery and Equipment, and (5) Transport Equipment.

1.1 Research Questions

This study poses four major research questions. They are:

1. Where are the significant gaps in the supply chain in the clusters?
2. Are there new industries that could potentially be developed, through the identification of gaps in the supply chain?
3. What supporting infrastructure, talent, and financial resources are needed to complement these gaps, including investments requirements to support existing industry clusters and or attract new industries?
4. How could State investments in these clusters benefit from the Nation's Transformational program?

Over the course of the past 12 months and during the data gathering process, several more questions evolved out of the study. Responses to these questions and their implications on cluster development are presented in the study.

The development of the State's cluster policies and strategies, of course, is all about execution. Execution of these policies, however, must be set in the national and international context that drives regional economic growth, based on the region's existing and emerging core competencies.

1.2 Terms of Reference

Clusters are group of inter-related and inter-connected industries that drive wealth creation in a region, primarily through export of goods and services. Industries within the clusters are typically identified using the classic Standard Industry Classification (SIC) code. Unlike the classic definition of industry sectors, an industry cluster is different. This is because industry clusters represents the entire value chain of a broadly defined industry, from suppliers to end products, including supporting services and specialised infrastructure. As such there is interdependency between these industries because they possess resources (financial, labour, land, research and development etc.) and perform activities (production, distribution, consumption etc.) needed by their industries.

According to the United Nations Industrial Development Organizations (2013), “clusters are defined as “agglomerations (collections) of interconnected companies and associations. Firms in a cluster produce similar or related goods or services and are supported by a range of dedicated institutions located in spatial proximity, such as business associations or training and technical assistance providers. Vibrant clusters are home to innovation-oriented firms that reap the benefits of an integrated support system and dynamic business networks.”

The State government plays a crucial role in the success or failure of cluster policy. These policies offer cluster organisations numerous benefits, including communicating to interested parties the cluster’s unique competencies and knowledge. Importantly, the transformation activities these cluster organisations undertake can be concentrated within a spatial, defined area, focused on specific areas of specialisation, and industry - specific sectors that are located within a defined area. For examples, the Selangor’s Life Sciences cluster (general and broad-based cluster), Aerospace City (Subang) and Pulau Indah Halal Hub (business specialisation within defined areas), and Internet of Things (IoT) in Electrical and Electronics cluster and precision engineering in Oil and Gas sectors (specialisation in specific sector).

Stakeholders in these clusters contribute to cluster development by attracting new businesses, talent and investment. Instead of a mindset that focuses on their respective sectors and industries, stakeholders see the benefits of cross-sector and cross-industry collaborative initiatives. Cooperating to compete becomes their new business model and mantra. There are, of course, economic, social and political benefits in being a co-contributor to the cluster. Specialisations within and between clusters identify and redefine the organisation’s role and position, in terms of their contributions to the regional (State), national and global value chain. For examples, the role of Strand Aerospace in pure play engineering in Airbus regional value chain, and Selangor Halal Hub in global halal food production and certification.

In these ways, public and private stakeholders and the State government through participative regulations, gather and attract new businesses to the cluster. The State government signal their strategic and operational intent to develop economic, social and technological policies and actions, built around the cluster. There is on-going promotion of dialogue aimed at continuous improvements and engagements between stakeholders, particularly their specialisations and contributions to the cluster value chain. Trust, support, commitment, and co-adaptation are keys to success, while at the same time being sensitive to stakeholders’ interests.

Important stakeholders must, therefore, create a unified cluster vision, meet to identify their respective and collective goals, and act as a collaborator group that leads to the development of a State cluster mentality. This requires them to support the development of new collaborative ideas, engage in value-adding productivity and process activities, and address immediate issues such as:

1. Producing graduates with skills the employers want
2. Funding support in R&D and innovation
3. Creating a State's based innovation centre and a techno entrepreneur business environment
4. Engaging in international branding and developing relational network ties

Of course, the State's cluster policies and actions would need to be set in the national and international context that drives regional economic growth, based on the State's existing and emerging core competencies.

1.3 Methodology

The methodology employed in this study involves a combination of both secondary and primary research. We first undertook an extensive secondary data and content analysis of local and international published materials on economic, social, political, industry and business development, as they impact on cluster policies, organisations and networks, prior to the gathering of primary and original field data. Data on employment and export earnings were also sourced from various government agencies (Department of Statistics, MIDA, MATRADE, MIGHT etc.) as they impact on cluster development and growth potential. Business specialisations in established and emergent industries, current and future investment in R&D and innovations, and local and international sales and marketing initiatives from a cluster perspective, were also examined and updated from various press releases. Data were synthesised and revisited as they dovetail with major developments in these clusters - regionally, nationally and internationally.

Secondary data analysis includes sourcing for regional and global case studies of "Best Practices," from which the State could draw important lessons in cluster development. Cases were selected based on relevance to the industries within the cluster, as well as their unique activities and competencies. For example, we selected a case study of processed food (i.e. "The future of Australian Processed Food Sector") due to the dominance of this subsector in the State's food industry. This was complimented by a case study of the "Danish Food Cluster: The European Hub for Innovation," noting that while the dominant subsector is meat followed by dairy, the region is also strongly represented by seafood, ingredients, cakes, confectionary and processed fruits and vegetables, not unlike that of Selangor. Closer to home, we included a case study of Foodpolis (Republic of Korea) as they provide insights into how the State could integrate the food industry with tourism and culture.

Following on from the content analysis, a set of semi-structured questionnaires were developed, for use in face-to-face interviews with CEOs and senior executives operating in various sectors and/or industries in the five nominated clusters. Interviews took place mainly at their workplace, and typically lasted between 1-1.5 hours. The interviews were voice recorded, the contents later transcribed and interpreted. Key themes were identified from their verbatim comments, “dots connected,” and maps of relational ties between stakeholders were constructed, providing us with valuable empirical evidence to draw key findings and conclusions. A total of 40 interviews were conducted, spread across various industries and sectors in the clusters. They included foreign MNCs, large and medium-sized companies, agencies, associations and universities.

The last phase of the data gathering involved an on-line survey of 167 businesses, following strict data gathering guidelines. The interviews were spread across a range of industries, and comprise of 19% businesses operating in manufacturing (including transport equipment), 12% in food, beverages and tobacco, 13% in wholesale and retail, 11% in health care, 6% each in utilities and energy and construction (building and civil engineering) and 5% each in distribution, logistics and transportation, and professional services (for business and consumers). Questions posed in the questionnaire provide key current and development information on:

1. Nature of the industry they are operating in – Capital, technology, labour intensity, etc.?
2. Capabilities of local firms and suppliers – Degree of dependency on local markets, local labour, business leadership, etc.?
3. Factors with the most impact on their industry over the next 2-3 years – Business environment, availability of talent, access to export markets, product innovation, etc.?
4. Role of the Selangor State Government – Influential, Facilitative, Supporting and Inhibitive?
5. Cluster (ecosystem) offering the most growth potential over the next 5 years?

Results from the data gathered allowed us to identify gaps in the cluster, and the measures needed to address them. For example, a highly competitive domestic market where buyers have increasing bargaining power, might suggest the need to undertake export - orientated activities, especially if such activities are likely to have the most impact on their businesses in the future. This finding, together with an increasing desire to seek new markets, may imply that support infrastructure such as financial incentives, export market information, and assistance in formulating market entry strategies, may be needed to address these shortcomings.

1.4 Analysis

We used a combination of analytical tools to generate the data that forms the basis of our empirical analysis. The purpose of the analysis is a fact-based mapping of Selangor, with a view to future State's cluster development, in the context of the State's role in the national and global supply chain. Combined with our analysis of numerous sectors and industry development, a major objective of the study is to transform the State's Industrial Development Plan by identifying new infrastructure investments and upgrades on the five major business clusters. More importantly, the analysis offers insights on new thinking and new ways of competing, based on the State's specialisations and contributions to the regional and national growth agenda. The analytical tools used in the study, the data generated, and the insights they provided, include:

- **Cluster Map** - Identify the broad spectrum of stakeholders, supporting networks, and outgrowth from the cluster's core activities. Whenever possible (data and information availability, developmental phase the industry policies, etc.), cluster map are provided that looks at specific industries for the State. For example, while it is possible to map out the cluster map for the aerospace industry with the granularity that includes maintenance, repair and operation, the task is more challenging for the automotive industry, beyond identification of two key clusters currently operating in Selangor, namely, the Northern Automotive Hub (Bukit Beruntung, Serendah, Batang Kali and Rawang) and the Southern Automotive Hub (Shah Alam).
- **Value Chain Analysis** – Understand the broad connections between key stakeholders and the other components of the cluster in delivering its value-creating services within the overall industry cluster value chain. The same limitations apply when examining the granularity. Whenever possible, cluster maps are provided that looks at specific industries. For example, while it is possible to map out the value chain analysis for electrical and electronics (including Malaysia role's in the global value chain), and to a certain extent, the Life Sciences, it is much harder for the food cluster. This is why the relational and network tool is important as it looks at activities and resources between actors in the food cluster.
- **Diamond of Advantage** – Demonstrate the inter-organisational support of the industry, each with its unique contributions to the strength and cohesiveness of the cluster.
- **SWOT** – Show the important internal and external factors, including strengths, weaknesses, opportunities and threats that affect growth in the cluster.
- **Relational and Network Impact Analysis** – Establish the strength of interactional relational ties and linkages between stakeholders at a broad (macro) and inter-community (meso) level. Thick arrow indicates that actors have strong ability and capability to affect each other. A normal arrow indicates some ability and/or regular or typical relations, while a dotted/"broken" arrow indicates relatively weak relationships or influence.
- **Cluster Characteristics and Governances** – Summarises key empirical and speculative factors that informs on cluster development.

In using these tools, interpretive, argumentative and objective analysis are used based on the wealth of quantitative (statistics, published materials, survey) and qualitative data gathered (case studies, press reports, conference presentations, face-to-face interviews).

The data generated using these tools are context specific to Selangor, taken into consideration global, regional and national development. For example, data generated in the SWOT analysis of the life sciences cluster, note national health reforms, life sciences initiatives and establishment of clinical research, as opportunities Selangor could capitalise on, especially with a large hospital network infrastructure and concentration of research, teaching and supporting educational institutions in the State – key support infrastructure needed to drive the creation of a life sciences cluster. The threat for Selangor is attracting much needed global venture capitalists in a knowledge, innovation, and capital intensive life science cluster.

Key in any cluster analysis is the determination of the Industry LQ. This is a way of quantifying how “concentrated” an industry is in a region compared to a larger geographic area, such as the state or nation. The basic uses of industry LQs (and, by extension, for clusters and occupations as well) include the following:

- To determine which industries make the regional economy unique.
- To identify the “export orientation” of an industry and identify the most export-oriented industries in the region.
- To identify emerging export industries beginning to bring money into the region.

Industry LQs are calculated by comparing the industry’s share of regional employment with its share of national employment. Following Michael Porter Diamond Model (1990), an LQ greater than 1 means that employment in a given specialisation has a greater significance in the region in question than in the regions as whole. An LQ less than 1 however means that employment within the specialisation has less significance than in the regions as a whole.

Lastly, feedback from two presentations made to Invest Selangor in 2015 and from numerous discussions, was taken into account when compiling this report.

Cluster Specific Insights 01

Electricals and Electronic

2.0 Electricals and Electronic Cluster

The State's historical, structural, administrative and systemic challenges that have hampered growth prospects in semi-conductors, LED and solar panels, continue to impact on their developments. A decade of missed opportunities, Penang's dominance in E&E, fractured development, and an inherent low-value add consumer electronics sector, suggest that specialised, niche targeted infrastructure spending in design and development (through embedded technology), export initiatives, and OEM in high end value add solutions and end products, provides some hope in the region's E&E sector.

Key Takeaways:

- Opportunities exist for the State to reinvent the region's E&E industry through the development of specialised, niche targeted infrastructure spending in design and development (IoT and embedded technology), export initiatives and OEM in high end value-adding solutions, and end products.
- The State could consider the setting up of a Centre of Excellence for Techno Entrepreneurism that focuses on science, innovation and business entrepreneurship, to inspire and encourage thinking on all things IoT and embeddedness.
- In consumer electronics, more emphasis could be placed on combining production of traditional consumer electrical products with high-end industrial design of innovative solutions in lighting, semi-conductors, testing equipment and analysis that appeals to the health care, automotive and aerospace sectors.
- A business model that emphasises the State's position as a regional and global sales and distribution centre could be further reinforced, especially for small and Mid-Tier companies with potential capacity expansion.
- Financial and subsidy assistance could be provided to local consumer electronics manufacturers, to build their design capabilities, improve OEM know-how, undertake R&D and engaging in collaborative partnerships with MNCs, especially on high-end electronic products.
- A need exists to fill the talent gap in demand for IC Design Engineers, Embedded System/Firmware Engineer, RF Engineers and Software Engineers, among others. Universities and vocational training institutes could also respond by producing talent for an innovation and research - driven E&E sector, by engaging with the industry.

- Malaysia's regional comparative advantages in proximity and accessibility to air and sea logistics could be reinforced with the State's government strong supportive and facilitative role in developing the E&E industry, complimented by good basic infrastructure that facilitates innovation and pursuit of value-adding activities in E&E manufacturing.

2.1 Introduction

Given Penang's dominance in the electrical and electronics cluster (E&E) and the scales of global market competitive threats from China, Germany and the United States in semiconductors and solar, Selangor needs to act fast to build on existing remnants of excellence and business confidence, especially in consumer electronics. This include a state action cluster plan that leverage existing and emerging national and regional business specialisation and technological prospects in sub-clusters identified in E&E 1.0 and E&E 2.0.¹

With this in mind, the State's priority, in tandem with the national E&E agenda is to move beyond low-end, down-stream manufacturing to identifying, focusing and developing front-end, higher yields and value-adding activities. This includes investments in research and development in semiconductor chips design and innovative test equipment that is increasingly dominated by Internet of Things (IOT). As one executive says,

“That thing (IoT) can be embedded into anything that is around us. The markets and industries operating in the E&E space will be completely transformed.”

For Selangor, IoT and embedded technology could potentially offers the opportunity and/or circuit breaker to rethink and reboot the State's fledgling E&E sectors, by capitalising on IoT disruptive technology that will redefine sub-sectors and create new business specialisation opportunities.

For this to happen, it is not hard to see the need for a new business model and business environment that emphasises techno-entrepreneurism. A marketing director of one of the nation's largest semi-conductor sees such an environment as,

“Having people with entrepreneur skills, know - how to spot and capitalise on opportunities, and how to execute very quickly. The government is typically not very good at this (and hence the need to work collaboratively with the private sector to create the environment.”

¹ Economic Transformation Programme - A Roadmap for Malaysia. Chapter 11: Revitalising the Electronics and Electrical Sector

Ironically, the Penang State Government has seen the IoT as a potential disruptor in the Electrical and Electronics sector by creating a similar-like environment.

In rethinking and redefining the State's E&E sectors, how businesses create value for their customers, locally and internationally, remains important. The IoT, together with innovative developments in industrial electronics equipment testing and prototypes and high-end value consumer electronics, could be the platforms that deliver value in the State's E&E cluster. Especially, if these developments cut across sectors that includes automotive, medical devices and advanced electronics in mobility devices.

A business model that emphasises the State's position as a regional and global marketing and distribution centre could be further reinforced. Particularly for large and Mid-Tier local companies seeking to expand their product range by acting as agents for MNCs and/or fill the gaps left behind by established MNCs that have ceased their manufacturing operations in Selangor.

2.2 Scope

Before we explore the scope of the E&E cluster, we will first take a closer look at some key institutional, structural and market developments over the years and their potential impact on the State's E&E action plan. Drawing on the work by Rasiah (1999)², we identified three distinct phases in our analysis. We described them as follows:

Phase 1- Selangor's Missed Opportunities (Early 1970's – early 1990's)

According to Rasiah (1999)³, Selangor was better endowed than Penang when the first exodus of electronics MNCs relocated in Malaysia, in the early 1970s. The administrative capital, the promotional agency of MIDA and federal support was strongest for Selangor. Unlike Penang, however, Selangor did not receive tangible investment on computer and related assemblies. Selangor, while enjoying a relatively strong skills base is, nevertheless, limited largely to entry-point, which exists till today.

Penang has since built up a high reputation in the assembly and testing of semiconductors and components, computers and peripherals, machine tool support and consumer electronics. The presence of many large multinational corporations (MNCs) has created a very sizeable local market for the components and supporting industry, providing opportunities for local companies to be part of their supply chain, in the supply of equipment, materials, parts and components, and dedicated services such as contract design, burn-in testing, failure analysis and rapid prototyping.⁴

² Rasiah, R., 1999, "Regional Dynamics and Production Network: The Development of Electronics Clusters in Malaysia"

³ Ibid.

⁴ Ibid.

Other local supporting industries focus on activities such as moulds, tools and dies, metal stamping, surface treatment, plastic injection moulding and M&E (Mechanical & Electrical). These businesses contributed to the development and evolution of Penang's EEC. The State Government of Penang and the Penang Development Corporation has also successfully developed networks that encourage horizontal information sharing and considerable inter-firm employee interactions.⁵

Phase 2 – NKEAs under E&E 1.0 and E&E 2.0

The E&E industry in Malaysia can be broken down into four sub-sectors namely, electronic components (semiconductors, passive components, other devices), consumer electronics (audio, visual electronic games console), industrial electronics (office electronics, telecommunications, electronic tests and measurement equipment, computer hardware, storage & peripherals), and electrical products, components and industrial electrical (household appliances, white goods, solar modules, lighting equipment, solar power equipment etc.)

Information sourced from MITI⁶, with data drawn from MATRADE shows that export of electrical and electronic products grew by 13.2%, from RM149.3 Billion in 2013 to RM 168.89 in 2014. Import totalled RM 146.77 Billion in 2014, an increase of 9.7% when compared with RM 133.8 Billion in 2013 (See Table 2.1). Year-to-date November 2015 export was RM253.12 Billion, comprising mainly of electronic integrated circuits and photosensitive semiconductor devices. Import was RM183.63 Billion for the same period.

Products	2010 (RM Billion)		2011 (RM Billion)		2012 (RM Billion)		2013 (RM Billion)		2014 (RM Billion)	
	Export	Import								
Electrical Machinery, Apparatus & Appliances & Parts	131.3	137.7	140.9	127.7	140.1	128.7	149.3	133.8	168.9	146.8
Office Machines & Automatic Data Processing Machines & Parts	75.2	28.8	53.9	26.3	51.9	24.6	49.0	23.2	46.2	21.7
Telecommunications & Sound Recording and Reproducing Equipment	43.3	22.6	42.3	23.7	39.2	21.4	38.4	22.6	26.2	20.6
Total	249.8	189.1	237.1	177.7	231.2	174.7	236.8	179.6	256.1	190.8

Table 2.1 Export and Import of Electrical and Electronic Products

Source: MITI, <http://www.miti.gov.my/index.php/pages/view/2482>

⁵ Ibid.

⁶ MITI, 2015

Earlier, a study by Abad⁷ found that Malaysia's IT exports captured 5% of the global export market, significantly larger than the 1% average across other clusters. However, IT has experienced one of the biggest declines in global market share (-1.4%) across clusters since 2000 (See Figure 2.1). The authors also noted that despite policies to encourage diversification away from commodities, Malaysia's largest exporting cluster (by sheer volume) is Oil & Gas Products, while Agricultural Products represent the third largest after IT.

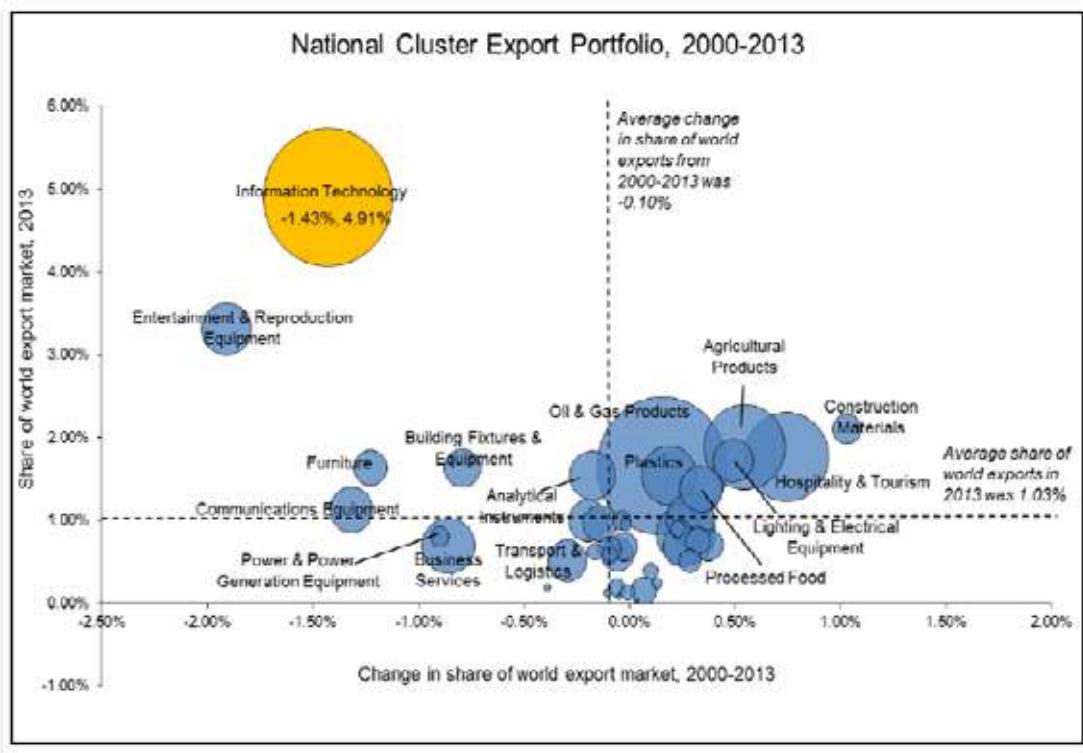


Figure 2.1 National Cluster Export Portfolio, 2000 – 2013

Source: Abah 2015, "The Malaysian Semiconductor Cluster"

Malaysia, has since, developed the Multimedia Super Corridor (MSC) which brings together a legislative framework, a high capacity of global telecommunications and a logistics framework, and eco-friendly surroundings, to create the ideal environment for the growth of multimedia industries. The aims were to move traditional main base manufacturing beyond the low end value chain to higher end in the four key – subsector.

The Electronics and Electrical sector (E&E) is now an important contributor to Malaysia's economy, accounting for 6 percent of Malaysia's gross national income (GNI), 522,000 jobs and 41 percent of Malaysia's total exports. The baseline growth and multiplier effect in this sector will deliver RM90.1 billion in incremental GNI impact by 2020⁸ (See Figure 2.2).

⁷ Abad, 2015, "The Malaysian SemiConductor Cluster- International Cluster Competitiveness Project, Institute for Strategy and Competitiveness", Harvard Business School in "The Malaysian SemiConductor Cluster" – Michael E. Porter (Abad et.al, 2015)

⁸ Economic Transformation Programme Handbook on "Revitalising the Electronics and Electrical Sector", 2012

15 EPPs, 3 business opportunities, baseline growth and multiplier effect will deliver RM90.1 billion incremental GNI impact by 2020

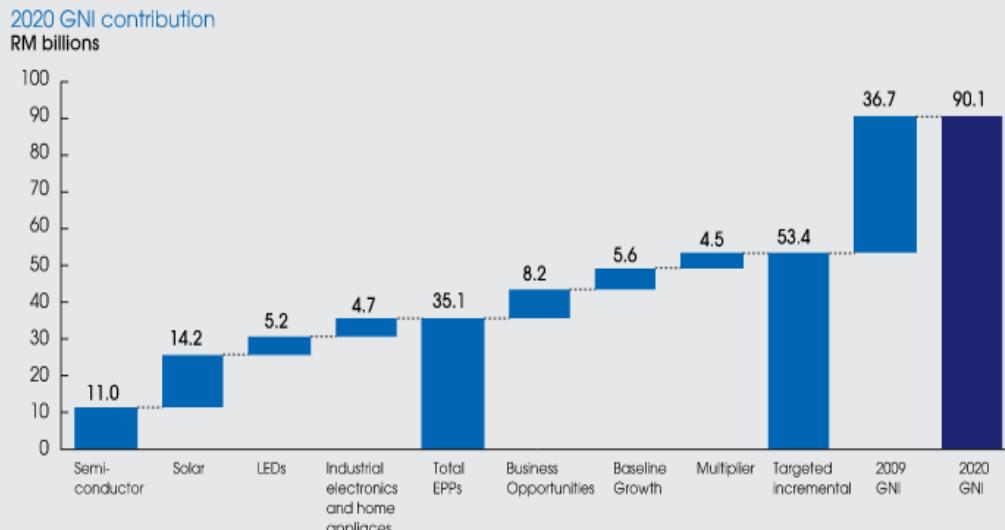


Figure 2.2 Targets and Aspirations – Malaysia’s Electronics and Electrical Sector

Source: Economic Transformation Programme - A Roadmap for Malaysia. (Chapter 11: Revitalising the Electronics and Electrical Sector, 2012)

The chapter also notes that while most global E&E leaders have operations in Malaysia, differences lies in the role the industry play in different region. Unlike Penang and the Northern Corridor with a strong orientation in (semiconductors and industrial electronics), Klang Valley orientation is on sophisticated services, while Sarawak is developing cluster for silicon substrate manufacturing.

Major E&E players and their principal business activities in Klang Valley include Sun Edison (manufacturing and sale of wafers in semiconductor), ABS (production of automation), Hanwha Q Cells (production of high performing solar modules and cells), and Khind (a major local player in Electrical Home Appliances.) MNCs that are engaged in the manufacturing and distribution of consumer electronics are also very well represented in the State although recent news report suggest that Sharp may shut their plant soon⁹, while Panasonic has closed their liquid crystal display (LCD) manufacturing plant located in Selangor in the first quarter of 2013¹⁰.

⁹ Reuters, “Sharp may shut plant in Malaysia soon, says executive”, Malaysia Kini, November 20, 2015, (<https://www.malaysiakini.com/news/320440>)

¹⁰ Jamil, Azli, “Panasonic closes LCD plant in Shah Alam, 500 lose jobs”, Free Malaysia Today, February 22, 2013, (<http://www.freemalaysiatoday.com/category/business/2013/02/22/panasonic-closes-lcd-plant-in-shah-alam-500-lose-jobs/>)

Crucially, while many E&E companies continue to play a major role in the global E&E market (example Globetronics, Silterra, Intel, Inari, Agilent and Pensonic in the Northern Corridor), and continue to provide substantive employment to the value chain and are world leaders in the market, Malaysia's focus in E&E has traditionally been on assembly, the lower value-added part of the industry.¹¹ (See Figure 2.3)



Figure 2.3 Malaysia in the Globalized Production Chain of Semiconductors

Source: Chen & Goh in KS Felker & Rasiah, 1999, "The Globalized Production Chain of Semiconductors; "Semiconductor Industry in Malaysia" in Industrial Technology Development in Malaysia: Industry and firm studies.

But as the Malaysian E&E sector faces significant challenges in maintaining growth in the face of competition from China, Taiwan, Singapore and other Asian countries, and with E&E's share of Malaysian exports declining over the last 10 years, there are now increasing calls for E&E companies to move up the value chain. Beyond assembly, packaging and testing and focusing more on R&D, Design, Manufacturing of High-Value Added material and parts¹² (See Figure 2.4). Unfortunately, they are also the areas where countries like Taiwan, South Korea and Singapore have captured the higher value-added.

¹¹ Chen & Goh in KS Felker & Rasiah, 1999, "The Globalized Production Chain of Semiconductors; "Semiconductor Industry in Malaysia" in Industrial Technology Development in Malaysia: Industry and firm studies.

¹² Economic Transformation Programme Handbook on "Revitalising the Electronics and Electrical Sector", 2012

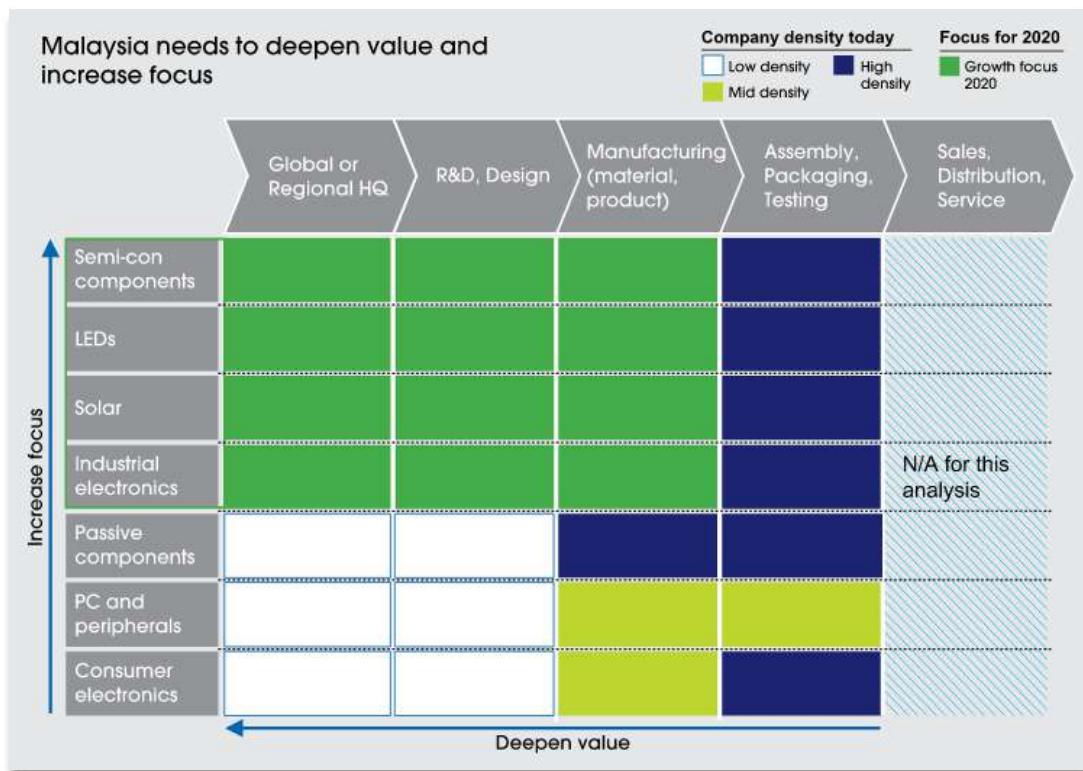


Figure 2.4 Activities in Malaysia's E&E Cluster

Source: Economic Transformation Programme - A Roadmap for Malaysia. (Chapter 11: Revitalising the Electronics and Electrical Sector)

What follows next is a description of these sectors, market trends, and challenges faced at a national and regional level. It draws on materials sourced from the Economic Transformation Handbook on the Nation's Electronics and Electrical Sector (2012). The study is significant because:

1. It identifies key developmental gaps in the value chain and measures to address them through various EPPs
2. These priorities (and highlighted) are set among identifiable regions, such as wafer fabrication in SCORE
3. It impacts on Selangor's efforts to develop the E&E sector could or could not do

The cluster is made up of 4 spaces: semiconductor, solar, light emitting diodes (LED) and industrial/integrated designs.

Semiconductor

According to the US Semiconductor Industry Association, the global semiconductor industry posted sales totalling US\$335.2 billion in 2015. This represents a decline of 0.2% when compared to 2014 total, which was the industry's highest-ever sales total. Modest growth is projected for 2016 (See Figure 2.5). Regionally, annual sales increased 7.7 percent in China, leading all regional markets. All other regional markets – the Americas (-0.8 percent), Japan (-10.7 percent), and Asia Pacific/All Other (-0.2 percent) saw decreased sales compared to 2014 (See Table 2.2).

Autumn 2015	Amounts in US\$M				Year on Year Growth in %			
	2014	2015	2016	2017	2014	2015	2016	2017
Americas	69,324	68,930	70,516	73,072	12.7	-0.6	2.3	3.6
Europe	37,459	34,388	34,355	35,331	7.4	-8.2	-0.1	2.8
Japan	34,830	31,251	31,564	32,203	0.1	-10.3	1.0	2.0
Asia Pacific	194,230	201,823	204,576	210,990	11.4	3.9	1.4	3.1
Total world - \$M	335,843	336,392	341,011	351,596	9.9	0.2	1.4	3.1
Discrete semiconductors	20,170	18,794	18,902	19,584	10.8	-6.8	0.6	3.6
Optoelectronics	29,868	33,493	35,269	36,895	8.3	12.1	5.3	4.6
Sensors	8,502	8,789	9,204	9,366	5.8	3.4	2.7	3.8
Integrated circuits	277,302	275,316	277,816	285,752	10.1	-0.7	0.9	2.9
Analog	44,365	45,483	47,027	48,953	10.6	2.5	3.4	4.1
Micro	62,072	61,170	63,047	64,474	5.8	-1.5	3.1	2.3
Logic	91,633	90,212	91,753	93,785	6.6	-1.6	1.7	2.2
Memory	79,232	78,450	75,989	78,539	18.2	-1.0	-3.1	3.4
Total products - \$M	335,843	336,392	341,011	351,596	9.9	0.2	1.4	3.1

Table 2.2 Semiconductor World Trade Statistics

Source: <http://marketrealist.com/2015/12/global-semiconductor-industry-grow-slower-pace/>

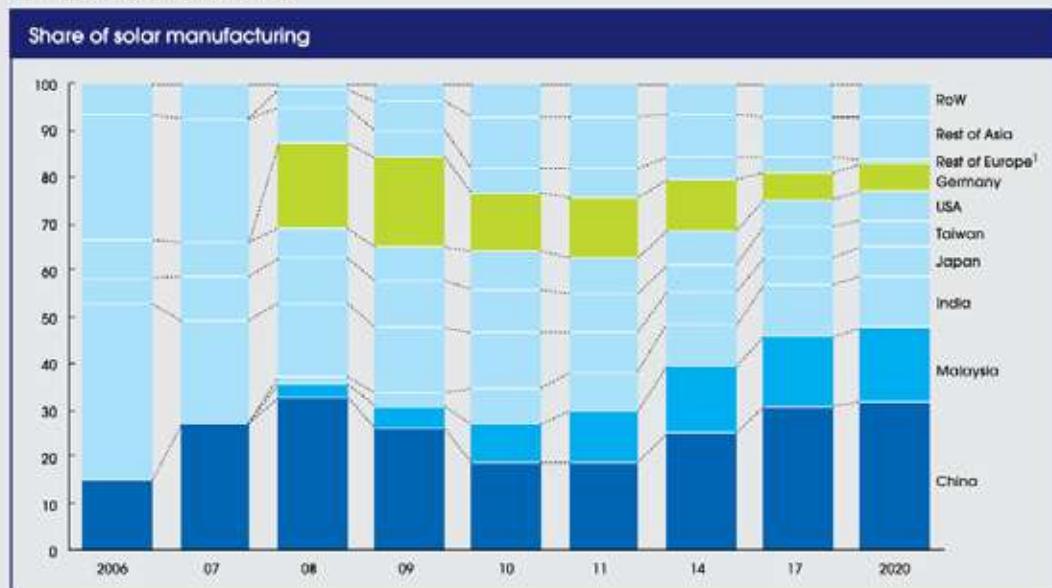
While semiconductor products make up a large proportion of Malaysia's exports, this is offset by equally large imports of core components to be assembled and/or tested, according to a report by PEMANDU.¹³ The report also notes that to increase the value-add from this sector, contributions need to increase via premiums from **intellectual property** and **import substitution programmes (emphasis added)**. Malaysian incorporated companies can also increase their top-line numbers by enhancing global competitiveness. In order to achieve healthy growth, this sector requires a robust ecosystem of component fabricators and wafer foundries, thus enabling local chip designers to market themselves effectively in their targeted niches.

¹³ Economic Transformation Programme Handbook on "Revitalising the Electronics and Electrical Sector", 2012

Solar

Up to 15% of the world's production of solar cells/modules is produced in Malaysia making the nation the world's number three producers after Germany and China, and home to major solar photovoltaic (PV) players (See Figure 2.5). The report also note that to maintain the current 15% market share, the country will require several times the **current capacity (emphasis added)** in all forms (wafers, cells, modules and panels). Interestingly, the solar value chain has similar stages to the semiconductor value chain. Malaysia already have companies operating across the entire value chain, from silicon production (Tokuyama) to solar cell manufacturing (Sunpower and Q-Cell) and module assembly (Flextronics, First Solar Putrajaya, Solartif). Many of these local companies are engaged in solar farming with significant tie-up with large corporation. Supporting agencies such as Kettha or power generating companies such as TNB could potentially provide the commercial impetus to drive growth in this sector.¹⁴

Building on strong #3 position, Malaysia is aiming to become #2 in solar manufacturing by 2020



¹ Rest of Europe for the years 2008 and 2007 includes Germany

Figure 2.5 Malaysia's Share of Solar Manufacturing

Source: Economic Transformation Programme Handbook on "Revitalising the Electronics and Electrical Sector", 2012

¹⁴ Economic Transformation Programme Handbook on "Revitalising the Electronics and Electrical Sector", 2012

Light Emitting Diodes (LED)

The Pemandu report¹⁵ made several key observations with regards to the Light Emitting Diodes (LED) sector in Malaysia. Specifically, unlike the Malaysian semiconductor ecosystem, the Malaysian light emitting diodes (LED) industry is relatively complete. Local and multinational companies also provide a total value chain, including product design, LED wafer fabrication, component fabrication, packaging and assembly, testing and certification, marketing and distribution. Growth potential for this sector remains promising due to increasing awareness on environmental and sustainability concerns.

The report also notes that an area of potential focus for this sector therefore, lies in the creation of enabling services (including design, technical, manufacturing and financial) which will allow more Malaysian companies to take their solid state lighting (SSL) products into the global marketplace. While Malaysia has many downstream SSL companies (e.g. in packaging and testing), MIDA has proposed the need to have more ***upstream companies, e.g. in chip and application R&D (emphasis added)*** producing the missing higher-value parts of the value chain (front-end), among others.

Industrial/Integrated Designs

According to MIDA¹⁶, Malaysia must integrate locally manufactured components into locally designed and produced end user products to create additional value. Leading this space is the test and ***measurement systems, automation solutions, and electrical appliance makers (emphasis added)***. Locally-designed and manufactured products are sold to industrial and retail consumers worldwide, thus increasing the GNI contributions of the original component production via design, marketing, distribution, and post-sales services premiums. Opportunities therefore are present to create a conducive ecosystem where supply and demand players can be successfully integrated.

Phase 3 - Formation of CREST (Early 2000+)

The formation of Collaborative Research in Engineering, Science and Technology (CREST) is important to the concerted attempt of the nation's effort to spearhead Research & Development, Talent Development and Commercialisation to accelerate economic growth of the Electrical and Electronic Industry in Malaysia. CREST as a company, offers R&D grants for collaborative research projects between industries and universities, in various science and engineering disciplines relevant to the E&E sector.

The objective of Targeted R&D Grant is to promote targeted research in key growth areas in LED/Solid State Lighting, Internet of Things (and Embedded Solutions), and IC Design clusters. The targeted research projects will drive new technology development and innovation (products, solutions) for intended market verticals. These will be shaped by the Technology & Market trends Input from industry and academia partners.

¹⁵ Ibid.

¹⁶ Ibid

Parameters influencing Selangor's role in the nation's E&E value chain

For Selangor, creating new business opportunities and identifying specialisations from an existing complex and interdependent networks of subsectors, is precisely what stakeholders need to focus on. With low value add, interstate competition for investments and niche-like specialisation, what we are seeing is a seemingly, disaggregated supply chain within and between sub-sectors. This reinforces a silos-like sector mentality.

What is needed is for the State to rethink and re-examine its value proposition in the various E&E sectors, and their respective and collective contributions to the regional and global E&E value chain, from a cluster perspective. Numerous parameters, however, have to be taken into consideration prior to establishing Selangor's role in the regional and global E&E value chain. From our research and face-to-face interviews with companies operating in E&E subsectors, these parameters include:

1. A small domestic regional market, general reluctance to undertake costly research and concerns over patent protection, creates and reinforces an existing "module assembly" business model among solar and semiconductor players in the State. The large imports of core components needed in assembling semi-conductor and solar and import substitution programmes will continue to drive the value chain. Says one executive,

"The need for land, water, electricity, use of chemicals and toxins to properly treat the foundries and factories further acts as disincentives for Selangor."

2. A few small-mid tier companies that are involved in the production of LED in Selangor reflect, to some extent, the actual market reality despite press releases and retail-driven promotion initiatives suggesting otherwise. Businesses involvement in LED production is, in the words of an executive working for a local company with metal stamping as its core competency, "Survival instinct, one that taps into existing production (of consumer electronics), to fill the void left by Japanese manufacturer (in consumer electronics) and that is volume-price driven."
3. Companies operating in the E&E sector are good at designing components for incorporation (embedded technology) into end user products to create value in IoT and smart phones. A good example is KeyAsic. Mr. Eg Kah Yee (CEO of Key Asics), a semiconductor design company shared similar sentiment when he says: "Key ASIC is the only semiconductor company in Malaysia that has developed a complete System on a Chip (SoC) system product and applications software on its own. Our ultra-powered products are designed for the Internet of Things (IoT), which is expected to be the next exploding trend after the personal computer and smart phones."¹⁷

¹⁷ Starbiz, 2015

4. By combining traditional consumer electrical products with high-end industrial design of innovative solutions in lighting and semi-conductors, testing equipment and analysis that appeals to vertical markets such as automotive, medical devices, oil and gas and the agricultural sector, businesses could redefine the competitive landscape that has so far been Penang-driven. Says another executive, “The general outlook for the semi-conductor industry seemed to be improving and that it (the company) was well-positioned to benefit from the growth with industry-leading products and services offering in mobile interconnectivity and automotive market. The growth in the “Internet of Thing” drive that included wearables, smartphones and wireless internet routers, among other, was evident, and estimated number could increase from 2 billion in December 2014 to 25 billion in the next 2 years.”¹⁸

2.3 Cluster Map

Historically, Selangor has been better endowed than Penang when the first exodus of electronics MNCs relocated in Malaysia in the early 1970s.¹⁹ While Selangor have become highly industrialised, their share of electronics production is not comparable to Penang. Since then, outside Penang, little links were forged between foreign multinationals and local and indigenous firms in the electronics industry, due partly to the lack of political dynamism restricting the establishment and strengthening of sourcing relationships between electronics MNCs and local firms in Selangor.²⁰ The intermediary coordination role played by the PDC in Penang has been missing in the Selangor. Through Invest Selangor and Selangor Human Resources Development Centre, investment and talent initiatives are now managed appropriately.

Malaysian electronics industry is a composite of three micro regional clusters of roughly the same size in employment, namely, Penang, the Klang Valley and Johor. Klang Valley is one of four regional clusters (besides Northern Corridor, Johor, Sabah and Sarawak) singled out by MITI for development. Its strength is in sophisticated (creativity and services) services. Selangor still has strong and renowned strengths in research and development, services and manufacturing, despite its historical shortcomings in mainstream manufacturing electronic components (semi-conductor) and electronics test and measurement equipment. Other areas such as Melaka, Negeri and Sembilan have developed later as spill-over effects took place in Penang and the Klang Valley. East Malaysia is a region that is just developing its electronics industry.

¹⁸ Ibid.

¹⁹ Rasiah, R., 1999, “Regional Dynamics and Production Network: The Development of Electronics Clusters in Malaysia”

²⁰ Ibid.

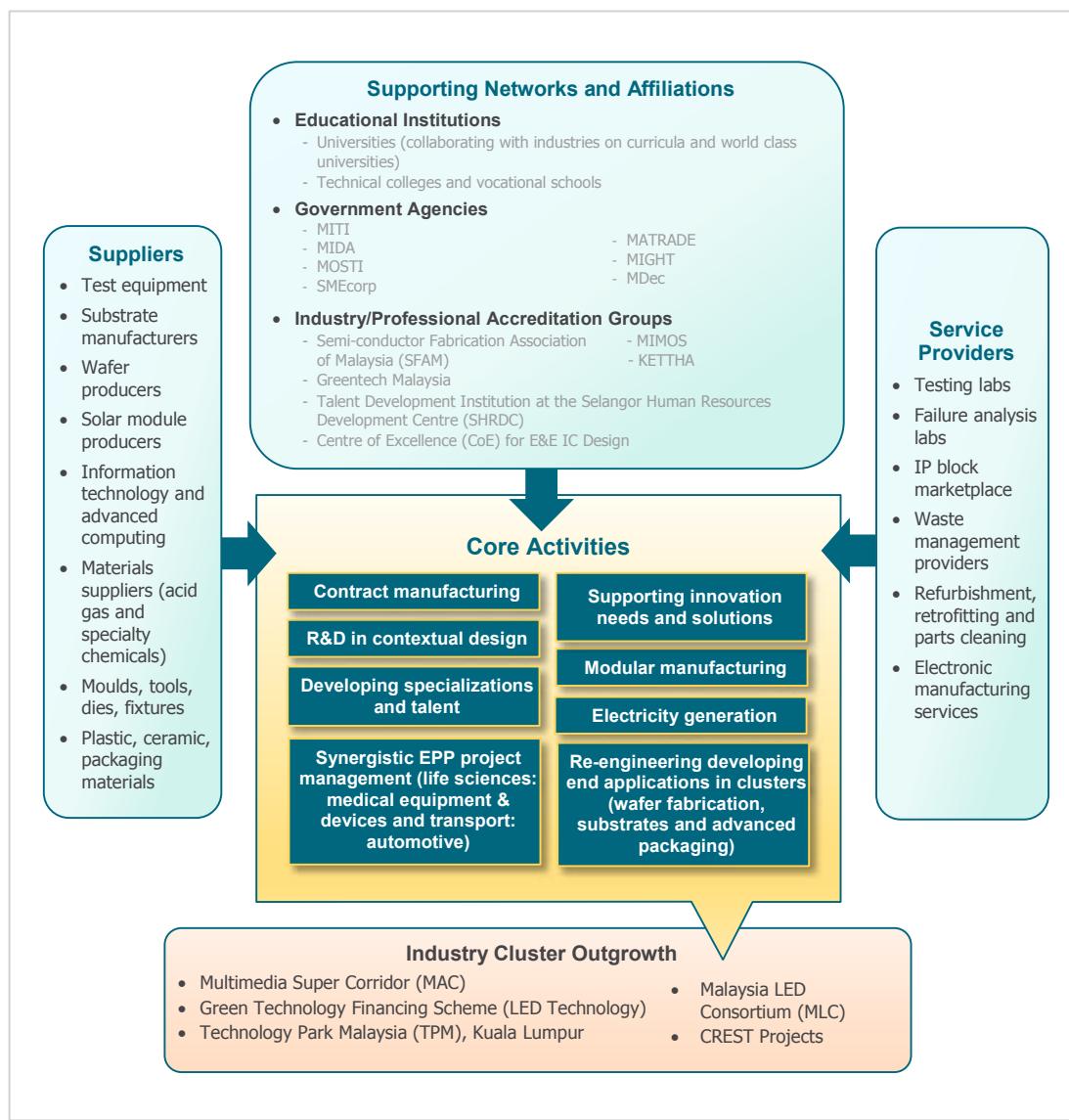


Figure 2.6 Cluster Map

Source: Monash University Malaysia, 2016

As the nation's biggest economic well-being contributor, the E&E cluster comprises of an eclectic mix of suppliers, service providers and supporting networks and affiliations (see Figure 2.6). This mix is broken down into four subsectors that include semi-conductor, LED, solar panels and industrial activities. The value chain activities of these 4 categories include chip design, packaging, wafer fabrication, substrate manufacturing, IOT, and electrical and electronic that include components, finished products such as consumer and industrial electronics, electrical appliances and industrial electrical (See Figure 2.7).

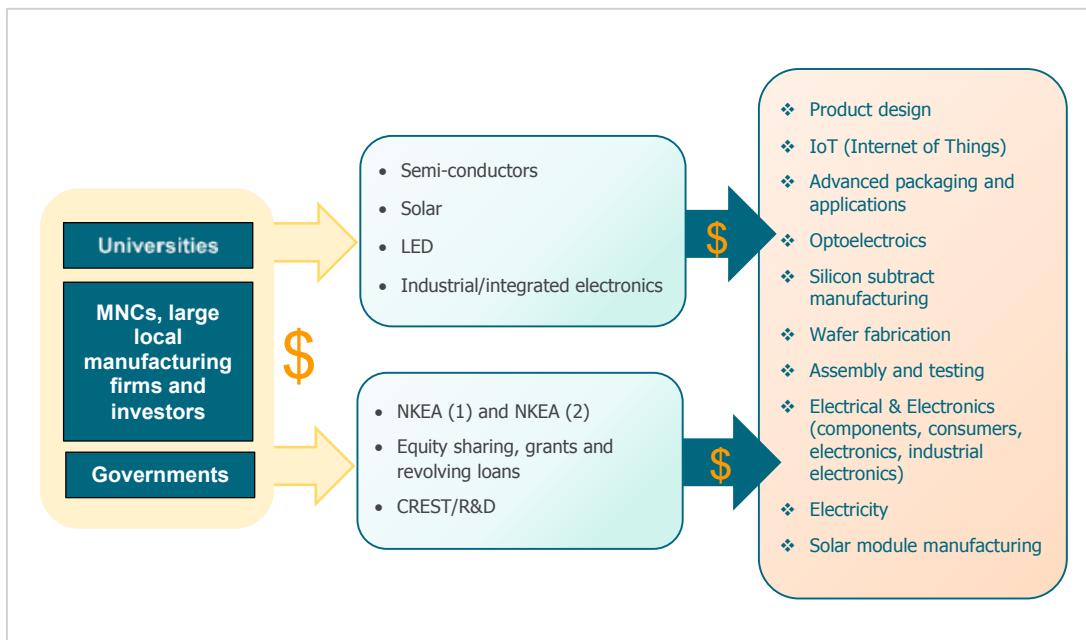


Figure 2.7 Inter-industry Value Chain Analysis

Source: Monash University Malaysia, 2016

Suppliers and/or manufacturers with active involvement in this cluster includes substrate manufacturers, wafer producers, solar module producers, plastic and ceramic packaging materials LED manufacturers and LED and semi-conductor test equipment. Service providers such as electronic manufacturing services, include end-to-end services from plastic injection moulding to printed circuit board assembly and final assembly. Examples of large MNCs and local companies operating in the **semiconductor** space, their principal business activities and locations include:

- Silterra**
Semiconductor advanced packaging; located in Kulim, Kedah
- Intel Malaysia**
Manufacture and sale of semiconductor chips; located in Penang
- Inari Technology**
Back-end semiconductor packaging and RF final testing for the electronics/semiconductor industry; located in Penang
- Infineon Technologies**
Wafer Fabrication; located in Kulim, Kedah, Melaka
- Sun Edison**
Manufacture and sale of wafer substrate; located in Klang Valley
- JF Technology**
Advanced semiconductor solutions; located in Klang Valley

- g. **S.E.H.(Shin-Etsu Handatai Group)**
Manufacture of silicon wafer, semiconductor substrate; located in Klang Valley

Companies with a strong presence in **Solar**, their principal business activities and locations include:

- a. **Tokuyama**
Silicon producer; located in Sarawak
- b. **Sunpower**
Manufacturer of solar cells; located in Melaka
- c. **First Solar**
Manufacturer of photovoltaic modules; located in Kulim, Kedah
- d. **Solartif**
Manufacturer of photovoltaic (PV); located in Kuala Terengganu, Terengganu
- e. **Solar Plus**
Solar system integrator; located in Klang Valley
- f. **Q-Cell**
Solar cell manufacturing; located in Klang Valley

Companies operating in the **Light Emitting Diodes (LED)** space include:

- a. **OSRAM Malaysia**
Manufacture LED and LEDs for General Lighting; located in Penang
- b. **ItraMAS**
Produces LED lighting products and advanced ITS field equipment; located in Penang
- c. **Globetronics**
Full turnkey manufacturing for LED products; located in Penang
- d. **Infineon**
Power, including LED Driver/Lighting ICs; located in Penang

Companies with a strong presence in **Automation Testing** include, among others:

a. **Globetronics**

Manufacturing Capabilities in Die Sawing, Auto Die Sorting, Auto Pure Tin and Tin Bismuth Plating, Auto Die Attach, Wire Bonding and Automatic Optical Inspection (AOI); located in Penang

b. **ABB**

Measuring and testing equipment for use in power and automation technologies; located in Klang Valley

Companies with a strong presence in **Industrial Electronics and Electricals** include, among others:

a. **Agilent**

Testing and Measurement Equipment; located in Penang

b. **National Instrument**

Products offered include DCS / PLC, Inverter, Process Controller / Robotics, SCADA / HMI, Sensors, Switchgear, Test & Measurement; located in Penang

c. **Motorola**

RFID, Land Mobile Radio (LMR), broadband-LTE (Long-Term Evolution) devices and system solutions; located in Penang

Manufacturing of consumer electronics (audio, visual and electronics) and electrical appliances (household appliances/white goods,) and lighting equipment particularly Solid State Lighting (SSL) system and industrial electrical and industrial electronics (office electronics, telecommunications, computer hardware, storage and peripherals) dominate Selangor's core contributions in the E&E cluster. Besides MNCs that include Sharp, Samsung and Panasonic, large local manufacturers, principal business activities and their locations include:

a. **Khind**

Manufacturer of electrical appliances; located in Klang Valley, Shah Alam

b. **Pensonic**

Manufacturer of air conditioners, heaters, televisions and home theatre and small kitchen appliances; located in Penang

c. **Alpha Home Appliances**

Manufacturer of electric water heaters; located in Shah Alam

d. **Joven Electric**

Manufacture of instant water heater for both single and multiple point shower system, water purifier and shower filter; located in Shah Alam

An extensive, supporting network and affiliations provide influential, supportive and facilitative assistance in driving cluster activities. These include various government agencies that assist in sourcing foreign and local investment activities, and the development of policies that spurs sectors growth. Notable government agencies actively involved in shaping the cluster include MIDA, MITI and MDeC, while industry associations such as Semiconductor Fabrication Association of Malaysia (SFAM), KETTHA and SHRDC are among some of the key associations that impact cluster's development.

MNCs and subsidiaries of MNCs, large local national organisations and the government through various incentives, grants and developmental funds provide much needed resources to drive cluster growth. These funds are channelled primarily through NKEA (1) and NKEA (2), equity sharing, and research and development through CREST. Nationally, we now have two E&E clusters. Where previously the nation has 4 clusters under NKEA 1, under NKEA 2 these have been expanded to five (5), which is differentiated along the lines of value add. From among the several clusters outgrowth, CREST, perhaps, has been the most important "outgrowth" in the cluster.

It is in these contexts that Selangor E&E cluster will have to consider, focussing on specialised areas and working collaboratively with other states, within the context of the state's role in the nation's global supply chain, and identifying specific niches for development, such as LED, and perhaps, SOLAR manufacturing. Especially with E&E 2.0, it is no longer feasible to focus and develop value add within one sector, without considering the impact on other sectors, as they share common technology and production processes.

This, in turn, leads to a variety of applications which will enhance the competitiveness of the sector. Value adding activities across the entire value chain rather than activities being limited to one particular sector should underpin the State's E&E action plan. For example, performing a variety of operations ranging from R&D, wafer fabrication to packaging and applications, contract manufacturing, systems integration and application design. The alternative is a continuation of low-value adding activities, with a focus on low-end manufacturing and assembly, rather than developing specialisation and talents that drives the State's core E&E activities.

2.4 Diamond of Advantage

Foreign Multinationals and their subsidiaries with few Mid-Tier local companies dominate the local E&E cluster. They influence strongly the local innovation infrastructure, employment and also exercise significant leverage in federal and MNC funding support, through their representation in key research and funding agencies. In recent times, global competition from China and Germany, escalating operating cost in wafer fabrication, increasing power of suppliers and customers and their impact on profits margins, have raised concerns over businesses viability in the production of electronics, especially semi-conductor and electrical components such as solar modules.

One bright spot, however, is in industrial design and/or industrial electronics, particularly in the production of Electronics Tests and Measurement Equipment and in IoT. Consumer electronics, semi-conductor and solar panel manufacturers are also undertaking several business transformations initiatives, as they seek to reinvent themselves and engage in higher value adding activities, such as chip design, wafer fabrication and project management.

In Selangor, the State's historical, structural, administrative and systemic challenges that have hampered growth prospects in semi-conductors, LED and solar panels, continue to impact on its development. Penang's comparative advantage, stemming from its first mover advantage with its established networks of MNCs, strong manufacturing and R&D investment infrastructure, and emerging competition from Johor, Kedah and Sarawak that offers new investors better value, whether for consumption in local market or as a contributor to the company's global supply chain, place further constraint in Selangor as an investment site for these sectors. It limits Selangor's contribution to the cluster's value chain, regionally, nationally and internationally, beyond production of low-end, high volume electronics for local consumption. These factors, and the nation's priorities in developing and redirecting investments in E&E cluster in appropriate, identifiable value chain activities, as set out under E&E2.0, provides the current and future context in Selangor's role and/or contributions, in the development of the nation's and the State's electrical and electronics cluster.

Of course, a number of input conditions could help shape the State's development of the E&E sector (See Figure 2.8). Accessibility to skilled workforce ought to provide much needed impetus to drive a high-value, innovative-driven cluster. That means inputs that are less labour - intensive and more R&D led. Inputs that tap into emerging new business growth areas such as IoT, embedded technology and equipment testing, provides much needed focus for Selangor to take the leap forward caused by disruptive technology in semiconductor. It offers Selangor the opportunity to leverage and built on its core competencies in manufacturing, and contributes to high value-adding activities that cut across the entire spectrum of sectors in E&E, transportation equipment and life sciences sector.

Local, regional and global demand factors will also impact on businesses operating in this cluster. This includes proximity to regional markets, price sensitivity, especially as it relates to local labour cost, and relationship with local and international manufacturers, suppliers and markets. Growth in local population and a corresponding increase in demand and purchase of white goods, especially among low-end, price-volume manufacturers, will ensure their continuous survival. This, however, is complimented by efforts to seek growth in export markets, greater involvement in contract and original equipment manufacturing (OEM) and acting as regional distributor for companies without

a local manufacturing and/or regional distributor presence. Other key inputs condition as they impact on foreign MNCs in consumer electronics, in the Klang Valley (Sharp, Samsung, Panasonic), include access to skilled workforce, innovations, investment in R&D, and a redefinition of their roles in Malaysia, in their respective corporation's global value chain.

Increasingly, stakeholders are now expanding beyond their silos-like mentalities that have hampered commercialisation of cluster development, leveraging off their existing infrastructure, reframing their business models, and working together toward shared, common cluster goals. There is also a greater level of federal-state inter-ministerial coordination, to drive technological initiatives (primarily through CREST). Crucially, it seems that various associations, agencies and organisations are mindful of the importance of leveraging off their respective resources and resource transformation activities to add value, not only to their only industry, but to the cluster as a whole. In this context, relating and supporting industries could, perhaps, brings together spatially distributed activities, move a business model beyond their respective sectors, to one that is oriented towards an export market, demand-driven agenda.

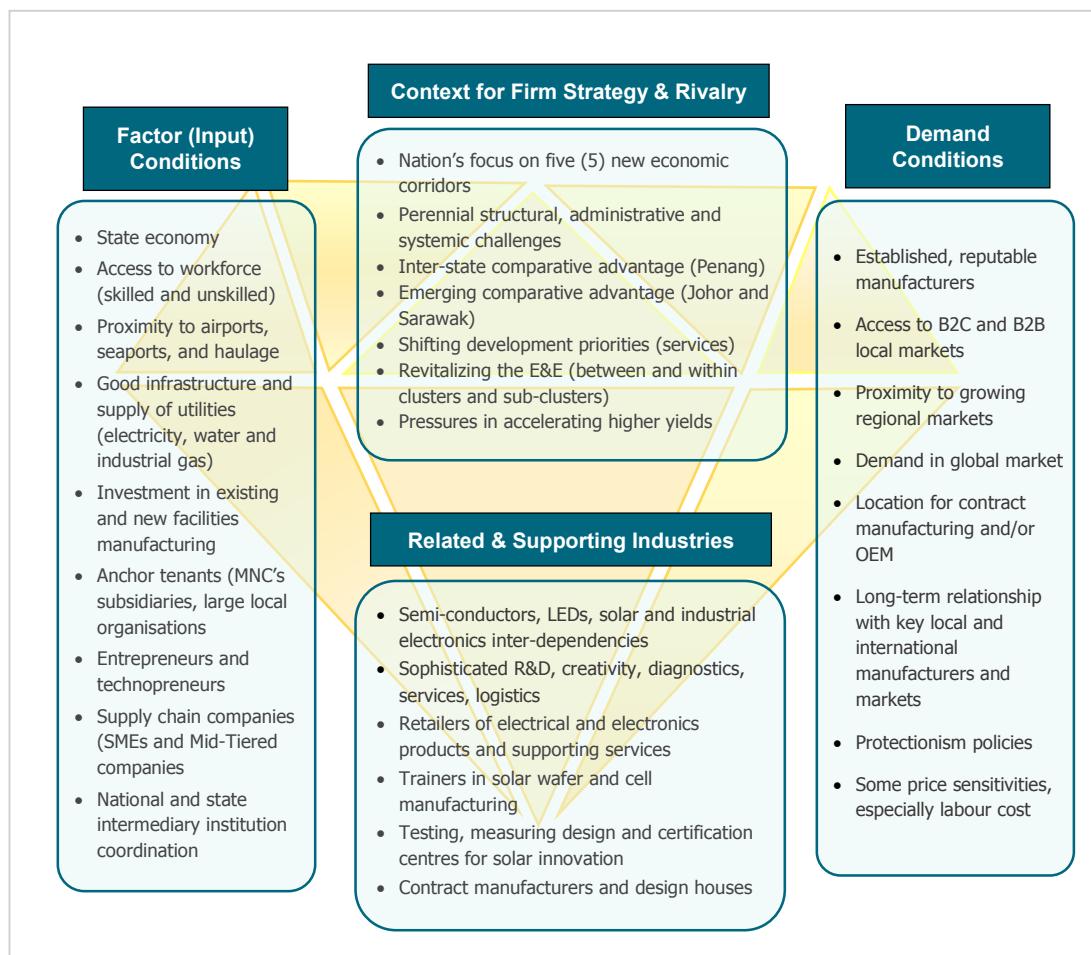


Figure 2.8 Diamond of Advantage

Source: Monash University Malaysia, 2016

2.5 SWOT Analysis

2.5.1 Comparative Advantages

In the 2014-2015 Global Competitiveness Report on competitiveness factors driving the E&E industry, it is worth noting that Malaysia was ranked 20th overall, coming behind Singapore (ranked 2nd) and Taiwan (14th) but ahead of the Republic of Korea (26th) and China (28th) (See Table 2.3). Comparative analysis of these countries on six key competitiveness factors driving the E&E industry, however, ranked Malaysia 25th in the world in infrastructure, ahead of China but behind the others.

While Malaysia offers good investment incentives (10th in World Ranking) compared with Singapore (4th), the nation's tax rate was poorly ranked (65th). Interestingly, in terms of number of procedure needed to start a business in the E&E industry, Malaysia's ranking is on par with Singapore and Taiwan (10th equal). The country's financial market development was ranked 4th but on low tax rates, it was ranked 65th, behind China (13th) and Singapore (27th).

No.	Competitiveness Factors Driving E&E Industry	World Ranking				
		Singapore	Taiwan	Malaysia	Korea	China
1	Infrastructure	2 nd	11 th	25 th	14 th	46 th
2	Labour market efficiency	2 nd	32 nd	19 th	86 th	37 th
3	Incentives to invest	4 th	33 rd	10 th	106 th	44 th
4	Low tax rates	27 th	58 th	65 th	30 th	13 th
5	No. of procedures to start business	10 th	10 th	10 th	32 nd	13 th
6	Financial market development	2 nd	18 th	4 th	80 th	54 th
	Overall	2 nd	14 th	20 th	26 th	28 th

Table 2.3 Competitiveness Factors Driving E&E Industry

Source: The Global Competitiveness Report 2014-2015, World Economic Forum

2.5.2 Operating Environment

In a survey of E&E industry in Malaysia's operating environment, government regulations, ease of dealing with government, and availability of electricity were the top three enablers in industry. On a score of 1-5 (5 being the most important factor), there were, however, very little separating the top three factor from the next four factors, as all had importance ranking score of at least 4 (See Figure 2.9).

Interestingly, in addition to having the right incentives as enablers, labour (including availability, cost and productivity) follows closely behind. Presumably, labour includes talent in technical, engineering and complex machine operation skills. The availability and cost of land, as well as proximity and accessibility to both air and sea logistics, were among the lower ranked enablers.

Singapore performed well when compared with Malaysia across the top six enablers, including availability, cost and productivity of labour. Malaysia's comparative advantages include proximity and accessibility to air and sea logistics.

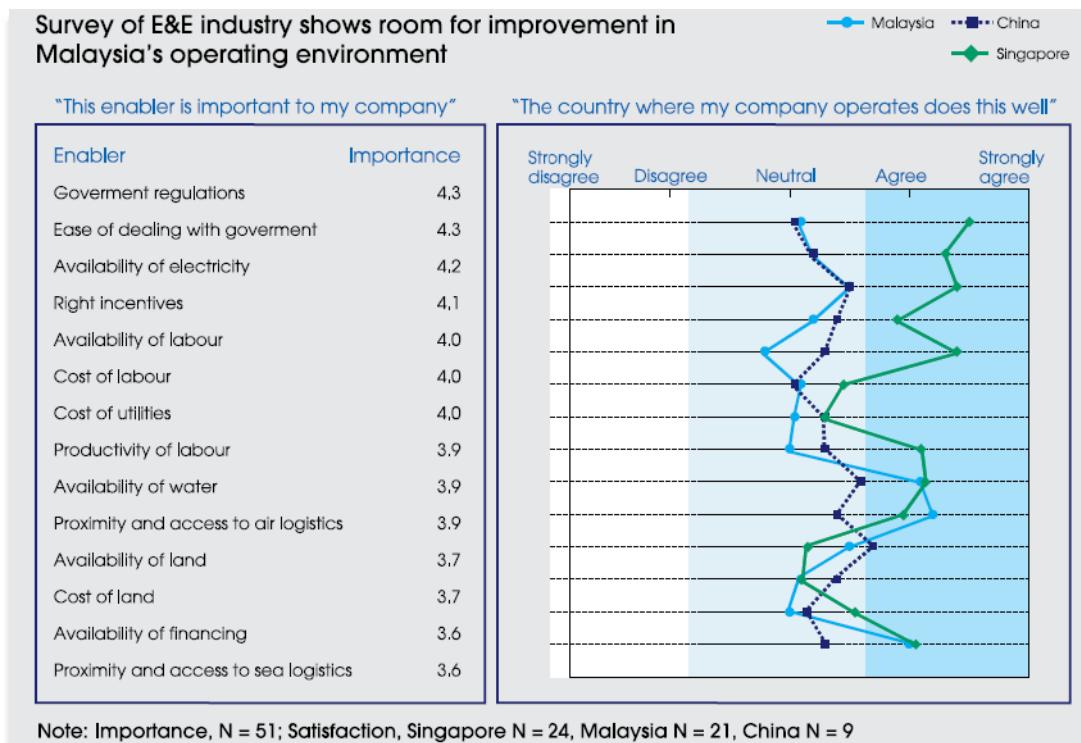


Figure 2.9 Survey of E&E Industry in Malaysia

Source: Economic Transformation Programme - A Roadmap for Malaysia. (Chapter 11: Revitalising the Electronics and Electrical Sector)

Findings from the survey of E&E Industry in Malaysia are reinforced somewhat by this study's survey of 32 businesses operating in the E&E cluster in Selangor. Specifically, 66% think that the business environment will have the most impact on their businesses over the next 2-3 years. Availability of talent (44%) and availability of labour (41%) were, however, the next two most important issues.

Importantly, our survey shows that 75% of these businesses described the State's government role as being supportive or facilitative in the development of their industries. This is a very positive and important development, especially since government regulations and ease of dealing with the government, were deemed the top two enablers to businesses operating in the E&E Industry, described earlier.

2.5.3 Talent

It is also worth noting that between the period January – December 2014, and the potential employment among personnel with technical and science qualifications, the number of E&E engineers, Mechanical engineers, Chemical Engineers and Others is expected to total 407, 353, 350, and 336 respectively, contributing to a combined total of 1,737 engineers in Selangor.²¹ This compared with 3076, 2242, 1524 and 1153 total engineers that are required in Penang, Johor, Kedah and Melaka respectively. Most of these engineers will be deployed in high technology, capital-intensive and knowledge-driven industries that include among others, advanced materials, advanced electronics, optics and photonics, and ICT.

While in general the demand and supply of engineers isn't giving businesses in the E&E sectors any great cause for concern, in terms of quality of talent, these businesses are not celebrating either. A study conducted by Ipsos Business Consulting²² identified several areas where the talent shortage is prevalent i.e., areas in which industry players are unable, or find it difficult, to recruit entry and experienced level talent with the required skill-sets needed for the specific roles. According to the study, the identification of the talent shortage areas also took into account the key talent areas that can support the growth of the sector towards higher value added activities (e.g. R&D) as well as key subsectors identified by the ETP. Talent shortage areas that were identified in the study are mainly in the areas of R&D, Design, Software, RF and Engineering Support functions (See Table 2.4).

Talent Shortage Area	World Ranking			Educational Requirement
	Entry	Mid-Level	Experienced	
IC Design Engineers	●	●	●	Degree in E&E with emphasis in IC Design / Microelectronics
Embedded System / Firmware Engineer	●	●	●	Computer Engineering, E&E
Software Engineer	●	●	●	Degree in Software Engineering, E&E
RF Engineer	●	●	●	Degree in E&E, Telecommunications
Media Process Engineer		●	●	Mechanical Engineering, Material Engineering, E&E
Wafer Fabrication Process Engineer		●	●	Chemical Engineering, Mechanical Engineering, Material Engineering
Test / Measurement Engineer		●	●	Mechanical Engineering, E&E, Statistical
Product Design R&D Engineer	●	●	●	Mechanical Engineering, E&E

Table 2.4 Key Talent Shortage Areas at Different Talent Level and the Educational Requirements

Source: Ipsos Business Consulting, 2012, "E&E Sector Study on the Supply-Demand of Talent in Malaysia"

²¹ MIDA, 2015

²² Ipsos Business Consulting, 2012, "E&E Sector Study on the Supply-Demand of Talent in Malaysia"

Anecdotal evidence from our interviews conducted with senior executives in the E&E industry also suggests a gap between academic learning and real-world engineering practice. One senior executive view reflects his peers' sentiments when he warns,

“We have recruited fresh engineers from local universities for IC design. We found whatever they learn is not sufficient. We still need to train them for another 6 months or one year before they are productive or they can't be involved in the customers' projects.”

The same executive when on to says,

“The E&E sector is becoming more exciting and is transforming. This is the best time to do something because of a very exciting and unknown opportunity which is called IOT. IOT is a market that is tailored to engineers. You need to be an engineer before you can solve an IOT problem. Inside the heart of IOT, it's actually intelligent device, it's the integration of hardware, software and firmware. If you don't have an engineering background, there's no way that you can do this.”

Under these circumstances, there ought to be better interactions between practitioners and academic researchers and instructors, to share information on how they could support each other, with better trained engineers. With a high concentration of universities in Selangor and Kuala Lumpur, offering a variety of engineering related programs, and a number of vocational institutes that offers skilled vocational training that includes machine operators, plant maintenance, machinist, quality controller, and electrician/charge man, having a qualified pool of engineers could only result in comparative, higher level of engineering outputs (See Figure 2.10).

Nationally, there are opportunities in higher value fabrication, advanced packaging and design of integrated circuits, growth of substrate markets, and high-end LED markets. Demand for memory and logic products, semi-conductor content in automotive and high-end smartphones is growing. Doing well in these business areas could, however, pose a challenge for Selangor given Penang's comparative advantages. In addition, these business areas require an unprecedented level of customisation through project management, responsiveness through high-end value adding technical R&D and innovations. It requires the State's to also re-examine its role in the local and global E&E value chain, while being sensitive to existing players' current contributions at the same time.

Of course, a concentration of lower value adding activities that are unfocussed and undifferentiated, due to poor marketing, branding, distribution and limited capacity building among SMEs and Mid-Tier companies, also contributes to the cluster's weaknesses. Rethinking and rebooting requires businesses to move beyond contract manufacturing, investment in new soft skills engineering development, progressing from project management and modular assembly to investment in high-value adding software customising, for regional and global clients. The lack of cooperation between sectors in the cluster further impacts investment in innovation, presents challenges in accessing equity, and undermine efforts to create a techno business environment that incentivise risky business propositions.

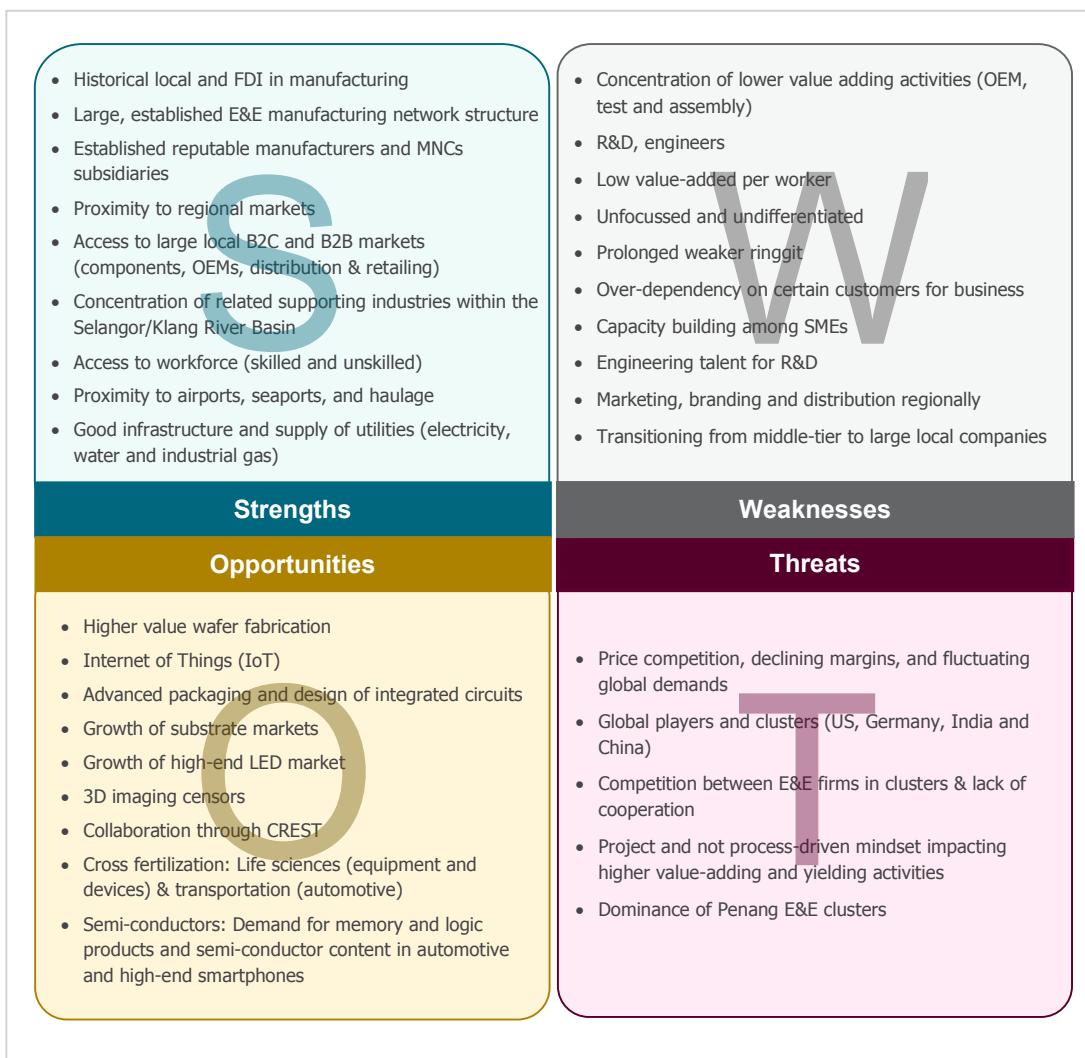


Figure 2.10 SWOT Analysis

Source: Monash University Malaysia, 2016

2.6 Relational and Network Impact Analysis

2.6.1 Relations between MNCs and Large Local Firms

Historical reliance on MNCs to develop the nation's E&E sector that led to the creation of a sizeable local market for the components and supporting industry has meant that local firms have a weak technological and market base to begin with. Close collaborative ties existed between foreign MNCs and local firms led to the emergence of electronic manufacturing services (EMS) companies and supporting industries that focus on activities such as moulds, tools and dies, metal stamping, surface treatment, and plastic injection moulding (See Figure 2.11). Not surprisingly, it depicts a strong dominance of foreign MNCs in sectors development, in the clusterisation of electrical and electronic industry, especially in electronic components (semi-conductors, passive components), electrical components (solar modules) and industrial electrical (solar power equipment and heavy electrical equipment) and solar panels.

Regular interactions between MNCs and local companies exist in Selangor, particularly in the production of consumer electronics and electrical appliances. Our research suggests that this is partly due to local company primary role in sales, distribution and manufacturing of appliances for MNCs, as well as contract manufacturing, including OEM. Mid-Tier, large local companies that have upgraded their technical skills, with excellent knowledge of local markets and strong relational ties with local distributive networks, have also benefited from the MNC's role in directing industrial development in the consumer electronics and electrical appliances sector. Importantly, they have indirectly spurred the creation of small entrepreneurial start-up, that have since prospered and grown to Mid-Tier and large local companies (examples KHIND, MEC and Pensonic), that compete in price-sensitive markets. While their capabilities are limited in R&D, engaging in low-end moulds and dies casting, export efforts are being stepped out to build their brands globally.

2.6.2 Relations between MNCs, Government, Local Intermediaries / Associations and Academic Institutions

While local firms are enhancing their capacity and gaining more exposure to export markets, with greater access to a wider pool of labour and talent, as well as demonstrating readiness to invest in R&D and seeking patents for their innovation, the governance of this technology-driven and export-led cluster is still influenced heavily by interactions between MNCs, government and local intermediaries, that includes specialist agencies and industry association.

In Selangor, the Talent Development Institution at the Selangor Human Resources Development Centre (SHRDC) provides skill training, with programs in Electrical & Electronic/Industrial Electronics and Solar Photovoltaic. Besides CREST, whose members include many MNCs, spearheading research & development, talent development and commercialisation, in an effort to accelerate economic growth of the Electrical and Electronic Industry in Malaysia, other government associations such as the Semi-Conductor Fabrication Association of Malaysia (SFAM) and the Centre of Excellence (CoE) for E&E IC Design are also involved in cluster policy processes.

Federal and local agencies such as MITI, MIDA, MOSTI, MIGHT and Invest Selangor, provides strong influencing and supportive role for E&E cluster development, in interacting frequently with MNCs and large, local companies. Many of these agencies serve as core coordinating agency or intermediary institutions, targeting particular industries or assisting local companies in export marketing initiatives. Indeed, as the local general and business environment is not giving cause for celebration among businesses operating in the E&E cluster, an existing fractured supply chain needs urgent and remedial measures, to prepare much needed technological and market platforms to compete in the global market.

For the State government, that means engaging in strong collaborative relationships with the industries. While in a developed economy, universities and research institutes are expected to have key influence in cluster policy process, as they are also more likely to be in sync with clusters and industries requirements, this is unlike in a developing economy. Especially, one that is still dominated by MNCs, where the role of academic institutions is on the supply side and not the demand side of industry needs. The State will have to develop an Action Plan that capitalises on identifiable niches and/or gaps in the State's E&E sectors, while taking into considerations market, technological, and historical institution context, that includes the development of E&E 1.0 and E&E 2.0. These gaps and/or opportunities are highlighted below.

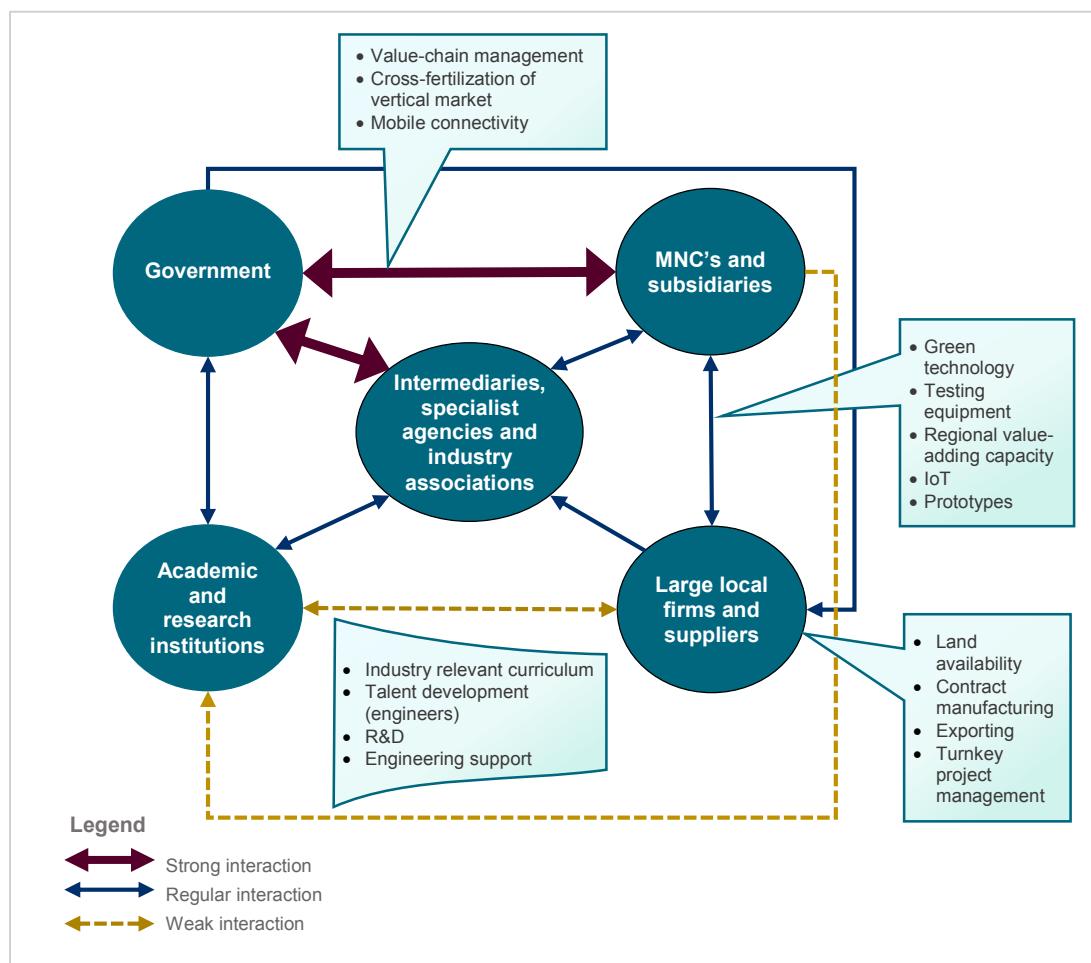


Figure 2.11 Macro Analysis

Source: Monash University Malaysia, 2016

2.7 Relational Gap and Opportunities

Between MNC's with large, national firms - New ideas, new thoughts, new roles?

- Research and development in Internet of Things (IOT)
- IC designs and development of prototypes
- Testing equipment in industrial electrical
- Green technology, module and contract manufacturing
- Selangor's and the nation's role regional value-adding capacity

Between academic, research institutions, large, local manufacturers and MNC's – Greater, closer collaborative engagements?

- Development of industry-driven curriculum
- Investment in talent development, especially engineers
- Creating and supporting a techno entrepreneurs business environment

Between Government, MNCs and large, local manufacturers – Rebooting and Rethinking?

- Enhancing productivity and value chain management
- Transiting from silos-based E&E sector specific mind-set to cross-fertilisation of innovative solutions with vertical markets (examples: medical devices, automotive and oil & gas), IOT & mobile connectivity
- Capitalising on disruptive technology
- Beyond factor of production to service dominant E&E cluster
- State facilitated and supported business environment and/or centre of excellence for techno-entrepreneurs underpinned by science, innovation and business entrepreneurship to inspire and encourage innovative thinking on all things IoT and embeddedness.

Large, local manufacturers – Reinvention and expansion?

- Industrial congesting and land scarcity
- Generally low skill set requirements
- Export markets
- Contract manufacturing, module assembling and turnkey project management

2.8 Summary of Online Survey Findings

- **32 (19%)** businesses identify their company's business as primarily operating in the Electrical and Electronics (E&E) cluster from 167 interviews conducted online.
- **Fewer than one in five businesses (19%)** in the E&E cluster think that the business environment will **change for the better**. **44%** think it will change for the **worse** while one in three businesses think it will **remain unchanged**.
- **75%** however remain **very confident or somewhat confident** about their company's business prospect over the next 2-3 years.
- **72%** describe their industry as **highly competitive**. The E&E industry is described as technology driven by 59% of businesses while **50%** thinks that it is an industry where **buyers have increasing bargaining power**.
- Heavy dependence on local market (**63%**), strong local market wisdom (**59%**), and strong technological expertise (**38%**) were listed as the top three capabilities of local firms and suppliers operating in the E&E cluster.
- The issues with the most impact on businesses in the E&E cluster over the next 2-3 years are **business environment (66%)**, availability of talent (**44%**), and availability of labour (**41%**).
- **75%** of businesses in the E&E cluster describe the state government's role as being **supportive or facilitative** in the development of their industries. **16%** think that it was **inhibitive or constraining**.
- **78%** (25 businesses) also describe the role of industry associations, academic and research institutions in the development of their industries as **supportive or facilitative**.
- Only **38%** of businesses operating in the E&E cluster are **optimistic** about their growth potential in Selangor, ranking the cluster among the top two growth cluster.
- **78%** of businesses in the cluster indicate their sales and marketing priority for the next 2-3 years is to **concentrate on existing or develop new products/services but seeking new markets**.
- **40%** (16 businesses) reported **export sales of more than 30%** while **38%** of businesses focus exclusively on the **local market**.

2.9 Conclusion and Recommendations

The Electrical and Electronics cluster is, not surprisingly, very capital intensive with fast changing technology. The ownership of dominant firms in semi-conductor, LED and solar photovoltaic, comprises mainly of subsidiaries of foreign MNCs with strong, local manufacturers emerging. Manufacturers generally have a high level of technological expertise and local wisdom, especially in integrated industrial electronic design, manufacture of wafer substrate, semiconductor packaging, and manufacturing of solar cell and module assembly. The federal government exercise strong influential and supportive role in a cluster which, historically, is dominated by foreign MNCs. Overall, companies operating in the cluster could be characterised as dispersed and non-cooperative, at least prior to the formation of CREST (See Table 2.5).

Despite many challenges in the E&E sector, there are tremendous opportunities for cross sector fertilisation of ideas, innovation and product development. These could feed into other sector such as the automotive and aerospace. According to MIDA²³, in Semiconductors, the focus could be building on our strong foundations in the area of mature tech fabrication and expanding into advanced packaging and design of integrated circuits as well as supporting the growth of substrate manufacturers. In SOLAR, opportunities exist for capacity building in the production of solar photovoltaic and high-value adding activities and productivity in integrated industrial electronics design. In LED, there is a need to move up the value chain, from packing and testing, to chip and application R&D, while the need to grow scale and build a strong international distribution is important among local home appliances companies seeking growth beyond the local markets.

Opportunities for cross sector fertilisation could translate into opportunities for specialisations. For example, expected increase in integration of electrical and electronic with automotive technology that offers better safety design and driving features and provide in-car access to communication networks, as well as mobile devices increasingly serving as gateway to Internet of Things (IoT) that could fuelled demand for Advanced Testing Equipment, offers one such opportunity. The focus on international customers is also now broadening the field of competition among local and foreign MNCs in the cluster, with many also moving into other markets and other industries in the cluster.

2.9.1 Recommendations

It is in these contexts, that Selangor has to rethink its capabilities in the E&E industries. Among several proposed recommendations, the State could consider:

1. Capitalising IoT

Beyond a manufacturing-driven E&E sector, the Internet of Things (IoT) offers the State an excellent opportunity to rethink and reboot this sector. By capitalising on IoT (i.e. the analysis and design of its embedded technology,) the State could redefine existing E&E sub-sectors and identify new business specialisation opportunities that are underpinned by its core competency. Crucially, the State could reposition its contributions to the national and global E&E value chain, relative to Penang's dominant position in E&E infrastructure.

²³ Economic Transformation Programme Handbook on "Revitalising the Electronics and Electrical Sector", 2012

For this to work, a techno entrepreneurial committee could be set up as a matter of State's priority. The State next needs to create a centre of excellence for techno entrepreneurship that focuses on science, innovation and business entrepreneurship, to inspire and encourage thinking on all things IoT and embeddedness, mindful, however, of an existing IoT cloud data centre and research lab in Penang where domestic and international industry players work collaboratively with CREST.

2. Combine traditional and high-end

Combine production of traditional consumer electrical products with high-end industrial design of innovative solutions in lighting and semi-conductors, testing equipment and analysis that appeal to vertical markets in the health care, automotive and aerospace. For this to work, State's government participative regulations are needed to bring together key stakeholders from various E&E sectors currently manufacturing and/or producing applications to these sectors. To move up the value chain, identifiable companies working in these specialised areas need to also consider working collaboratively with other states, and contribute to the nation's role in the global supply chain. We note, in particular, systems integration in solar photovoltaic, advanced packaging and applications, integrated industrial analysis and design.

3. Emphasise position as regional and global sales distribution centre

While the State's priority in tandem with the national EEC agenda is to move beyond low-end, down-stream manufacturing to identifying, focusing and developing front-end, higher yields & value-adding activities, the reality is that large local and foreign MNCs in the electronics sector have consistently been a major employer, generating strong export earnings. Although harder times, in terms of cheap imports from China, are likely to prompt more serious thought about their business model, large local companies need to have more room to grow and export their products, while building on their existing core competency of producing low-value, high volume products for local market consumption. A business model that emphasises the State's position as a regional and global sales and distribution centre could be further reinforced, especially for small and Mid-Tier companies, with potential capacity expansion.

4. Assistance for local brands

The idea of establishing an Industrial Design Centre of Excellence in Klang Valley put forth by MIDA²⁴ deserves consideration, especially since there is a cluster of headquarters of local E&E brands (e.g. Khind) and international brands (example Panasonic, Samsung). Local brands, however, not only require assistance to build design capabilities they also need assistance in improving their OEM know-how, especially with high end electronic products. Research and development spending and/or collaborative partnerships in technology transfer should be given more impetus. This development could be reinforced

²⁴ Ibid.

by the State push to position itself as the nation's international and regional distribution centre, as MNCs in Asia Pacific seeks to leverage off the nation's reputation in consumer electronics. Export initiatives and incentives could be extended to smaller, local manufacturers in the state to expand their capacity.

5. Filling talent shortage gap

As an enabler, the availability and quality of talent is a cause for concern as they impede the growth of the industry. Several areas where talent shortage is prevalent have been identified. They include IC Design Engineers, Embedded System/Firmware Engineer, RF Engineers and Software Engineers, among others.²⁵ There is also the issue of engineers with academic training but not necessarily the skill to make the transition to the demands of the industry. Universities and vocational training institutes could respond by producing talent for an innovation and research - driven E&E sector, by engaging with the industry, thus enhancing student's employability. Working in close collaboration with stakeholders that include CREST, universities and industry could pursue more commercialisation opportunities. The State could also provide innovation funds to promote the discovery and commercialisation of IOT and embedded technology. Through Selangor Human Resource Development (SHRDC), the State could also mix-and-match identifiable sector skills set with their talent requirements.

6. Enhance competitiveness

While Singapore performed well when compared with Malaysia across the top six enablers in the competitiveness factors driving E&E industry²⁶, including availability, cost and productivity of labour, Malaysia's comparative advantages include proximity and accessibility to air and sea logistics. These advantages could be reinforced with the State's government strong supportive and facilitative role in developing the E&E industry, especially since government regulations and ease of dealing with the government were deemed the top two business enablers in this industry. This ought to be complimented by good basic infrastructure, predictable supply of utilities, faster broadband internet connections, integrated logistics systems, and reasonable costs and incentives to innovate and undertake value-adding activities in manufacturing.²⁷

²⁵ Ipsos Business Consulting, 2012, "E&E Sector Study on the Supply-Demand of Talent in Malaysia"

²⁶ "The Global Competitiveness Report 2014-2015", *World Economic Forum*

²⁷ Monash University Malaysia, 2015, "A Study of Industrial Parks in Selangor"

2.9.2 Summary of Cluster Characteristics and Governances

Characteristics of Electricals and Electronic Cluster								
Cluster	Nature and Structure of Industry			Capabilities of Cluster Actors			Cluster Governance	
	Capital Intensive	Technology-driven	Structure of Cluster Ownership	Local Private Firms / Selangor	Intermediary Institutions (association, academic, research institute)	Government Agencies / Selangor		
Semi-conductor	High	Very fast changing technology	Clusters of subsidiaries of MNCs and emerging strong local manufacturers	Large local firms, high level of technological expertise, entrepreneurial flair and strong export orientation	Emerging leadership, available resources, strong local and regional networks	Influential and supportive (E&E 1.0 & E&E 2.0)	MNC-dominated and government coordinated, growing local intermediary institution coordination	
Solar	High	Moderately fast changing technology	Clusters of subsidiaries of MNCs and strong local manufacturers and modular assemblers	High level of local wisdom and expertise with capabilities in advanced SSL	Strong reliance on foreign MNCs, emerging leadership, reliance on large local firms and foreign MNCs	Influential and supportive	MNC-dominated and government coordinated, growing local intermediary institution coordination	
LED	High	Moderately fast changing technology	Clusters of subsidiaries of MNCs and emerging local manufacturers	Active local firms, high local level downstream wisdom with strong export orientation	Highly available local resources and strong networks for local markets	Influential and supportive targeted facilitation	MNC-dominated and government coordinated	
Industrial / Integrated electronic design	Medium	Fast changing technology	Clusters of local designers and innovators	Local firms are gaining prominence in advanced technology	Weak reliance on MNCs to compliment local designers	Facilitative and supportive	MNC-dominated and government coordinated to build capacity for SMEs	

Table 2.5 Summary of Cluster Characteristics and Cluster Governances

Source: Monash University, Malaysia, 2016

2.10 Best Practices

Case Study 1: Chinese Government Support to Solar PV Manufacturing

Background and Findings

The Chinese government has strongly supported the development of a world leading solar manufacturing industry. China also promoted an industrial policy with measures that included low-rate loans, tax credits, and grants. The National Development and Reform Commission (NDRC) programme targeted R&D development and demonstration projects for manufacturers and R&D institutions with various incentives. China's core cost advantage in cell manufacturing comes largely from scale economies and vertical integration. All these factors have provided 18 - 20% core cost advantage for Chinese cell manufactures (exclusive of shipping costs).

In the context of global glut, Chinese module prices further declined from \$3.25/Wp to \$1.14/ Wp from 2008 to 2011/ Solar PV Deployment Policies China has made a conscious effort towards accelerating solar PV installation by addressing the financial and regulatory barriers that hampered deployment. In March 2009, a national PV subsidy programme to promote the use of Building Integrated PV (BIPV) applications and rooftop systems were introduced. A competitive bidding scheme for price - discovery in solar PV projects was also initiated under the program me. As a result of these deployment schemes, the solar PV installations were ramped up.

Relevance

The importance of a large domestic market to drive growth in world market, government promotion of an industrial policy that include tax and financial incentives, targeted R&D development projects, and incentives to accelerate local solar installations.

Source: Pattaswamy, N., & Sahil Ali, 2012, "How did China become the largest Solar PV among manufacturing country", Centre for Study of Science, Tehcnology and Policy India

Case Study 2: The Semiconductor Industry in Wuxi, Jingsu

Background

The development of industrial clusters in China has become a subject of international interest, but attention has primarily focused on government efforts to attract FDI to promote industrial clusters and regional development. The local process which supports the rise and growth of clusters driven by the domestic firms has been relatively ignored in this debate.

Relevance

The role of the State in managing strategic coupling of key regional assets and its contributions to cluster formation, dynamics and effects.

Findings

Study concludes that the rise and growth of the semiconductor domestic-led cluster in Wuxi is not dependent on FDI, but instead results from the dynamic interplay of several elements. Effects of technology spill-over from the government-funded research institutions, as well as mutual competition and co-operation in technological emulation among domestic firms are important elements for the development of the domestic-led cluster. Moreover, all these elements lie within the strategic coupling of the regional assets and the transnational Chinese technical community, mediated by the state. It is the state that has mobilised regional assets to negotiate with overseas technology talent for strengthening global linkages and facilitating the entrepreneurial knowledge absorption of domestic leading firms—a feature which has not been theoretically observed in Western countries.

Source: Chou, T. L., Ching, C.-H., Fan, S.-M., & Chang, J.-Y. (2011), "Global Linkages, the Chinese High-tech Community and Industrial Cluster Development", *Urban Studies*, 48(14), 3019-3042.

Food

Cluster Specific Insights 02

Food

3.0 Food Cluster

Changes in food consumption habit, growth in health and wellness food and fast food service, strength in processed food, and the State position as the nation's regional and global Halal Hub, will shape the development of the region's food cluster.

Key Takeaways:

- Businesses operating in the food cluster offer the most growth potential follow closely by life sciences and transport equipment cluster.
- Selangor's position as a global halal hub could serve as one of several platforms to develop the State's food sector business, bringing together key stakeholders, particularly SMEs.
- The State's value proposition in the food sector could be built around: (a) **Food** (e.g. local and traditional food); (b) **Tourism** (e.g. ecotourism, events, history & culture), and (c) **Region's core competencies** (e.g. Halal food hub, food processing, food life education), among others.
- Support and facilitative initiatives are needed to encourage food processing manufacturers to keep track of new technologies, invest in new production and processing technologies, and to collaborate with food manufacturers.
- Financial incentives and assistance are also needed to encourage food processors to invest in new production technology and processing methods, to improve their productivity and profits.
- Infrastructure through connectivity to cold chain and storage system, and facilities for frozen and refrigerated products, transportation, distributions and communication infrastructure, will assist processors to move up the value chain.
- Targeted and selective funding on export and promotional initiatives are needed for regional food processors and/or food-related businesses to stay competitive in the food processing sub-sector.

3.1 Introduction

Malaysia has its own vast production of agricultural products, such as palm oil, cocoa, tea, rice and poultry which supports the processed food sector. However, the country remains a net importer of other processed food products, particularly cereals and cereals preparations, coffee, tea, cocoa, spices and manufacturing thereof, vegetables and fruits, and dairy products and bird's eggs.²⁸ The expanding agricultural sector in the country, however, has a positive impact on the processed food industry, as it ensures a steady supply of agricultural produce for processing activities, which include palm oil, chicken – related products, biscuits and confectionary, among others.

Under the 2006-2020 Industrial Malaysian Plan period, the food processing industry investment target have been set at RM24.6 billion. Malaysia approved 73 food manufacturing projects with investments worth RM4.35 billion in 2013. As of Q2 2014, a total of 22 food manufacturing projects worth RM1.15 billion had been approved.²⁹ In Selangor, food manufacturing is the fifth largest industry with the highest amount of approved investment in the state, with a value of more than RM400million.³⁰

The major sub-sectors in the food cluster are fish and fish products, livestock and livestock products, fruits, vegetables and cocoa, and beverages. The beverage segment covers the manufacturing of soft drinks and mineral water. Many larger companies have been producing their goods for decades and export them to many other countries.

A large number of small and medium size enterprises also export their products to regional markets. The strength of the state's food cluster business environment is the somewhat, loose collection of SMEs, strong physical infrastructure, presence of large local and foreign MNCs, access to low to medium skill work-force, and potentially, a large domestic market for food, accommodation and hospitality services.

The cluster's productivity level is increasing, although companies still compete based on low factor input costs. Among Mid-Tier and large local companies, there is a shift from labour - intensive stages of food processing to automation in food processing, investment in food testing and analysis, and an uptake in packaging and handling technology. Capacity for expansion is limited due to increasing reliance on foreign raw materials and labour. High initial capital outlay in new production machinery, lack of innovative product development capacity, inability to identify specialised food segments, limited control of distribution channels in global export markets and the low level of coordination between sectors in the food cluster, limits the state's ability to realise cluster's growth potential.

²⁸ Department of Statistics, Malaysia, 2014

²⁹ MIDA, 2014

³⁰ Ibid.

As the industry faces intense competition from neighbouring countries due to the effects of globalisation and new entrants to the European Union, the challenge for Selangor is to move from being a supplier of commodity food products to foreign markets, to become a provider of distinct food products with its own brands, better access to distribution channels and direct understanding of customer needs. The growing demand for processed, pre-cooked fast food, health and wellness food, as well as sustainable and safe food, is providing huge opportunities for key stakeholders in the food cluster. Especially when combined with food trends like organic and functional foods, potential collaborative innovations could be developed between stakeholders in the food value chain.

That means drawing on and complementing existing sub-sectors in the food processing industry, while strengthening cooperation between Mid-Tier, large and foreign MNCs in these sub-sectors. It also means rethinking strategically Selangor's role as an Asian food hub by integrating the food industry with other sectors such as tourism (eco-tourism, history and events) and culture. On-going initiatives to build and capitalise on local and global demand for Halal certified foods and services driving growth opportunities in the Halal sector needs reinforcement and clear directives. There is also a need to build and develop synergies and economy of scale among the many SMEs in identifiable food sub-sectors, with regional and global growth potential, especially in identifying and developing value-add food specialisations and branding of local and traditional food.

The questions posed for the State in the development of the food cluster are:

1. How do you move from a manufacturing food economy for local consumption, with a growing middle class consumption economy, to an export-driven economy?
2. How could the State leverage food production expertise across growth in service industries (example tourism and hospitality), mindful, however, of Kuala Lumpur strong presence in these industries, especially in accommodation and food services?
3. Could Selangor leverage existing competencies in food-production, and increasingly halal certified foods and certification networks, into the regional and global market for SMEs entrepreneurship, employment and export earnings, especially with the impending TPPA?

3.2 Scope

Food cluster revolves around the growing, harvesting and supply of raw materials, processing of food, and the distribution of processed food. They include fruit and vegetable product, fishing, agricultural supplies, dairy products and ingredients, meat processing, and the production of bread, cakes and cereals, beverages, spices and ingredients. The cluster also includes professional advisors and supporting agents (knowledge and skills, equipment, labour, professional support); infrastructure (transportation, logistics, packaging, warehousing), intermediate operators, retailing and hospitality operators, and export outlets. Public sector organisations include government agencies (Dept. of Agriculture, Dept. of Fisheries, Halal Industry Development Corporation, MIDA, MPC, MATRADE, MIDF, FELDA etc.), university/colleges and associations, quality and accreditation bodies (SIRIM Berhad, Food Safety and Quality Division).

3.3 Background

Nationally, agriculture and commodity-based economy contribution to GDP has reduced dramatically over the last 40 years (See Figure 3.1). Constituting 7.1% of the GDP, it is significantly skewed towards commercial commodities with world players.³¹ At a constant 2010 prices, agriculture contributed 9.2% to the nation's GDP in 2014, although this contracted by 4.7% in Q1, 2015.³²

While Malaysia has a significant amount of land space for agricultural production, and attracts many global companies to operate in this sector, thus enhancing the contributions of states such as Perlis, Sabah, Sarawak and Johore GDP contribution to their respective states, the agriculture sector contribution in Selangor is less than 2.2% in 2014.³³

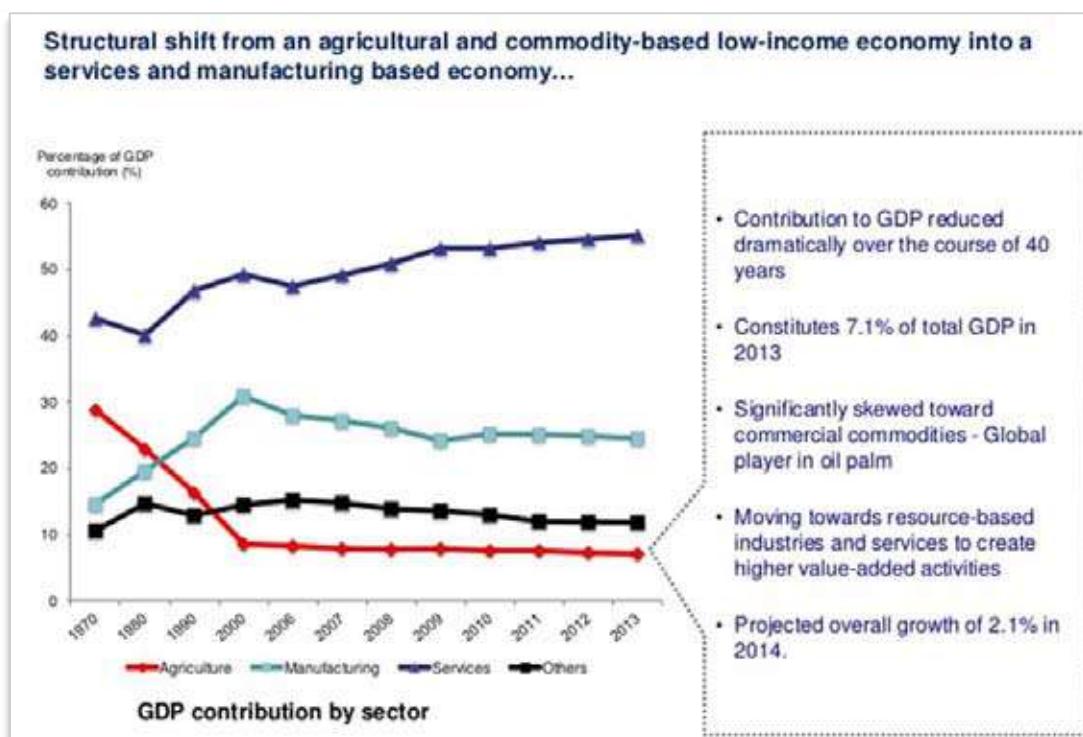


Figure 3.1 GDP Contribution by Sector

Source: Bank Negara Malaysia Presentation, <http://www.slideshare.net/ctaspace/s29-muhammad-ibrahim>

³¹ Bank Negara Malaysia, 2014

³² Department of Statistics, Malaysia

³³ Wong, Jun Tatt, et al., 2014, "World and Malaysia Agriculture: Food Security, Fertigation and Hydroponic"

For Selangor, while agriculture and food production remains an issue in the presence of growing emphasis placed on the service and manufacturing sector, the State remains a major consumer and producer of food, particularly processed and packaged food, and increasingly health and wellness food, and services for its local population and tourist trade. Our analysis of the nation's food industry revealed several major developments. They include:

Development Area 01: Food Import and Export

Nationally, we import more food than we export. Total food import was RM42.6 billion in 2014, an increase of 9.8 billion when compared with RM38.8 billion in 2013. Total export in 2014 was RM25.6 billion compared with RM22.1 billion in 2013, an increase of 16.2% in 2014 (See Table 3.1). The ratio of import to export in 2013 was 1.8:1 while the ratio in 2014 was slightly lower at 1.7:1. Among the nine selected major food categories dominating the nation's import and export trade, several observations are made, with implications on the State's future infrastructural development. They include:

1. Imports of cereals and cereals preparation accounts for more than 17% of the total imports in 2014 compared with 18.4% in 2013, followed next by coffee, tea, cocoa and spices (13.5% in 2013 and 15.2% in 2014) and vegetables and fruits (13.5% in 2013 and 12.5% in 2014). Imports of dairy products and bird's eggs recorded an increase of 20%, the highest during 2013-2014.
2. Coffee, tea, cocoa and spices and manufacturing however, accounts for 26.3% of total export in 2014, marginally replacing meat and meat preparation as the top export revenue generator with 26%. Meat and meat replacement was the top export commodity in 2013. Both these commodities also generate more export revenue compared with import.

Selected commodity sections	Imports		Exports	
	2013	2014	2013	2014
	Total (RM Million) ^a	38857	42643	22101
Dairy product & bird's eggs	3292	3958	1390	1811
Cereals & cereals preparations	7178	7338	1880	2359
Vegetables & fruits	5263	5345	1563	1618
Fish, crustaceans, molluscs & preparation thereof	3185	3519	2386	2696
Coffee, tea, cocoa, spices & manufacturing thereof	5248	6463	5398	6752
Beverages	2396	2288	894	859
Sugars, sugar preparation & honey	3424	3768	408	438
Meat & meat preparations	2572	2949	5746	6655
Miscellaneous edible products & preparations	4371	4677	1211	1281
Total of selected commodity sections	36929	40305	22338	25986

Table 3.1 Monthly External Trade Statistics (2013 – 2014)

Source: Department of Statistics, Malaysia

^a Total do not include Beverages and Tobacco

Development Area 02: Consumer Food Services and Retail Sales

Malaysian consumers continued to remain cost conscious around their spending because of the rising cost of living and food prices, resulting in less spending on dining out. Malaysian consumer foodservice saw value sales growth of 5.1% from 2011 to 2012. It is predicted to grow by a CAGR of 5.3% through 2016.

Fast food and 100% home delivery were the top performing subsectors with a CAGR of 9.2% and 19.9%, respectively, during the 2008 to 2012 historical period. These two subsectors will remain the top two performers through 2016, with a CAGR of 6.4% and 10.0%.³⁴ Independent operators make up 67% of Malaysia's foodservice industry, but are forecasted to experience a lower growth rate (4.5%) than their counterparts (chained operators) which will boast a 6.9% CAGR through 2016.³⁵ But like other countries, Malaysian consumers are also looking for healthier menu choices due to the increasing trend of diabetes, hypertension and obesity among the population, resulting in foodservice operators adding healthier food choices to their menu.³⁶

In retail sales, over the period 2009 to 2012, the health and wellness category demonstrated a 7.7% CAGR and will continue to have positive growth through 2014 (See Table 3.2). The top performing segment within the health and wellness category—from 2009 to 2012 was fortified/functional food, with a CAGR of 8.8%. Fortified/functional food is forecasted to account for approximately 75% of all retail sales during the period 2015-2018 (See Table 3.3).

Food fortification is the practice of adding essential vitamins and minerals (e.g. iron, vitamin A, folic acid, iodine) to staple foods to improve their nutritional content and may include staple products such as salt, maize flour, wheat flour, sugar, vegetable oil, and rice.³⁷ Functional food could broadly be described as a modified food that claims to improve health or well-being by providing benefit beyond that of the traditional nutrients it contains. Functional foods may include such items as cereals, breads, beverages that are fortified with vitamins, some herbs, and nutraceuticals.³⁸ Naturally healthy food is the next major segment in this category, accounting for approximately 20% of all sales.

Packaged food sales increased in value at a CAGR of 5.0% between 2009 and 2012, with a further increase of 4.4% forecasted to 2014. Within this category, dried processed food accounts for close to 25% of all sales, followed by dairy and bakery products with 16% and 11.6% respectively. Packaged food, baby food, sauces, dressings and condiments, and noodles are among the other major segments in sales of packaged food in Malaysia between 2014 and 2018. Within this category, one of the best performing growth segments was pasta, registering a CAGR of 15.1% between 2009 and 2012, albeit value sales are lower than the main segments such as dairy, dried processed foods and oils and fats. However, between meal replacement is forecasted to register the highest CAGR (10.3%) between 2014 and 2018, with expected sales of US365 million in 2018 compared with US 271.9 million in 2013.

³⁴ Euromonitor, 2014, "Report: Market Overview, Malaysia; Agriculture and Agri-Food Canada"

³⁵ Ibid.

³⁶ Ibid.

³⁷ Why Food Fortification, 2015 (<http://projecthealthychildren.org/why-food-fortification/>)

³⁸ Definition of functional food, 2016 (<http://www.medicinenet.com/script/main/art.asp?articlekey=9491>)

Category	2011	2012	2013	2009 – 13 CAGR%
Health and wellness by type (Total)	2569.5	2757.9	2924.8	7.2
Fortified functional	1906.9	2065.7	2197.9	8.2
% of total	74.2	74.9	75.1	
Naturally healthy	521.7	546.3	575.3	4.9
% of total	20.3	19.8	19.7	
Packaged food (Total)*	6773.4	7112.4	7449.0	4.9
Dried processed food	1709.1	1801.9	1885.2	5.7
% of total	25.2	25.3	25.3	
Dairy	1032.6	1088.2	1148.3	5.3
% of total	15.2	15.3	15.4	
Bakery	826.4	859.8	899	3.7
% of total	12.2	12.1	12.1	

Table 3.2 Selected Agri-Food Retail Sales in Malaysia*

Source: Euromonitor, March 2014, Report: Market Overview, Malaysia; Agriculture and Agri-Food Canada, 2014

* All values are historic and forecasted in US\$ Million, based on fixed 2013 exchange rate.

Category	Forecast 2014	2015	2016	2017	2018	2014 – 18 CAGR%
Health and wellness by type (Total)	3091.8	3263.0	3445.7	3636.9	3839.3	5.6
Fortified functional	2382.2	2461.3	2604.5	2754.5	2913.5	5.8
% of total	77.0	75.4	75.6	75.7	75.9	
Naturally healthy	606.4	638.7	672.3	707.2	743.8	5.2
% of total	19.6	19.6	19.5	19.4	19.4	
Packaged food (Total)	7780.5	8121.6	8473.6	8836.6	9214.6	4.3
Dried processed food	1971.8	2064.8	2159.2	2253.9	2353.8	4.5
% of total	25.3	25.4	25.5	25.5	25.5	
Dairy	1211.0	1276.2	1342.9	1411.9	1483.5	5.2
% of total	15.6	15.7	15.8	16.0	16.1	
Bakery	931.3	962.1	993.5	1026.5	1060.9	3.3
% of total	12.0	11.8	11.7	11.6	11.5	

Table 3.3 Selected Agri-Food Retail Sales in Malaysia*

Source: Euromonitor, March 2014, Report: Market Overview, Malaysia; Agriculture and Agri-Food Canada, 2014

* All values are historic and forecasted in US\$ Million, based on fixed 2013 exchange rate.

Development Area 03: Food Processing Machinery and Equipment

Available statistics sourced from the International Trade Centre, in a report titled “Processed Food and Food Processing Machinery and Equipment Sectors in Asean”³⁹, provides some useful historical insights, in particular:

³⁹ OSEC, Business Network Switzerland, 2012

- Across all bakery machines, coffee pulpers and other beverages machinery, and other packaging and wrapping machines, import is more than export between 2007 and 2011. In 2011, and in dollar value, the ratio was 6.1:1, 7.7:1, and 4.2:1 for bakery machines, coffee pulpers and other beverages machinery, and other packaging and wrapping machines, respectively (See Table 3.4).
- In 2011 dollar value, import was highest for other packaging and wrapping machines. Worth at USD 82.1 million followed by coffee pulpers and other beverages machinery (USD 53.7 million) and bakery machines (USD 30.8 million).
- Export worth USD 10.4 million in 2011 was recorded for other packaging and wrapping machines, an increase of 85% when compared with USD 10.4 million in 2013. This category of food processing machinery and equipment represents the highest in dollar value and percentage increase, when compared with bakery machines, coffee pulpers and other beverages machinery.

Year	Import value (USD 000's)	Import volume (Tons)	Export value (USD 000's)	Export volume (Tons)
Bakery Machines				
2007	17628	865	2527	103
2008	15637	662	3894	148
2009	26343	978	2210	81
2010	21298	872	4435	76
2011	30896	12568 ^a	5024	1728 ^a
Coffee Pulpers & Other Beverages Machinery				
2007	24812	869	6093	193
2008	36836	1053	8199	241
2009	27629	766	8106	209
2010	39505	1130	6004	170
2011	53770	55461 ^a	6953	1116 ^a
Other Packaging or Wrapping Machines				
2007	60671	1804	9879	179
2008	56073	1518	25005	708
2009	51584	1301	9230	213
2010	66783	1708	10460	271
2011	82147	107,785 ^a	19371	2842 ^a

Table 3.4 Trade Statistics for Selected Food Processing and Machinery & Equipment in Malaysia (2007 – 2011)

Source: International Trade Centre; Report – OSEC, 2012

^a Measured in unit

Development Area 04: Halal Selangor

Knowing the lucrative and profitable market ahead, the Malaysian Government, the National Agriculture Policy (NAP), 1998 – 2010; the Ninth Malaysia Plan (9MP), 2006 – 2010; and the Third Industrial Master Plan (IMP3), 2006 – 2020, have identified Halal market, the trillion dollar industry, as the key growth area for their small and medium enterprises (SMEs), with the vision towards International Halal Hub.⁴⁰ Regionally, Asia-Pacific has the highest (62%) total Muslim population, followed by the Middle East & North Africa.⁴¹

The Halal Master Plan of 2008 addresses issues related to certification, sectorial development, Halal integrity, implementation, timeframes and responsibilities. To initiate the overall coordination and development of the national Halal industry, Halal Industry Development Corporation (HDC) has been incorporated in September 2006.

This HDC has been mandated by the government to assist SMEs and works with all the relevant ministries and agencies. Acting as market intelligence, HDC facilitates and support Halal entrepreneurs to penetrate the Halal global market through branding, marketing and promotional campaigns of halal products.⁴²

The Selangor Halal Hub (SHH) was launched in 2003, and was the first one Halal Hub in Malaysia for upstream and downstream manufacturing activities. Since then, SHH has successfully attracted numerous investors that are suitable for the Halal Hub including raw materials, food and beverage, confectionaries, culinary products, dairy products and non-food products.

For SMEs, Halal Development Corporation (HDC) facilitates the grooming and supports halal entrepreneurs so that over time, they may penetrate the global halal market. Institutional support in the form of Malaysian government incentives are given out to eligible companies for their efforts in trying to access the halal market. Notably, and among the several identified component singled out for capacity building, providing consultancy services to companies and MNCs represents part of the nation's efforts to be the reference centre for halal standards and certification.⁴³

In Selangor, the Pulau Indah Selangor Halal Hub (Established: 2003; Size: 1000 acres; Investment RM1.81B) and PKFZ Halal Flagship Zone (Established, 2007; Size: 100 acres; Investment RM561.8M) are constituted through the setting aside of industrial land to drive cluster activities and/or economic initiatives undertaken by firms in these clusters.⁴⁴ After having put funds into the development of this hub, it is perhaps not unrealistic to see a much stronger and discernible connections between investment in Halal food production, certification and accreditations with close cooperation between agencies, government and businesses.

⁴⁰ Bohari, Hin & Fuad, 2013, "The Competitiveness of Halal Food Industry in Malaysia – A SWOT – ICT Analysis"

⁴¹ Pew Research Centre, 2011

⁴² Halal Development Corporation, 2012

⁴³ Ibid.

⁴⁴ Selangor Halal Hub, 2013

For example, Ramly Burger recently announced MYR274 million to fund the first phase of the complex, which will be built at the Halal Hub Industrial Park at Pulau Indah, Klang, as part of its RM1 billion investment in a new processing facility to boost its export market capacity.⁴⁵ These Halal Hub and/or Flagship Zone represents important Halal cluster outgrowth that spearheads Federal and State's institutional development, which aims to capitalise on firms social and economic development, while operating in the hub and/or zone.

With many established foreign MNCs, Mid-Tier and large local manufacturers, and a high concentration of accommodation and food providers and knowledge agencies and institutions that are located in Selangor, the Halal industry represents a huge, untapped source of economic growth in the state.

The State's established infrastructure and logistics networks with its expansive networks of retailers, hypermarkets and specialty shops, concentration of food and service outlets, accommodation providers and fast food outlets, combines to provide ideal markets and test beds that will enhance the State's reputation and credibility as a reference centre for Halal standards and certification - locally, regionally and globally. With 60.4 per cent of the population of Islamic faith, Malaysia is a market for Halal food as well as being a hub for re-export to other Muslim countries. Malaysia is working with the Organisation of Islamic Conference (OIC) countries to promote the Malaysian Halal Standard.⁴⁶

⁴⁵ StarBiz, 2015

⁴⁶ Selangor Halal Hub, 2013

3.4 Location Quotient

Within the area of business specialisation of accommodation and food services, both important activities that are closely linked to the food cluster, our Location Quotient analysis shows insufficient critical mass in Selangor.

The analysis shows that the overall Location Quotient for employment in accommodation and services is lowest in Selangor (LQ is 0.9), compared with Penang (LQ is 1.4 in 2014), W.P Kuala Lumpur and Johor (LQ score of 1.0 for both). Crucially, over the past 4 years, the State's LQ score has consistently been lower compared to Penang, W.P. Kuala Lumpur and Johor (See Table 3.5 and Figure 3.2).

State	Number Employed ('000) in State	% Change	Share of Total Employed in Malaysia	Share of Total Employed in State	LQ
Selangor					
2010	163.8	-	19.1	6.4	0.9
2011	173.3	5.8	18.4	6.6	0.9
2012	166.2	-4.1	17.4	6.0	0.8
2013	168.6	1.4	16.6	6.0	0.8
2014	205.3	21.8	18.5	7.1	0.9
Johor					
2010	104.7	-	12.1	7.3	1.0
2011	109.4	5.5	11.6	7.3	1.0
2012	119.0	8.8	12.4	8.1	1.1
2013	132.8	11.6	13.1	8.5	1.1
2014	131.7	-0.8	11.8	8.3	1.0
Penang					
2010	63.7	-	7.4	8.5	1.2
2011	73.0	14.6	7.7	9.5	1.2
2012	65.4	-10.4	6.8	8.5	1.1
2013	69.0	5.5	6.8	8.8	1.1
2014	88.7	28.6	8.0	11.0	1.4
Kuala Lumpur					
2010	62.2	-	7.3	7.9	1.1
2011	66.8	6.7	7.1	8.2	1.1
2012	63.7	-4.6	6.7	7.7	1.0
2013	88.8	39.4	8.7	10.1	1.3
2014	70.9	-20.2	6.4	8.2	1.0

Table 3.5 Number of People Employed in Accommodation and Food Services (2010 – 2014)

Source: Department of Statistics, Malaysia

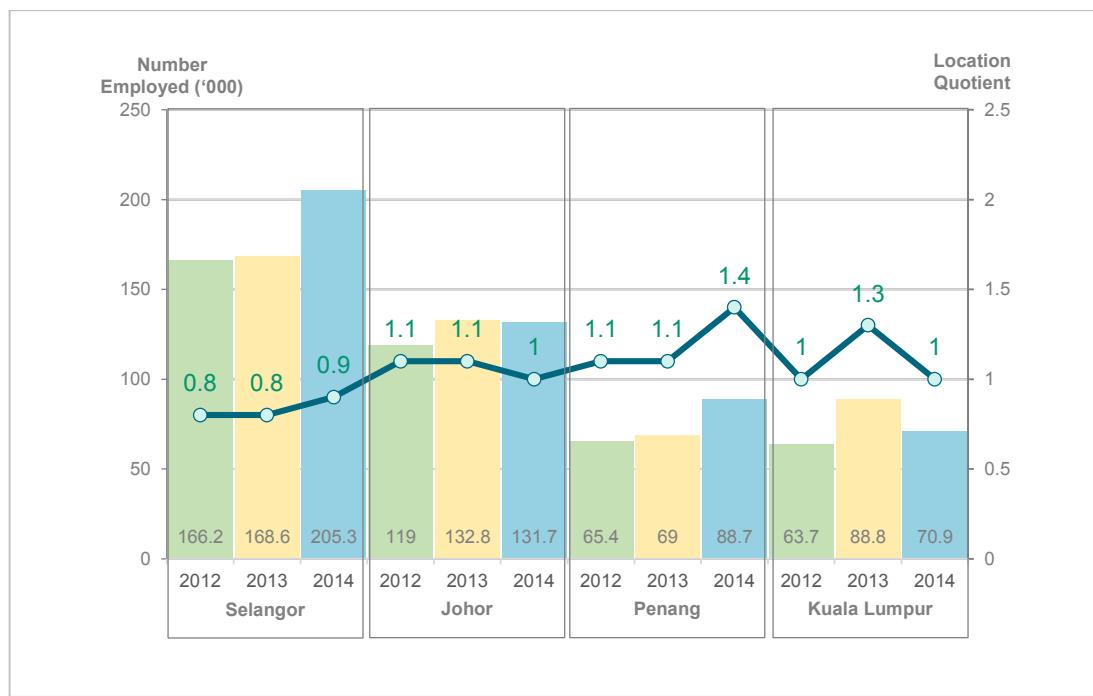


Figure 3.2 Breakdown of Employment in Accommodation and Food Services (2012 – 2014)

Source: Department of Statistics, Malaysia; Monash University Malaysia, 2016

3.5 Cluster Map

As with other clusters examined in this study, numerous and various types of firms, associations, government bodies, suppliers, service providers and supporting networks and affiliations (national and state level) constitute the food cluster (See Figure 3.3). Individually and collectively, these stakeholders possess resources and undertake various resource transformation activities that drive cluster's growth development. Of course, to better understand the connections between stakeholders with other components of the cluster one must also examine its value-creating services within the overall industry cluster value chain.

While food is often consider a matter of national security, the country is also looking to supply food, especially agri-seafood and processed food, to the global market. These characteristics take on new, added importance in seeking to understand how Selangor could create an economic advantage for the region's food industry. They include the thousands of small-scale food production operations / SMEs, many of which are family - based businesses SMEs, established MNCs and large local manufacturers, expansive networks of food importers and distributors, manufacturers and suppliers of food processing machinery and equipment playing an important role in providing equipment to the region's vibrant processed food sector, growth in regional tourism and food services market, and the State's position as a potential regional and/or global halal hub.

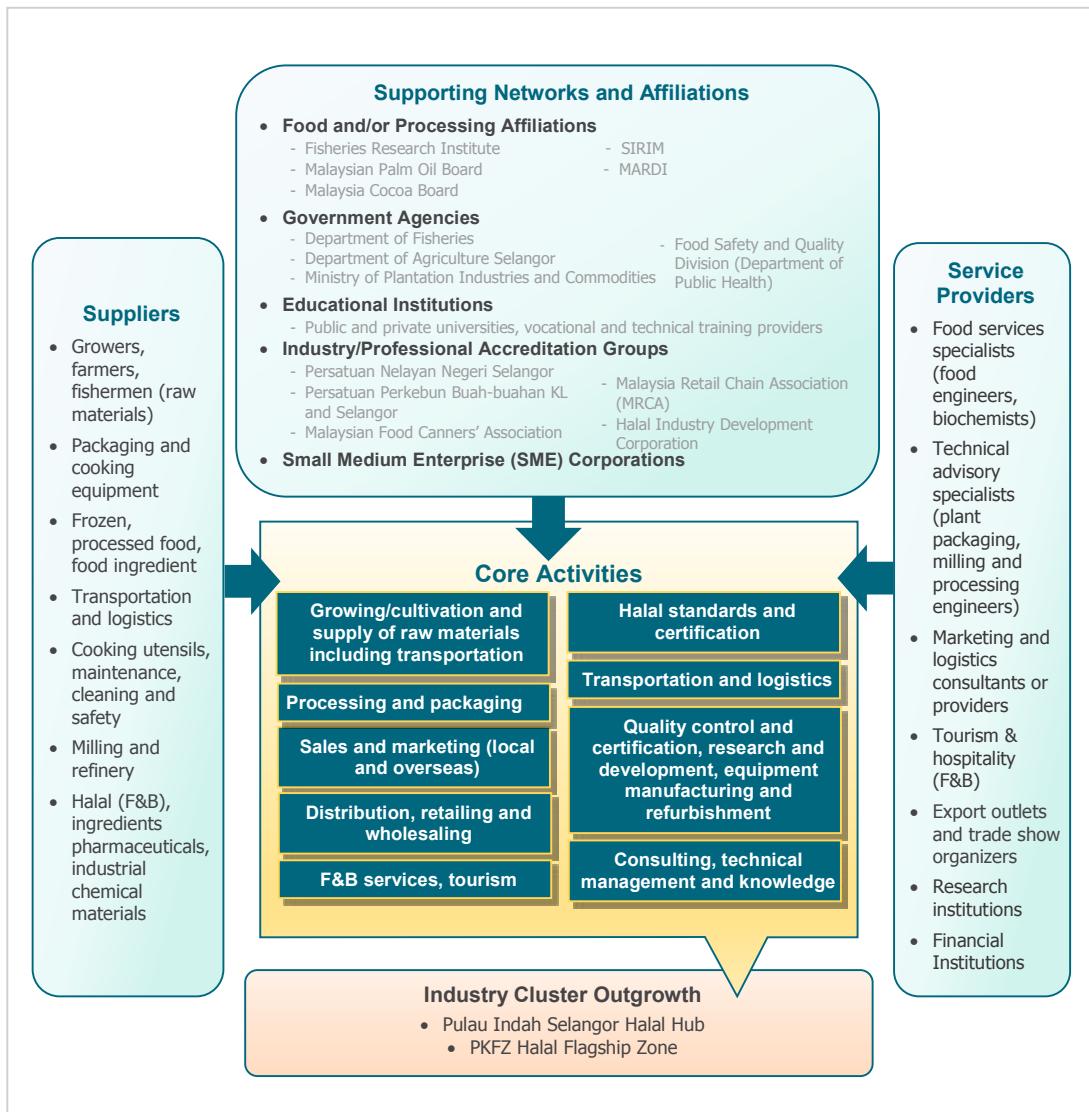


Figure 3.3 Cluster Map

Source: Monash University Malaysia, 2016

In producing, sourcing, processing, marketing and distributing food, food related services and accommodation, the State could built on and strengthen existing value adding activities. These activities, include, among others:

1. The need for solid infrastructure and logistics that will appeal to investors who are keen to capitalise on the region's food and tourism industry
2. Branding the cluster and creating visibility for members
3. Assisting Mid-Tier manufacturers/food processors with new investments in innovative processing equipment, and supporting training, knowledge and skill development, especially in relation to branding and export marketing (See Figure 3.4).

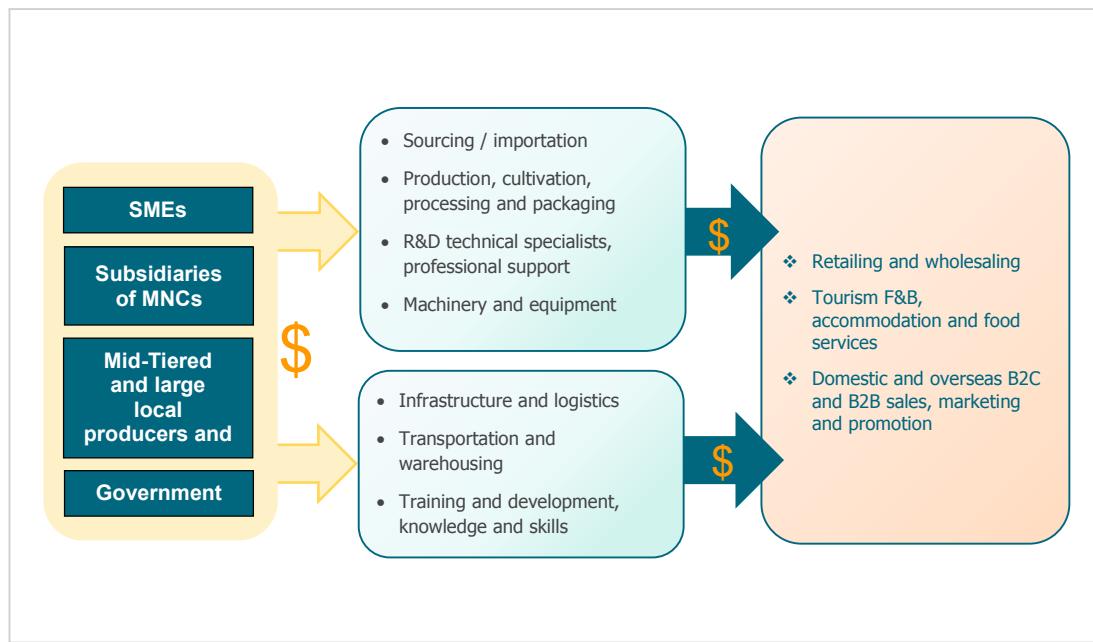


Figure 3.4 Inter-industry Value Chain Analysis

Source: Monash University Malaysia, 2016

In a cluster model of driving increase in export earnings and employment with better economic prosperity through higher pay, the following could also impact on how the State thinks about their food cluster policies and strategies, and implications on infrastructure investments.

1. Networks of supporting agencies

Our study reveals a high concentration of government agencies at both federal and state level that are responsible in providing advisory services. Some of these agencies offer a broad range of services, while others are more industry specific. Key agencies include Small and Medium Enterprise Corporation (SME Corp), Farmers Association Marketing Authority (FAMA), Malaysia External Trade Development Corporation (MATRADE), Malaysian Agriculture Research and Development Institute (MARDI), Standards and Industrial Research Institute of Malaysia (SIRIM), Malaysian Palm Oil Board (MPOB), Department of Agriculture (DOA) and Federal Land Development Authority (FELDA.)

With that many agencies, and many more services offered to assist businesses operating in various sub-sectors in the food industry, tensions are bound to exist between what is offered and what is needed by these businesses. There will be businesses seeking financial assistance, infrastructure support, access to export market and information on value-adding initiatives.

Within this context, and in terms of infrastructural support services, could the State play a role in mixing and matching various agencies services with the requirements of regional businesses, real time and on-time? Will this, in turn, assist businesses in the new competitive landscape, identify their potential roles, and contributions in the food value chain?

2. Thousands of SMEs - Economies of scale and specialisation

Figures from the Department of Statistics, Malaysia shows that in 2010, there were 662,939 of business food establishments in Malaysia. SMEs accounts for 97% of these establishments, with multinational companies taking up the balance of 3%. SMEs gross output value of 29%, however, lags behind that of MNCs (71%). Of the total gross output value of RM 1.7 trillion in 2010, SMEs only contributed RM 507 billion, which means that there is still plenty of room for improvement for SMEs.

Crucially, we believe the opportunities also underpin the importance of entrepreneurial activities that are associated with innovative, health and wellness food, processed food, and Selangor's strategy to become a major player in the nation's regional and global hub for Halal production, logistics and trade. The Pulau Indah Selangor Halal Hub and the PKFZ Halal Flagship Zone will play a major role geographically, with potential capacity to act as the region Halal cluster powerhouse.

With an increasing demand for innovative solutions in food growing, supply, manufacturing and packaging related to global challenges in food, climate, environment and health, the question posed is, "are SMEs well - equipped to handle these challenges?" Indeed, if future growth in employment is found in the food cluster, is there room for optimisation among SMEs? What are the types of SME jobs in the food cluster that will grow or decline among the food businesses and importantly, is there a need to move to food specialisation?

3. Urban concentration, tourism and food services market

Earlier, the study points to the fact that Malaysian consumer foodservice saw value sales growth of 5.1% from 2011 to 2012, and is predicted to grow by a CAGR of 5.3% through 2016. With a dense population in the State, a time poor consumer market, but also a growing health conscious market, Selangor has a natural, sizeable and growing consumer food service market. There is an abundance of food service outlets that caters to the wide multi-ethnic community. An educated, mobile, middle class associated with high urbanisation in a densely populated space, has also spurred the growth of high-end eateries and beverage outlets.

Together with the influx of tourists and many more hotels, restaurants, entertainment outlets and associated food and beverages outlets, these service providers and suppliers will drive and redefine opportunities in the State's food cluster. While mindful that Kuala Lumpur with its metropolitan set-up and a concentration of food and beverages and entertainment outlets offers good value proposition for locals and tourists, for Selangor, the value proposition in the food sector could be built around:

1. **Food** (e.g. local and traditional food, food technology and machinery support, and the region food economy)?
2. **Tourism** (e.g. include ecotourism, events, history and culture) (source)?
3. **Region's core competencies** (e.g.: Halal food hub for upstream and downstream manufacturing activities, food processing, health and wellness food subsector, food life education, local community and business networks)?

These value propositions could be seen through the dynamic interface of regional/local food system, State's regional food economy (particularly processed food), Food and hospitality, and Wellness and Halal food (See Figure 3.5 below).

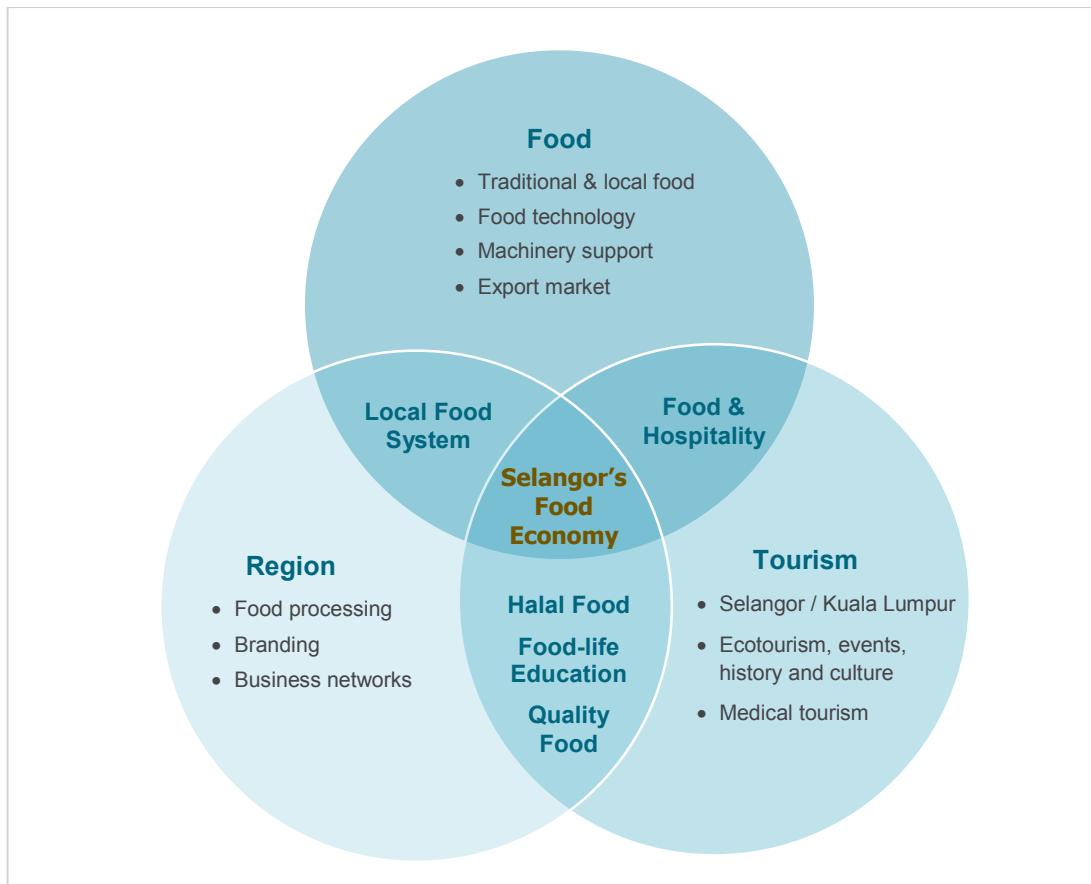


Figure 3.5 State's Value Proportion in the Food Sector

Source: Adapted from Lee, B., 2016, "Promotion Policies for Food Industry Cluster in Korea"; Monash University Malaysia, 2016

4. Food Processing Machinery and Equipment Suppliers

From a value chain perspective, the close link between the primary industry (agriculture) and the processing element (food manufacturing) must be matched by an equally strong link with the support industry, in particular the food processing machinery and equipment suppliers.

There are numerous manufacturers and suppliers of food processing machinery and equipment in Malaysia playing an important role in providing equipment to the country's vibrant processed food sector. Local manufacturers supply the machinery and equipment to both local food processors, and offer customised solutions and machinery for the food industry. There are also distributors who import machinery and equipment that are of higher technologies, to distribute them locally and globally. These are often imported from countries such as Japan, Europe and the China.

Food processing machinery and equipment include basic grinding machines, and packaging to full production lines. Suppliers and their principal business activities, include:

a. **Hup Sheng Machinery & Industry Sdn Bhd**

Designing and fabricating snack food processing and packaging machines

b. **Safe World Enterprise**

Designing, manufacturing, fabricating, importing and exporting of food raw material, processing, packaging, agricultural and light industrial machinery

c. **Kejuruteraan Perniagaan Chin Ma**

Design, manufacturing, exporting & importing food processing machine

d. **Weng Heng Leong Co. (WHL)**

Selling food processing machine, manufacturing and repairing of various imported food processor machines, including the design, manufacture and modifying of high quality food processing machines

e. **Clarity Excel Sdn Bhd**

Specialising in all kind of industrial packing machinery, food processing machinery, food packaging machinery and also services contract

Many of these suppliers' businesses have changed over time, with changes in customers' expectations. Anecdotal evidence gathered from face-to-face interviews also suggests that suppliers are generally ready to import machinery for local distribution, and engage in modification of food processing machines. The challenges posed for this sector of the food industry are:

1. How to keep track of changing new technologies in food production, processing, preparation and packaging?
2. Is there a need for them to collaborate with food manufacturers to customise food processing machinery and equipment? Especially in view of the growing demand for health and wellness food, snack food, and processed food?

5. Concentration of MNCs, large local manufacturers, importers and distributors

Besides being home to many food related government agencies, institutions offering food and food-related education and training services, Selangor also has a very high concentration of multinationals. Among the major multinationals that are based in Selangor and their principal activities, they include:

a. **Nestle (Malaysia) Bhd**

Baby food, confectionary, snack foods, bakery products, cereals, dairy products, ice-cream, pasta, noodles, milk, yogurt, beverages, sauces, and soups

b. **Dutch Lady Milk Industries Bhd**

Sweetened condensed milk, milk powder, infant formula, pasteurised & UHT milk, yogurt, and fruit juice

c. **Fraser & Neave Bhd**

Soft drinks including carbonated drinks and juice

d. **Carlsberg Marketing Sdn Bhd**

Beer, stout and other beverages

Some of the large, local manufacturers and their principal business activities include:

a. **Yeo Hiap Seng Sdn Bhd**

Curry, canned fish, jam, condensed milk, instant noodles, sauces, vinegar, and beverages

b. **Mamee Double-Decker Bhd**

Snacks, dairy products, confectionary, and beverages

c. **Qaf Food Ltd Gardenia Bakery Sdn Bhd**

Bread, bakery, confectioneries products.

d. **Oriental Food Industries Holding Sdn Bhd**

Snack foods including potato chips, rice crackers, cheese balls, crackers, and wafers

Major agricultural production, processed food manufacturers, poultry farmers that are based in Selangor includes **Farm's Best, Guan Chong Berhad, Ramly Food Processing Sdn. Bhd., Ayamas and Lay Hoong (M) Sdn. Bhd.**

Large food retailers obtain a major part of their supplies from food importers and distributors. The major food importers are usually larger establishments, and are able to offer consumers with a wider variety of lower priced food products. The major retailers and/or retail groups in the State include:

a. **GCH Retail (M) Sdn. Bhd.**

Part of Dairy Farm Group that include Giant hypermarket, Cold Storage, Mercato, Jason's Food hall and Guardian.

b. **Tesco Stores (Malaysia) Sdn. Bhd.**

Owned by Tesco Stores Ltd. Tesco and Tesco Extra.

c. **AEON Co. (M) Bhd.**

Owned by AEON Group AEON supermarket (formerly known as Jaya Jusco).

d. **Village Grocer**

Owes grocery outlets Jaya Grocer

e. **B.I.G. Group**

Retailer and restaurants operator who owns Ben's Independent Grocer and Ben's General Food Store and restaurants

3.6 Diamond of Advantage

Based on interviews with knowledge stakeholders and experts in various food sectors and analysis of secondary data from various sources, we produced a map demonstrating what we think is the inter-organisational support of the State's food cluster (see Figure 3.6).

Key demand conditions that will impact on cluster development include a growing, urbanised population, an emerging, educated middle class, which will drive demand for healthier, environmentally friendly produced goods. The demand on time among locals, growth in tourism and indulgence in hedonistic lifestyle consumption, will see an increase in consumption of food and beverages and food and accommodation services. The state's attraction among Muslim faith tourists, Halal service and product offerings and reputation will spur demand for Halal food and services sector. Local and international fast food outlets in metro Kuala Lumpur with spill-over effect on Selangor and/or Selangor on-going tourism initiatives will play an increasing role in the development of the food cluster. The introduction of the GST in 2015 will, however, result in tightening of consumer spending which will impact on demand for food and food-related services, as is concern over the economy over the next 2 years.

Entrepreneurs acting as change agents in the cluster will help redefine and reshape the food industry in hybrid food consumption and production. New, young enterprises with great growth potential are working within ‘hybrid areas’ at the interface between food and climate, environment and health. This is not surprising given a forecasted CAGR 5.6% from 2014 – 2018, with expected retail sales of RM3.9 billion, as noted previously. Fortified/functional food is expected to register a CAGR of 5.8% during the same period, and a retail sales forecast of RM2.9 billion in 2018. But while these young entrepreneurs bring innovation to the food industry, they might be ***in need of closer cooperation with the large, established companies in order to optimise their contributions to innovation and growth.***

According to our interviews, cost- effective measures in producing and sourcing of raw materials are key input conditions that will facilitate or inhibit the development of processed food. Furthermore, limited supply of local materials means on-going import substitution will persist. This creates incentives for traders and importers to flourish, without significant value-add to the products. Strong reliance on local labour among food producers, processors, ingredients and spice manufacturers will remain. While admitting to the need and importance to innovate their production process, ***the initial capital outlay acts as major disincentive to import costly, machineries.*** Access to financial assistance in sourcing packaging and processing equipment and increase technology capacity through skills and knowledge development, is sought by Mid-Tier food manufacturers.

With more than 6000 plus SMEs, strong presence of foreign MNCs and large local food manufacturers, and many accommodation providers and training institutes in the region, there are ***no compelling reasons why the State could not better synergised these key input factors to further enhance the cluster’s productivity and competitiveness.*** While anecdotal evidence from our interviews with stakeholders suggests a mismatch between vocational training and/or academic learning with industry requirements, there is also a general view that key stakeholders need to communicate what is needed in the industry.

Significant opportunities currently exist among existing and new supporting and related industries that will drive the cluster’s growth. The state’s vast network of good infrastructure provides a ready “hub-and-spoke” access to growers, manufacturers, warehousing and distributors. This has contributed to the development and growth of the state’s transportation and logistics services, including specialists warehousing facilities. Food, machinery and equipment suppliers, technical advisory specialists, marketing and cooperative extension, are among other key supporting industries in the food cluster. The number of academic, training and vocational institutes within the state, and ready access to a ready pool of labour and talent has not only spurred the human and talent development industries, they have also reinforced the state’s food, service and accommodation sub-sectors. ***One possibility is for the state to establish a formal food cluster that leverages these industries respective strength, with the aim of driving the cluster future business growth, while strengthening cooperation with key stakeholders in the respective industry.***

The context in which firm strategy and rivalry will evolve, will be shaped by access to raw material and labour, cost effective marketing, brand building and distribution strategies, opportunities for capacity expansion, capital investments (CAPEX) in innovation (packaging and processing), with local markets being the main battle ground. Specifically, results from our quantitative study show that nearly one in two businesses operating in the food cluster have a heavy dependence on the

local market (48%), while 55% have strong local market wisdom. While the issues with the most impact on businesses in the food cluster over the next 2-3 years are business environment (68%), followed by product innovation (45%), it is interesting to note that 42% nominated access to export market as having the most impact (on their business).

We note, for example the export of beverages that grew from RM2.67 billion in 2013 to RM 2.80 billion in 2014, an increase of 4.9%.⁴⁷ Import of beverages, however, decline by 4.6% from RM2.40 billion in 2013 to RM2.29 billion in 2014.⁴⁸ This, however, do not discount the CAGR of 6.1% and 5.5% in domestic retail sales of hot drinks and cold drinks respectively, from 2014-2018. Retail sales of hot drinks and cold drinks are estimated to be worth RM972 million and RM1.70 billion respectively, in 2018.⁴⁹

A case in point is Fraser & Neave Holdings Bhd (F&N) recent announcement of their intention to ramp up exports by expanding into new markets, in particular the Middle East and Africa, with the view that within the next five years, exports sales will grow to RM500 mil, which should account for around 10% of total revenue.⁵⁰ However, lower exports may be expected due to challenging environment as well as reduced demand, especially in countries where MNCs affiliates have invested in local manufacturing capabilities, evident in food and beverage giant, Nestle (M) Sdn. Bhd.

To compete in the global market, businesses also need data and information to evaluate their capabilities to market their products and meet international specifications, and to deliver what customers want. Widespread and fast-changing developments in a range of industries globally are spurring government concerns, making improved dialogue between public and private sector vital in undertaking export initiatives. As one executive says,

“Government policies are quite important. You need people who understand the figures on consumption in these countries. For example, the US has data on how much corn is consumed domestically. Those data are important. You would take which one you want to target and determine the products that they want. The government could then organise a fair but not forgetting the specifications. If you can't get the specifications right, there's no point. If you're going to EU, you follow EU standards.”

From our interviews and secondary data analysis, it appears that key initiatives are being developed and worked through with relevant authorities among stakeholders in the Halal food and services sub-sectors. Certification and quality control will form the basis of collaborative, strategic undertaking as they seek to reinforce the State's Halal positioning hub. Large established local manufacturers and MNCs with a closed culture will also, hopefully, see the benefits of engaging in more and closed innovation collaboration with each other.

⁴⁷ Department of Statistics, Malaysia

⁴⁸ Ibid.

⁴⁹ Ibid.

⁵⁰ StarBiz, 2015

A managing director of one of the nation's largest spice and seasonings manufacturer captures this sentiment when he says,

"Competition is inevitable. It comes from Malaysia, China or Indonesia. Might as well help someone here (in Malaysia), and hope that someday they would help you back. This will grow the community."

Among growers, unfortunately, a cooperative atmosphere is likely to stay a distant reality as distrust and a "them-and-us" mentality seems to pervade the community of growers. This has the potential to stifle production output at the source, with a corresponding greater and increase reliance on imports, import substitution and a business model that emphasises trading, importing and wholesaling, with minimal value-adding activities.

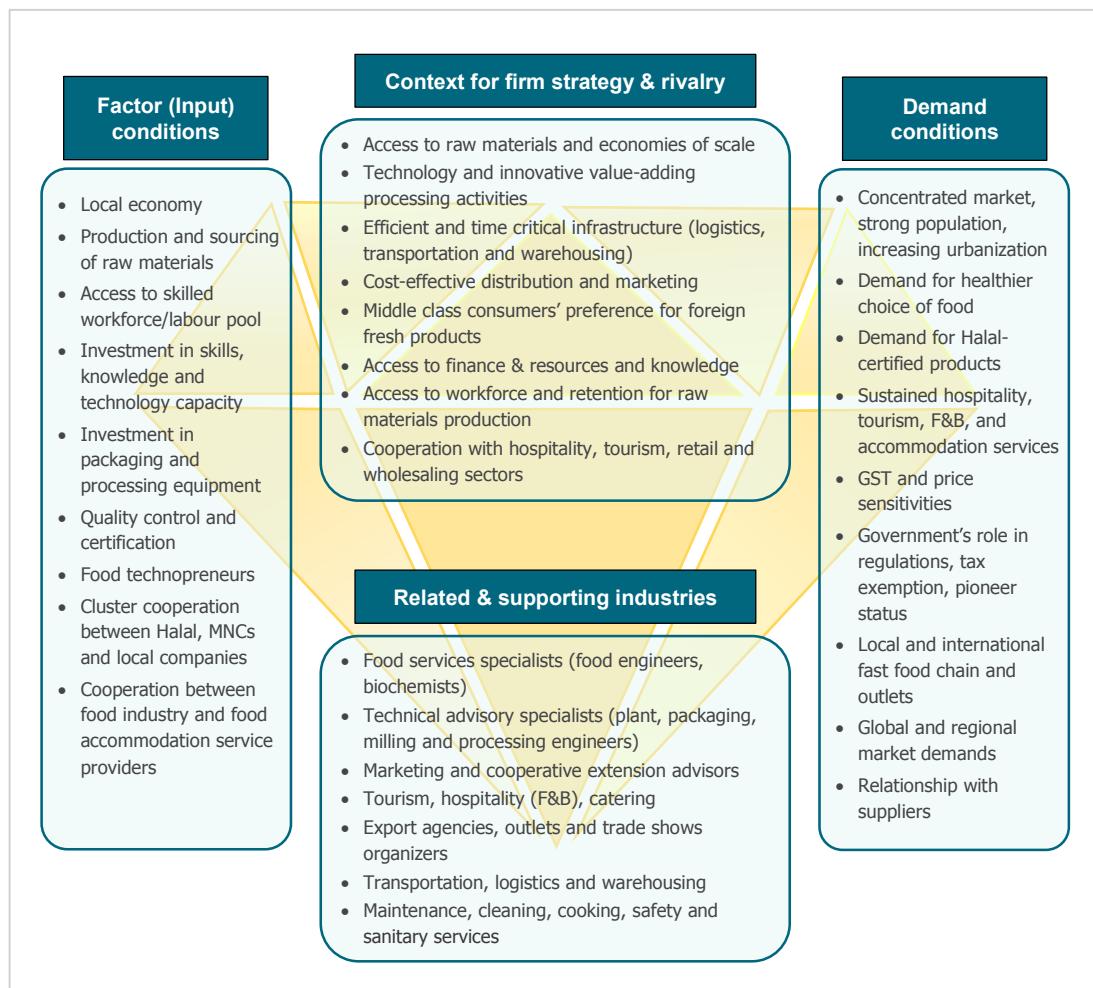


Figure 3.6 Diamond of Advantage

Source: Monash University Malaysia, 2016

3.7 SWOT Analysis

Today, it is widespread in cluster thinking to consider clusters as close collaborations between companies, knowledge and educational institutions and the public sector. The ability of various cluster stakeholders to contribute generally and specifically to cluster development requires appreciation of the dynamics between stakeholders that characterised the cluster's external opportunities and threats, and internal strengths and weaknesses (SWOT). In making this qualitative assessment, we examined the various stakeholders in and around the food activities, nationally, and in Selangor.

3.7.1 Strengths

Accordingly, we view some of the State's strengths in the food cluster as follows:

- Regional cultural diversity, a dense population, and a growing emerging educated, socially mobile middle class, will lead to increase consumption of food and demand for food and hospitality related services in the region.
- Established MNCs, large local manufacturers, networks of SMEs and high concentration of knowledge agencies and institutions that are involved in food, accommodation and service related activities (e.g. training, consultancy)
- MNCs and large local manufacturers with renowned reputation in producing and exporting spices and spice-related products, processed foods, and beverages.
- Strong supporting services provided by training institutes and academic institutions offering a range of vocational and/or food - related type industry training. This is complimented by a network of food processing machinery and equipment suppliers, manufacturers and/or OEMs' and distributors.
- Established "hub and spoke" infrastructure and logistics networks, with good access to seaports and airports, is reinforced by availability of cold storage and warehousing facilities.
- Modern, evolving retail sector and specialty shops operated by new non-traditional entrepreneurs are appearing in the food sector, operating at the intersection between food, climate and health (so-called hybrid areas), will spur growth in health and wellness food categories, innovation in food processing, preparation and packaging.
- Growing regional Halal hub reputation nationally, regionally and globally, in Halal production, logistics and trade, particularly in Halal certification and quality control.

3.7.2 Weaknesses

With these strengths, there are also numerous natural and structural internal weaknesses. A review of Figure 3.7 highlights the following weaknesses in the State's various food sectors:

- The economic feasibility of producing raw materials due to unavailability of rich land for production and farming, and insignificance of the contribution of agriculture to the State's GDP.
- Being both a major consumer and producer of food for its local population and local and international visitors/tourists, there is a heavy reliance on imports of dairy, poultry products, wheat, cereals and many key bakery and processing ingredients to sustain the population.
- High dependency on foreign technological machinery and knowledge to add value to processed food manufacturing machinery and equipment. High cost and technical know-how in full production machinery line limits spending in innovative production and processing technology.
- The reality of heavy reliance on foreign labour for raw materials production that includes farming and fishing, is matched by concerns and uncertainties in ensuring a consistent and steady supply of labour, at an affordable cost. The pitch for skilled workers is also now growing for food manufacturing industries.

3.7.3 Opportunities

Selangor offers the following opportunities that could be further capitalised, through the formulation of a State's Food Cluster Action Plan that takes into consideration the national context, but with a clear direction that focus on the State's food cluster specialisations and niches. They include:

- Demand for food, accommodation and services is growing, spurred on by the State's tourism initiatives, a dense and concentrated population located next to an equally densely populated Federal Territory (Kuala Lumpur), with a growing emerging educated, socially mobile middle class.
- Increase demand among state's population towards healthy, environmentally friendly, wellness food, and for time poor population, demand for pre-cooked and fast food – both reflective of emerging and changing lifestyle living.
- Potential in high value adding activities through packaging and pre-cooked preparation in wellness and health food and processed foods for domestic and global markets, in targeted business and food specialisations, will foster further growth and innovation. This includes opportunities to target specialisation and customisation of food processing machinery and equipment for global customers such as fast food giants expanding in the regions.

- Large local and global demand for Halal certified foods and services will further fuelled growth opportunities in the Halal sector Halal certification and quality control, with Pulau Indah Selangor Halal Hub and the PKFZ Halal Flagship Zone expected to play a major role, given their potential capacity to act as the region's Halal cluster powerhouse.
- Opportunities exist for the State to redefine and refine existing sub-sectors in the food industry that will drive the cluster potential for business growth and synergies through specialisations, while strengthening cooperation with key stakeholders in these sub-sectors

3.7.4 Threats

A combination of historical, institutional, natural and market environment have also created a number of external threats that could impact on any State's initiatives to strengthen cooperation with key stakeholders, operating within various food sectors. These include:

- The introduction of the 6% GST in April, 2015 has resulted in price increase that will impact on domestic consumption in the foreseeable future. A downturn in the nation's economy will add further pressure.
- Increase competition between various manufacturing sectors to train local talent amidst the backdrop of a diminishing talent, increased skills and knowledge mismatch, and the increasing cost of doing business.
- Shift towards consumers' preference for healthy, environmentally friendly food may require new, additional investment among producers and distributors, for new value adding and capacity building machineries.
- Competition from Indonesia and Thailand in production of processed food may limit export market potential, while reluctance to obtain EU certification as a result of investment requirement to comply with EU health standards, will impact further on the quantity of Malaysian seafood export.
- Cheap imports, inability to meet local demand and a business mind set driven by profit gains, will see more businesses reconfigure their business models in the production and sourcing of raw materials and the manufacture of cooking equipment. Lesser emphasis will be placed on value adding activities, with a corresponding focus on machine and equipment refurbishment, and greater involvement in trading, importing and agency activities.

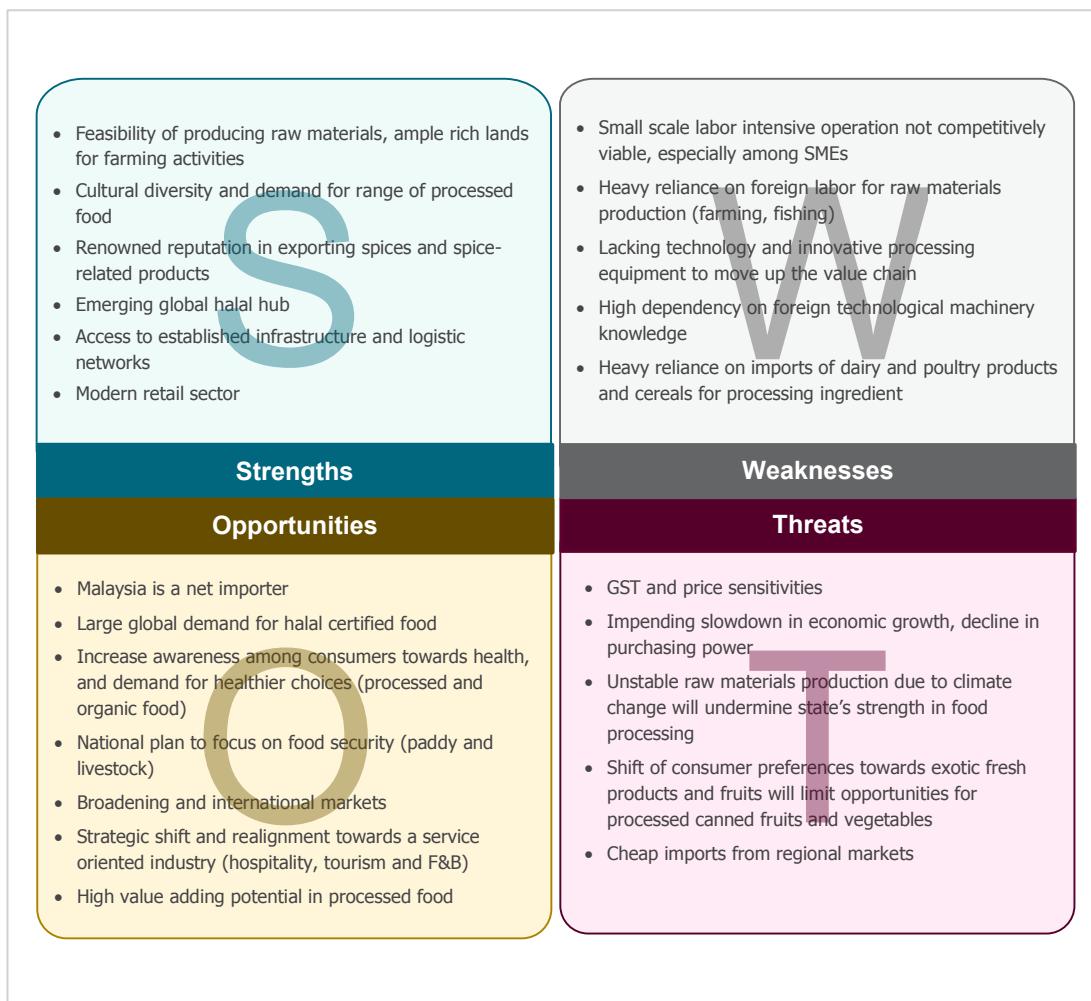


Figure 3.7 SWOT Analysis

Source: Monash University Malaysia, 2016

3.8 Relational and Network Impact Analysis

Figure 3.8 maps out relational ties that exist between stakeholders in the food cluster, taking into account their characteristics, competencies and their needs in relation to local, regional and global trends. The aim is to ensure the State's business, political and social initiatives are targeting the specific conditions that exist between gaps in the cluster. These gaps exist between two or more parties in a cluster of interconnected and interdependent relationships.

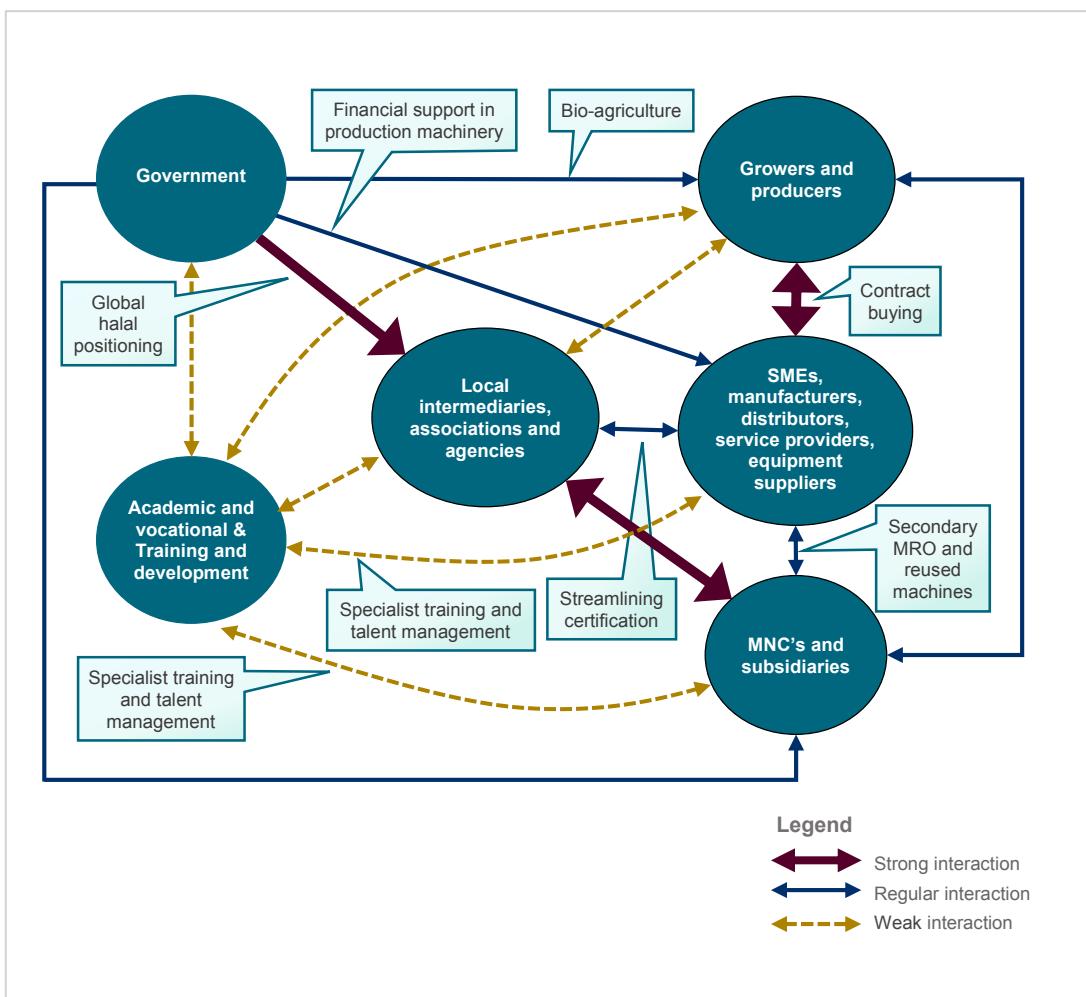


Figure 3.8 Macro Analysis

Source: Monash University Malaysia, 2016

Some of these relationships stems from strong interactions between parties over time. Others are weak because there are fewer interactions between them. For example, while strong interactional relationships exist between growers and producers with SMEs, manufacturers, distributors and service providers, relational interactions between growers and producers with local industries, associations and agencies are somewhat weak. The strong relational inter-dependency between parties involved in sourcing, processing, packaging, transportation and distribution of raw materials exist because these are critical activities in the value chain.

This is not necessarily the case with growers and producers, and their relationships with local industries, associations and agencies. More than anything, growers and producers have mixed views of the associations that represent their interest, including government agencies. As one interviewee explains,

"Government "We deal with SIRIM, MOH, Department of Agriculture, and Halal. Sometimes we deal with universities. Collaboration is okay, but it's not fast. Dealing with our association is a bit hostile. Probably it's because of the culture. But things will change eventually. Eventually, you have no choice. You'd work together. SIRIM is good. Responsive, informative. We deal with quite a lot. Even government committees like MIDA. Everything is okay."

Similarly, relational interactions between SMEs, manufacturers, service providers and equipment suppliers, and between foreign MNCs and their subsidiaries with academic and vocational training and development are also relatively weak. While we are keenly aware more universities are offering Food Science and Technology and Hospitality Management programs, there is also an increasing need for more of these parties to communicate what they really need, and how on-campus and on-site industry learning and training could further enhance their roles in the supply chain. One local university dean view perhaps best encapsulates this tension when he says,

"As far as public universities are concerned, I do wish there are more collaborations. We feel that we can help. We are often told that we are doing things the industry doesn't need. But we don't know what the industry need, if the industry doesn't say anything (We "understand" sometimes it is confidential.)"

Getting these stakeholders on the same page clearly requires collaborative commitment of their respective contributions, in terms of their respective sector's value adding roles, as it impacts on the food cluster.

From our relational impact analysis between various stakeholders in the food cluster, we have identified several important opportunities that will enhance relational strength between stakeholders, as they individually and collectively seek to understand each other's perspectives, to realise cluster's growth potential. These include:

- Global halal positioning, streamlining of halal accreditations, and certification.
- Financial assistance in innovation and automation of production, processing and packaging (3P's) of food.
- Sustained, collaborative engagements between universities, vocational institutes and businesses in food production and processing.
- Contract buying and/or formation of buying group to drive economy of scale and improve profitability, at the source of production and growth of raw materials (examples include vegetables and fish farming).
- Investment in bio agriculture.
- A change in mind set from domestic to export markets through accreditation, branding and networking.

The state has strong areas of food specialisations that include various agencies with their facilities such as food analysis and advice (See Figure 3.9). It also has strong presence of businesses involved in the processing of dairy products and ingredients, large multinationals with a strong market position, sales and distribution organisations, established infrastructure in distribution, meat processing and ingredient production – all suggesting opportunities for specialisation in these areas. Generally, interactions between these stakeholders are regular, with evident of strong interactions between production and source of raw materials, growers, fisheries with processed food manufacturers, restaurateurs, caterers, and franchisors, hotel chains, hospitals and canteens, and export agencies.

With the growing important presence of Selangor as a potential global Halal hub, existing and new SMEs with great growth potential could work closer with JAKIM (Jabatan Kemajuan Islam Malaysia), beyond major food processing, beverages, accommodation, restaurants and caterers. These SMEs could also work within 'hybrid areas' that extends beyond processed food to include food that appeals to the global market, taking into consideration the climatic, environmental, market and health conditions in these markets. For SMEs to achieve these outcomes, to bring innovation in both food and food service to the food industry, there is a need to tap into, and capitalise on already strong relational interactions and cooperation between JAKIM Malaysia with large, established local companies, MNCs and agencies. This will optimise SMEs contribution to innovation and growth in the local, regional and global market.

Knowledge organisations and knowledge sharing will play a significant role, primarily through cooperative initiatives that benefits the development of their respective food sector, in order to realise growth potential. Once again, getting these stakeholders on the same page on matters pertaining to Halal accreditation and certification, clearly requires collaboration of a different sort, needs new inputs to step up their investment in innovation, and to develop a mindset that extends beyond the local markets.

The extent of the cooperation that currently exist between large, captive and selected players in the food and food service industry could also be extended to include smaller processed food companies, raw materials producers, growers and fisheries, as well as enhanced working collaborative relationships with import agencies and crucially, local equipment suppliers and packaging companies. This will contribute to lesser reliance on foreign imports of machinery, improved health and safety requirements, and motivate growers and equipment manufacturers in contributing to the development of the food cluster. Says the CEO of a kitchen equipment manufacturer,

“Actually (kitchen equipment) is available everywhere. The most common one from US and Europe provide really good equipment. The rest of the countries are just up and coming, China can build it (especially) for people that like to bargain but it probably would not last long.”

As a result, businesses are reconfiguring their business models in the presence of these challenges, focussing less on value adding activities and more on trading, importing and agency activities.

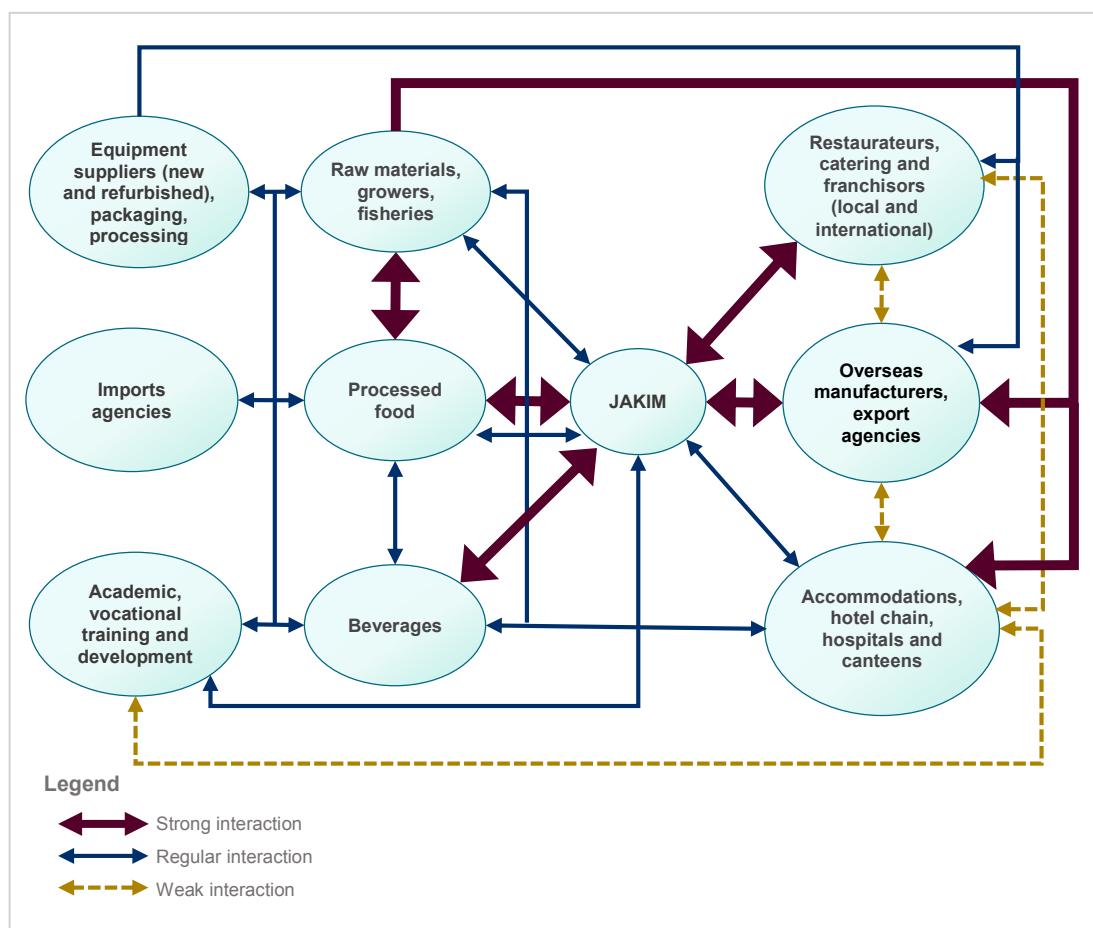


Figure 3.9 Meso Analysis

Source: Monash University Malaysia, 2016

3.9 Summary of Online Survey Findings

- **31** businesses identify their company's business as primarily operating in the food cluster from 167 interviews conducted on-line.
- **Nearly one in three** businesses in the food cluster thinks that the business environment will **change for the better** over the next 2-3 years. **One in two**, however, thinks that it will **change for the worse**.
- **More than one in two businesses (58%)** were however **very confident** or somewhat confident about their company's business prospect over the next 2-3 years.
- **More than 3 in 4** businesses describe their industry as "**highly competitive**" or "an industry where buyers have increasing bargaining power." **46% and 42%** think that their industry is **capital and labour intensive** respectively. Only **13%** view their industry as "**technology-driven**".
- Strong local market wisdom (**55%**), heavy dependence on local market (**48%**), and strong business leadership (**45%**) were identified as the top three capabilities of local firms and suppliers operating in the food cluster.
- The issues with the most impact on businesses in the food cluster over the next 2-3 years are **business environment (68%)**, **product innovation (45%)** and **access to export market (42%)**.
- While **more than one in two businesses (58%)** describe the state government's role as being **supportive or facilitative** in the development of their industries, 38% however felt that it was inhibitive or constraining.
- **58%** (18 businesses) also describe the role of **industry associations, academic and research institutions** in the development of their industries as **supportive or facilitative**, with **36%** (11 businesses) describing the role as **inhibitive or constraining**.
- Businesses operating in the food cluster are **optimistic** about their growth potential in Selangor with two in three businesses ranking the cluster among the top two growth cluster.
- **More than half (55%)** of businesses in the food cluster indicate that sales and marketing priority will be to **concentrate on existing products/services but seeking new markets**. One in three businesses will however focus on existing markets, with either existing or new products/services.
- Close to **one in two businesses (45%)** reported export sales of more than 30%. **One in three** businesses focus exclusively on the **local market**.

3.10 Conclusion and Recommendations

Our analysis and assessment of the major activities that makes up the food cluster's characteristics and governances are shown in Table 3.6. For example, and not surprisingly, in terms of cluster structure, local growers and suppliers dominate the agro and seafood-based sectors in growing, production, souring and harvesting activities. However, large foreign MNCs and large local companies' processors with many SMEs are involved in food processing as well as distribution and marketing. Cluster governance across all these activities is typically coordinated by local intermediaries and government agencies.

Following on from our face-to-face interviews with senior executives from parts of the value chain, analysis of secondary data, and results from the survey, it is clear that businesses in the food industries (from growing, sourcing, production, processing, packaging, transporting, marketing and distribution) do not necessarily have common incentives for engaging in cluster-led and initiated activities.

For large established businesses like MNCs, innovative packaging, new product introduction, innovative production and processing technology, and export markets are important. They may even see cluster as a way to market the products locally and internationally.

For local manufacturers, attracting and keeping talent and investing in new machinery and equipment that will enable them to compete domestically and survive are important. For many other businesses, food entrepreneurs, SMEs, and stakeholders in the supporting industries, they may be a growing realisation to move from generalisation to business and food specialisation, to ensure better economy of scale and survival, beyond TPPA. It is also important that they have access to companies that can help them fund identifiable business and food specialisation initiatives, new machines upgrades, and access to export markets.

3.10.1 Recommendations

With this in mind, the following recommendations aims to provide inputs to the State Government with a view to strengthening and exploiting existing and future business potential in the development of a food cluster. They include:

1. Parameters-specific strategy

Selangor has three competitive parameters to develop its food cluster. They include the region's: (1) local food system with a heavy concentration of businesses manufacturing processed food, (2) food and tourism sectors as they interface with the State's hospitality, accommodation and fast food facilities, and infrastructure, and (3) Halal food hub for upstream and downstream manufacturing activities, including the fast growing health and wellness food subsector, food-life-education, and sustainable and safe food.

The contributions of these three parameters to the State's food value chain are, however, different. While the region's local system is geared towards a domestic market consumption including health and wellness food, the tourism and halal sectors holds huge export earnings

potential. All three competitive parameters, however, have major multiplier effects in terms of employment and earnings potential in the State, particularly in their GDP contributions to the State Service sector (e.g. include revenues generated through Halal certification and accreditations, transport and logistics services, and hospitality and tourism services).

2. Targeting business, food and tourism sub-sector specialisation

It is clear that Selangor do not have a homogenous food cluster but several from which they could developed. It is also clear that Selangor do not have a strong agricultural base, and while agriculture and food production remains an issue, the State is also a major consumer and producer of food. It is also clear that various initiatives are under way to develop the State's tourism industry and to leverage existing relationships in a shared national Halal business model.

With this in mind, it is recommended that the development of the State's food cluster be established on the back of strong, future potential for value chain integration between stakeholders that are primarily involved in food processing, provision of tourism and hospitality, and halal food. These clusters affects and are affected by developments in national and regional tourism and hospitality, culture, consumption of local, traditional and fast food. Against these historical, institutional and market characteristics, various differentiated clusters would need to be implemented in order to develop the food industry in Selangor, with unique items and functional ingredients, based on these characteristics. We suggest clusters based around:

- i. Processed food, especially those with good export potential such as coffee, tea, cocoa, spices and manufacturing thereof, and meat and meat preparation.
- ii. Health and wellness food, in particular fortified and functional food and naturally healthy food for local consumption, middle class consumption economy, tourism, including medical tourism
- iii. Local and traditional food that appeals to the manufacturing food economy

There is also a need for Selangor to leverage off Wilayah Persekutuan Kuala Lumpur vast tourism infrastructure by bringing tourists into local food industries. In this way, Selangor food industry might be expanded through the production of a synergistic effect from mutual complementary relationships between its strength in food and tourism industries and W.P. Kuala Lumpur tourism infrastructure. This could involve joint, collaborative Selangor and Kuala Lumpur food and tourism promotion of key targeted sectors that include medical tourism, eco-tourism, sports tourism and heritage.

3. Targeted and selective funding on export and promotional initiatives

Targeted and selective funding on export and promotional initiatives is needed for local businesses to stay competitive in the food processing sub-sector. Exposure to competitive pressures has revealed the extent to which some parts of the food processing sector are unable to compete with imports. To become internationally competitive, food processing companies must first be competitive in the domestic market, before they become internationally competitive.

Food processors, particularly SMEs and mid-sized, local manufacturers, have thus far relied solely on the domestic market. While domestic market has increased, it remains small, so SMEs and mid-sized manufacturers rarely achieve economies of scales and reduce average costs. The impending introduction of TPPA brings added uncertainties as increased imports from foreign competition will further erode their share of the domestic market. These manufacturers need to overcome this constraint by seeking bigger markets overseas.

4. Financial assistance and incentives to increase competitiveness

Financial assistance and incentives are needed to compete and develop the food processing sector. While large local food processors, retail chains and their customers have demonstrated great price sensitivity, this has often been at the expense of more domestically grown and made products. Ultimately, local manufacturers competing in this sector must ensure it is producing products that consumers want, and at a price they can afford.

To compete and grow, they must invest in new, effective production technology and processing methods that improves their productivity and profits. Quite often, the initial capital outlay acts as major disincentive to invest, especially in importing costly, customised machineries. This further impacts their production capacity, reduces profit margins especially with increasing labour cost.

In addition to financial support, infrastructure in the form of connectivity to cold chain and storage system and facilities for frozen and refrigerated products, transportation, distribution and communication infrastructure locally and internationally, will move many of the local manufacturers up the value chain.

5. Learn from the large and established

Small businesses and growers in the food sector, especially those with business, production and food specialisation, should consider working with large, established local food manufacturers and intermediaries, to leverage existing opportunities and creating new ones. The fact that intermediaries that are involved in marketing and distribution of food, confectionaries, beverages and fresh produce are becoming increasingly aware of the benefits of a strong food cluster, by working with small businesses and/or growers, provides a strong basis for the development of a food cluster.

For integration to take place, small businesses and growers should consider forming cooperatives to manage their marketing of their products, locally and internationally. Most importantly, these cooperatives should be developed to suit the current marketing and financial requirements for local small businesses and growers. State government's support, through public policies, could provide much needed institutional mechanism by which small businesses and growers could bring existing economic imbalance under some form of control.

6. Leverage the 'halal' hub potential

Selangor's position as a potential global halal hub could serve as one of a selected few, if not the ideal platform, to develop the State's food cluster business, bringing together all key stakeholders, particularly SMEs. These SMEs could also work within 'hybrid areas' that extends beyond processed food to include food that appeals to the global market, taking into consideration the climatic, environmental, market and health conditions in these markets.

For SMEs to achieve these outcomes, and to bring innovation in both food and food service to the food industry, they need to capitalise on already strong relational interactions and cooperation between JAKIM Malaysia with large, established local companies, MNCs and agencies. This will, in turn, optimise SMEs contribution to innovation and growth in the local, regional and global market. The State government could identify, facilitate and further enhance these linkages through electronic means and mechanisms.

7. Include processing machinery and equipment

The linkages between the food and related industries could be extended to include food processing machinery and equipment manufacturers. Support and facilitative initiatives to encourage these manufacturers to keep track of new technologies, invest in new production and processing technologies, and to collaborate with food manufacturers, is also needed in integrating various food cluster's activities and resources.

Import substitution initiatives are needed, firstly, through leveraging existing manufacturing expertise in the industry, by tying multiple manufacturing platforms together (example snack food processing and packaging machines) before/and or at the same time manufacturing advanced but customised technology food processing machinery.

These developmental initiatives, however, requires better talent and skill management. Initiatives to strengthen and work with existing agencies focussing on technical training to address manpower needs, such as knowledge workers, for industries such as lifestyle and food technology, (among others) is important, and are among the some of the talent shortage identified by MIDA.

3.10.2 Summary of Cluster Characteristics and Govrances

Characteristics of Food Cluster							
Cluster	Nature and Structure of Industry			Capabilities of Cluster Actors			Cluster Governance
	Capital Intensive	Technology-driven	Structure of Cluster Ownership	Local Private Firms / Selangor	Intermediary Institutions (association, academic, research institute)	Government Agencies / Selangor	
Growing & harvesting	Low	LMCT	Clusters of local growers agro-based focussed	High level of local wisdom and expertise	Strong leadership, networks and associations	Influential and pragmatic	Local intermediary institution and government coordinated
Processing	Low	LMCT (SMEs) MFCT (others)	Clusters of large subsidiaries of MNCs, few large local firms, majority SMEs	Local firms are increasing strength in technology	Quite strong leadership but reliance on subsidiaries on MNCs and large local firms	Supportive and facilitative	Local intermediary institution and government coordinated
Distribution and marketing	Medium	MFCT	Clusters of SMEs	Local firms are increasing strength in technology	Reliance on large local firms and cluster of SMEs	Supportive and facilitative	Local intermediary institution and government coordinated
Halal food	Medium	MFCT	Clusters of large local firms, suppliers and SMEs	High level of local wisdom and expertise	Strong, emerging leadership and high availability of financial resources	Influential, facilitative and supportive	Local intermediary institution and government coordinated

Table 3.6 Summary of Cluster Characteristics and Cluster Govrances

Source: Monash University Malaysia, 2016

3.11 Best Practices

Case Study 1: Danish Food Cluster: The European Hub for Innovation

Background

The Danish food and agriculture sector is the third biggest food cluster in the Western world. Today, it employs more than 180,000 people and accounts for more than 20% of the country's total product exports. The food cluster in southern Denmark's Triangle region lies within reach of 80 million consumers, lying just one hour from the German border and within reach of all of Denmark within 2.5 hours. Some 7,000-8,000 people are employed in the sector and it is one of the key industries for regional development. More than 120 companies in the region are directly related to the food business, the vast majority belonging to food processing.

Relevance

While the dominant subsector is meat followed by dairy, the region is also strongly represented by seafood, ingredients, cakes, confectionary and processed fruits and vegetables, not unlike that of Selangor.

Findings

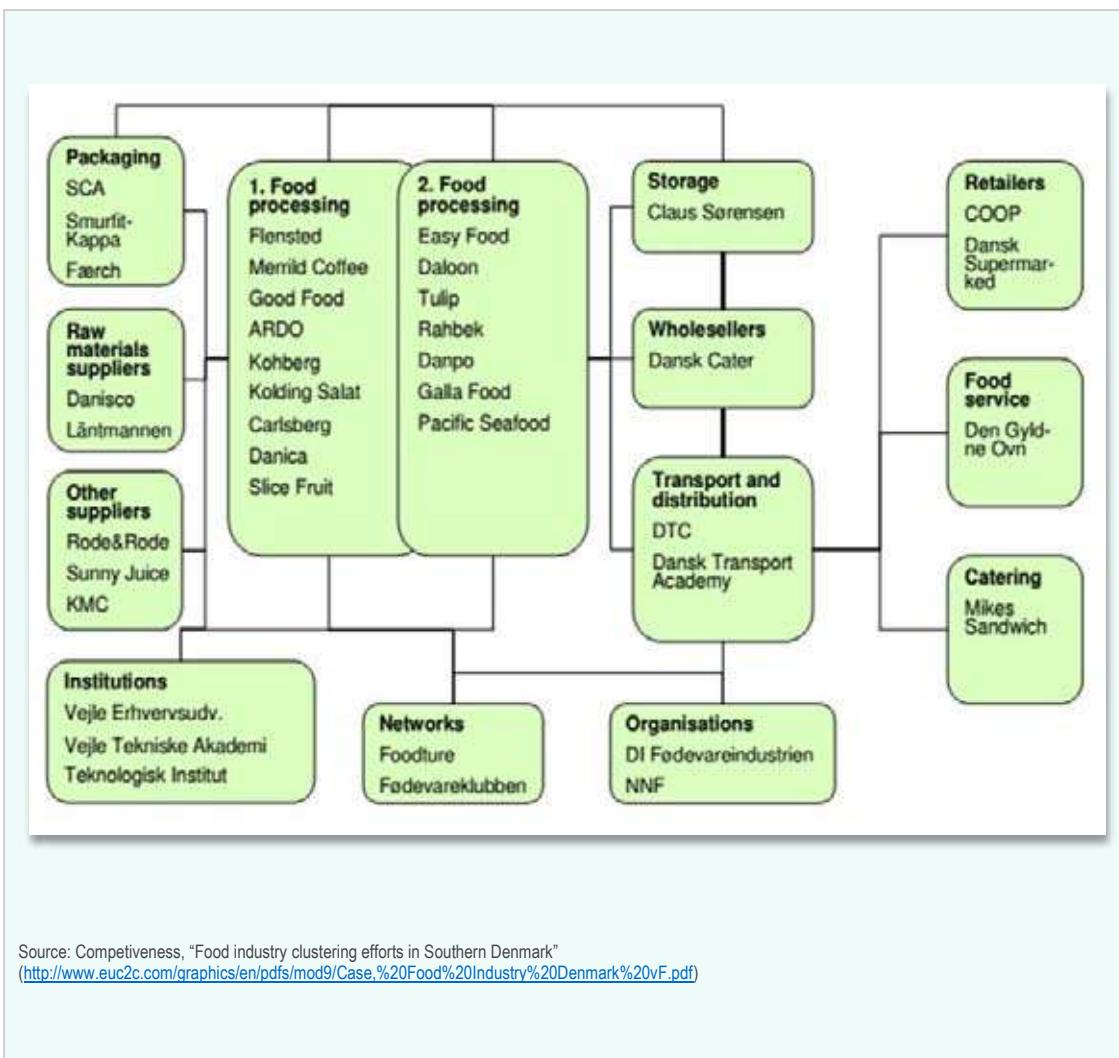
The best way for businesses to tap into the cluster's growth potential is by pooling resources, sharing knowledge and entering innovation partnerships with universities and specialist consultants. The Danish Food Cluster, as an association, has more than 100 members from all parts of the food value chain. The necessary pre-conditions to achieve continuous growth include government commitment, inter-related cluster and an experienced, satisfied workforce. Potential is maximised by:

- i. Attracting international business, talents and investment
- ii. Strengthening innovation in the sector
- iii. Supporting knowledge sharing and cooperation
- iv. Branding the cluster and creating visibility for members

The challenges, however, as is the case of the food cluster in southern Denmark's Triangle region is:

- i. Defining what constitutes a cluster as they impact on its potential
- ii. The need to refocus R&D
- iii. Improvement of human, financial and knowledge mobility

**Case Study 1 findings continue at next page.*



Case Study 2: Korea to dish up Asia's first food cluster: Foodpolis prepares to tap into \$6 trillion food industry

Background

South Korea is pushing ahead with building Asia's first food cluster, Foodpolis, to tap into the global food industry, which is expected to be worth up to \$6 trillion by 2020. The nation plans to invest 553 billion won (\$524 million) in setting up the cluster by 2016. It is currently in talks with up to 160 domestic and foreign companies, colleges and research centres that are vying for a spot at Foodpolis. The aim is to make Foodpolis an Asian food hub by integrating the industry with other sectors, such as tourism and culture.

Relevance

Early development stage of Foodpolis provides insights into how Selangor could potentially capitalise on its national food hub by integrating the food industry with tourism and culture, including specialisation of sub-food clusters (example halal and fine food) that have a local, regional and global appeal.

Findings

In Foodpolis, foreign companies starting a business in the cluster are offered incentives that include exemption from corporate taxes for three years. Then, for two years, they will only have to pay 50 percent of their corporate taxes. Free land leases and financial support, including educational subsidies for employees, are also being offered. Solid infrastructure is another incentive the government believes will appeal to investors. It has an advanced cold chain system for frozen and refrigerated products, and also is equipped for fast and secure transportation, distribution and communication infrastructure.

Source: <http://www.koreaherald.com/view.php?ud=20140930000727>; and quotes from various officials

Case Study 3: The future of Australian Processed Food Sector

Background

It has been suggested that Australia should take advantage of the 'Asian century' to become the 'food bowl of Asia'. Australia appears to be moving in this direction, as exports of particular food types are on the rise (example beef and wheat).

Relevance

The processed food sector in Australia, however, faces significant pressure, both domestically and internationally. What can be done to increase the sector's survivability? Malaysia appears to be moving in that direction as import continues to be more than export.

Findings

The Australian processed food sector faces a difficult future, as increased imports erode the sector's domestic market share. How then can Australia be the food bowl of Asia, if it cannot compete with imports in the domestic market? Until recently, the Australian processed food sector was relatively insulated from import competition and was able to survive by supplying the domestic market. However, it has become clear that for the sector to compete, even in the domestic market, it must become internationally competitive.

Source: http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/BriefingBook44p/ProcessedFood

Cluster Specific Insights 03

Life Sciences

4.0 Life Sciences Cluster

How well the state build on and leverage from its existing, vast healthcare infrastructure while having the confidence and wisdom to increase R&D funding, address talent demand, improve labour productivity, and access to equity funds, will provide the necessary impetus to develop an emerging regional life sciences cluster.

Key Takeaways:

- The healthcare sector in the State is very bright, offering the State an excellent opportunity to drive and create a vibrant, regional life sciences cluster.
- State's government through participatory regulations will provide the impetus and the message of intent, starting with the formation of a life sciences cluster working committee.
- Any cluster strategy ought to be built on the back of the State's network of healthcare infrastructure, to drive various subsectors connectedness. The emphasis is leverage.
- Promote dialogue, continual improvements and linkages between sub-sectors and key industry players, especially those with strong local manufacturing, R&D operations and global market appeal.
- Address quality talent gaps in pharmaceutical manufacturing (chemist, scientist, pharmacist, biotechnologists), health care tourism (surgeon, anaesthesiologist, internal medicine), and in clinical trials (principal investigator and biostatistician), among others.
- The need to address the low number of PCT applications by:
 - a. Improving better accessing to equity funding;
 - b. Capital for start-ups; and
 - c. Incentivising commercialisation of innovations, in developing a vibrant life sciences cluster with a global appeal

4.1 Introduction

A dense regional population, strong economic growth, access to educated workforce, influx of medical tourists and a well-established hospital network, are some of the key inputs and demand factors that drive Selangor's health care industry. The provision of health services in the State has enhanced the lives of local residents with proven patient outcomes, and creating an enviable national and regional reputation for efficiency.

With the Federal Government focussing on healthcare as an economic growth engine, Selangor is very well placed to take advantage of a rapidly changing, competitive landscape. This landscape places a premium on the delivery of health services based on value, volume of its patients, procedures and reimbursements, and at the same time, responding to tensions and disruptions between key sub-sectors in the healthcare industry. These sub-sectors include pharmaceuticals, medical devices, biomedical, medical health insurance, research and teaching, health informatics and administration, food processing, nutraceutical and cosmeceuticals.

Selangor's focus on patient care has, however, also meant that few patents are secured in the region and capital for start-ups remains difficult to obtain. While hopes are high for reform-minded healthcare entrepreneurs and hospital groups to assist and provide much needed infrastructure investment, and while many are aware of the potential for health care and improving patient outcomes, innovations remains limited.

In Malaysia, innovations are low in biotechnology, pharmaceuticals, food chemistry and medical technology when compared with some of the neighbours. The nation's total PCT (Patent Cooperation Treaty) application which measures innovative outputs was 53 in 2014, compared with 52 applications in 2013. There were 167 similar applications in Singapore in 2014, an increase of 35% compared with 115 applications in 2013. In China, hopes are running high in health care innovation with 1453 PCT applications in 2014 compared with 1133 in 2013, an increase of 22% (See Table 4.1 below). By filing one international patent application under the PCT, applicants can simultaneously seek protection for an invention in 148 countries throughout the world.

Country of Origin	Technology Area	2009	2010	2011	2012	2013	2014
Malaysia	Biotechnology	7	16	10	17	21	17
	Pharmaceuticals	9	18	13	17	11	16
	Food Chemistry	6	8	7	10	11	12
	Medical Technology	7	15	14	11	9	8
Singapore	Biotechnology	25	35	49	30	51	69
	Pharmaceuticals	20	32	31	26	25	41
	Food Chemistry	7	10	3	4	5	5
	Medical Technology	33	37	56	39	34	52
China	Biotechnology	79	118	178	259	268	292
	Pharmaceuticals	214	248	321	408	408	479
	Food Chemistry	38	44	44	75	76	83
	Medical Technology	159	178	254	387	381	599

Table 4.1 Life Sciences PCT Applications for Selected Countries of Origin

Source: World Intellectual Property Organization, 2015.

We believe the low number of PCT applications in Malaysia is primarily due to the difficulties in accessing equity funding, capital for start-ups and limited commercialisation of innovations in bio-pharmaceuticals, pharmaceutical medical devices and supplies. This is not surprising considering the huge investment required in R&D of new products, in a market that performs excellent outsourcing facility functions, particularly generics manufacturing industry. Large local and Mid-Tier players also do not engage in activities leading up to PCT applications, beyond perhaps specialisation in selected markets such as surgical and examination gloves.

For example, Bioven (Selangor), a Malaysian owned company with IP on several oncology programs resorted to raising funds in the London AIM market for future expansion to be used in accelerating entry into US market and embark on new R&D projects relating to cancer. Getting regulatory approvals from the key markets in Europe, of course, also suggest the company is competing with the big boys of the pharmaceutical world⁵¹.

Efforts to address these shortcomings are emerging in the public, private, and non-profit sectors. They include Federal and State inter-ministerial cooperation to create and sustain successful healthcare and biotechnology-related entrepreneurial activities, growth and innovation. The setting up of a biomedical programme by University Malaya and four other universities, seeks to address the need for biomedical engineers. Key stakeholders in the health care are engaging with each other to tackle some long, established tensions. They are also looking for international partners in global networks whose capabilities complement their own.

Greater urgency is now placed on pushing for collaborative R&D investments between MNCs and large local manufacturers and start-ups, in high value-added and new medical devices and IP protection over drugs, including next-generation drugs. The focus on improving patient outcomes and not just the process, is leading to more open dialogue between government agencies, medical and health profession, educational institutions, hospital and medical hospitality sectors. The improved connectivity between stakeholders is also contributing to an environment of greater cross-cooperation, in an emerging health care cluster.

For the State's policy makers, the challenge in creating and nurturing a life sciences cluster is two-fold:

1. How to build on and leverage from its existing, vast healthcare infrastructure, while having the confidence and wisdom to increase R&D funding, improve labour productivity, access to good supply of biomed engineers and scientists, as well as equity funds?
2. How to engage with reform-minded health care entrepreneurs, and work collaboratively with small to large specialty organisations in surgical and examination gloves, oncology medicines and biologics, to drive growth in research and development, employment and export earnings?

⁵¹ Starbiz, 2015

4.2 Scope

Life sciences are provided by private sector companies that include Pharma Biotech, pharmaceuticals, medical devices and diagnostics that are involved in basic research, education and specialist training, clinical trials, new product research and development, full scale manufacturing and health care delivery. Innovation, patent applications, funding and equity and commercialisation, are among some of the key primary activities companies undertake in the life sciences cluster. Indirect support includes businesses that are capable of providing other essential commercialisation support such as capital, information technology business expertise, services, networks and credibility. Public sector organisations include various government agencies, medical research affiliations and accreditation bodies. The focus on customers, particularly in-bound medical tourists, recognises the growth in demand from regional markets.

The scope, however, needs contextualising in order to provide meaningful interpretive analysis. For example, even though Malaysia has a strong manufacturing presence in the pharmaceutical and medical devices industry, this do not necessarily lead to strong investments in R&D and innovations. Correspondingly, there are fewer PCT applications. Instead, MNCs operating in Malaysia typically undertake developments of new promising products, clinical trials and treatments overseas. We also think that the barriers to medical entrepreneurship remains high among potential and existing players in the life sciences cluster, due to high R&D and innovation cost, although attitudes are now beginning to shift.

4.3 Background

The Malaysian Government is focussing on healthcare as an economic growth engine. According to MIDA (2014), Malaysia's Healthcare National Key Economic Area (NKEA) target is to achieve an incremental income (GNI) of RM35.5 billion and creation of 181,000 new healthcare jobs in the period 2011-2020. Good results were achieved in attracting more overseas capital and research and development investments in setting manufacturing facilities in pharmaceutical products and medical devices. Pharmaceutical industry attracted RM747.3 million in 14 approved projects in 2014, and RM4.9 billion in the period 1980-2013, in cumulative medical device project investments.

The local pharmaceutical market was valued at US\$1 billion in 2014 (or RM3.5 Billion). Generic drugs made up RM1.4 billion (40%) and innovators RM2.1 billion (60%). Pharmaceutical products export grew by 3 percent between 2012 and 2013, to RM982 million (See Figure 4.1). In 2014, export was RM1176 million, an increase of 20%. Medicaments, followed by glycosides and antibiotics accounted for 52.4., 24.2 and 5.4 percent of total export value (See Figure 4.2).

In the manufacture of medicinal active substances to be used for their pharmacological properties, in the manufacture of medicaments (Industry Code 21001), figures from the Department of Statistics showed an increase of 9.4 percent from RM1.59 Billion in 2013 to RM 1.74 Billion in 2014. Singapore, followed by the United States of America, Hong Kong and Brunei Darussalam accounted for 18.3%, 9.6%, 7.7% and 7% of total Malaysia's pharmaceutical products respectively (See Figure 4.3).

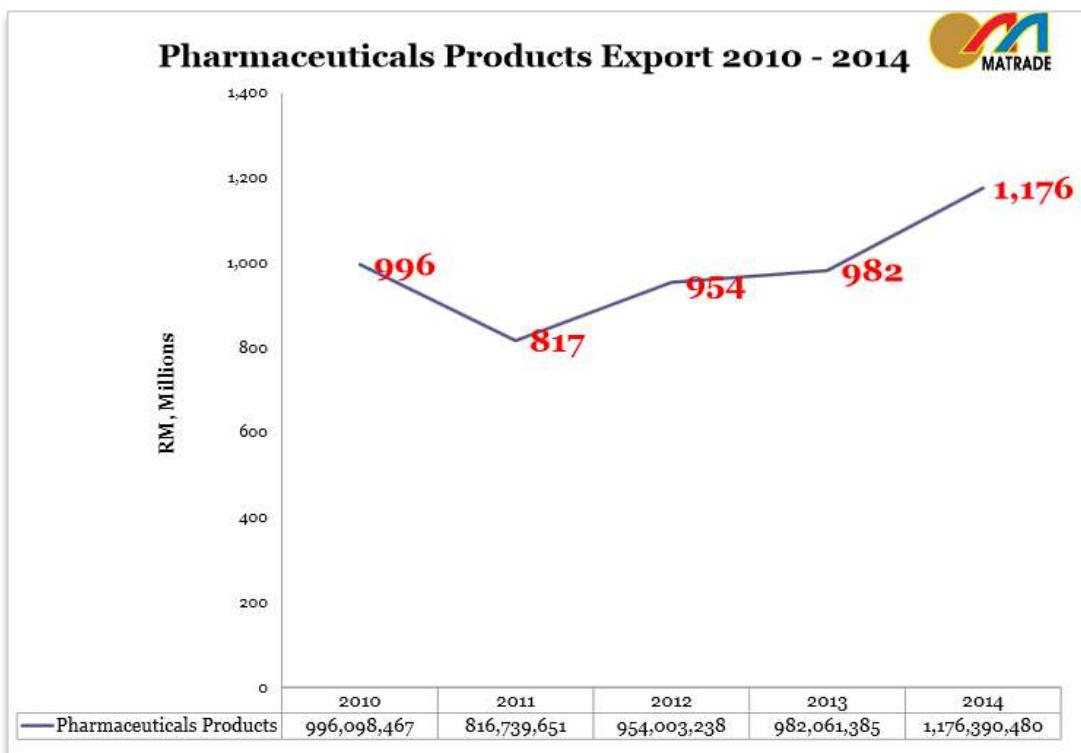


Figure 4.1 Pharmaceuticals Products Export 2010 – 2014

Source: MATRADE, 2014, "Export Opportunities in Medical Device and Pharmaceuticals Industry"

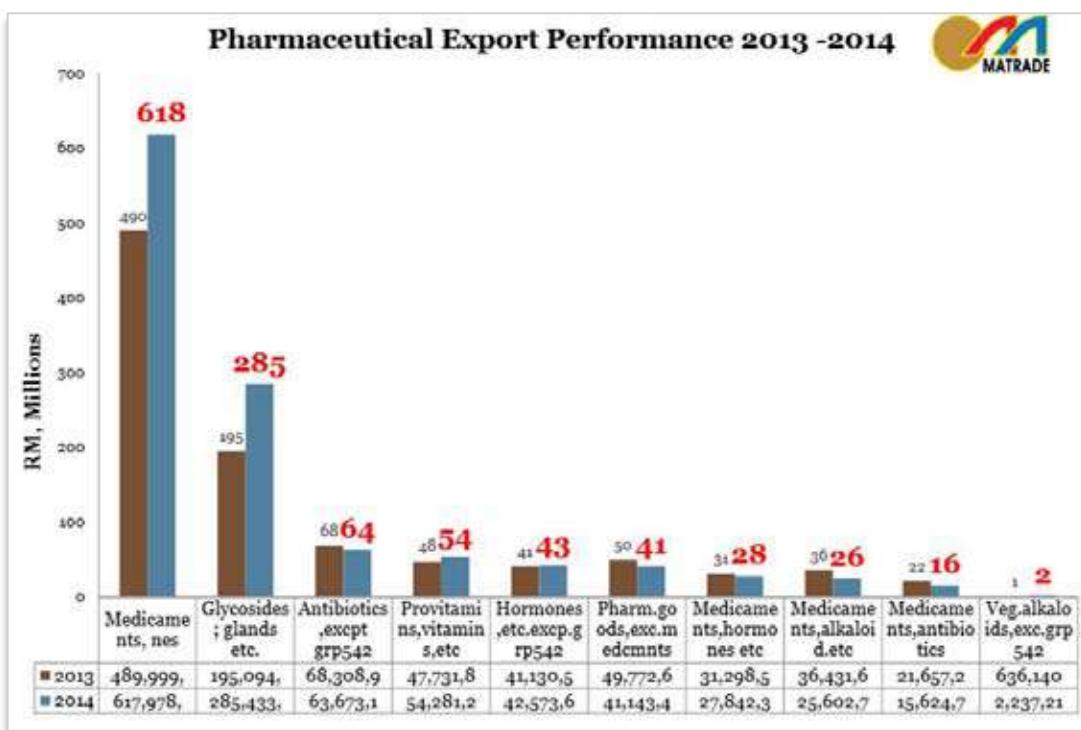


Figure 4.2 Pharmaceutical Export Performance 2013 – 2014

Source: MATRADE, 2014, "Export Opportunities in Medical Device and Pharmaceuticals Industry"

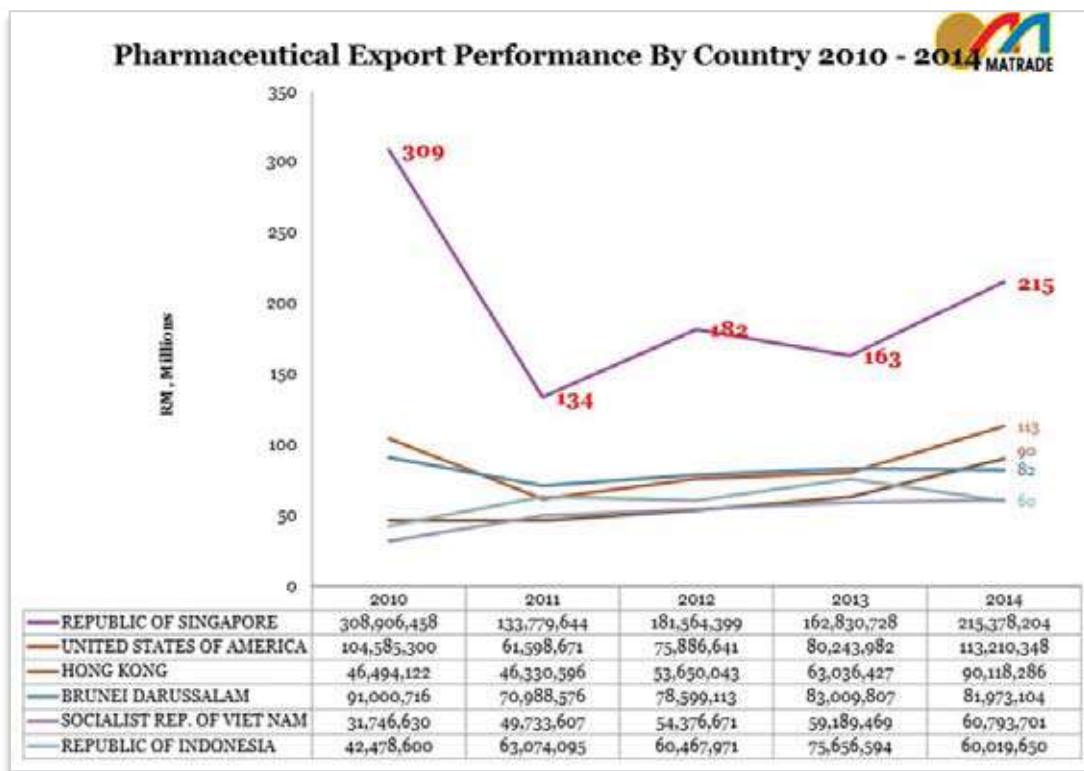


Figure 4.3 Pharmaceutical Export Performance by Country 2010 – 2014

Source: MATRADE, 2014, "Export Opportunities in Medical Device and Pharmaceuticals Industry"

The value of medical devices market in Malaysia grew by 9.5% in the period 2008-2013, in terms of CAGR or from RM3 billion to RM5 billion during this period. The value of medical devices exports increased from RM11.94 billion in 2013 to RM13.49 billion in 2014 (See Figure 4.4), and is expected to grow to RM15.11 billion in 2015. Surgical and examination gloves accounted for 52.9 percent of the nation's total export sales in 2014, followed by other medical instruments, apparatus and appliances with 15.6%, and catheters, syringes, needles and sutures with 14.2% (See Figure 4.5).

Selangor-based surgical and examination companies like Top Glove has flourished into the world's largest rubber glove manufacturer, while Hartalega has been in the forefront of Nitrile gloves production, introducing major technological improvements in Nitrile glove manufacturing. The top five export markets for the nation's medical devices are the United States, Federal Republic of Germany, Belgium, Japan and Singapore (See Figure 4.6).

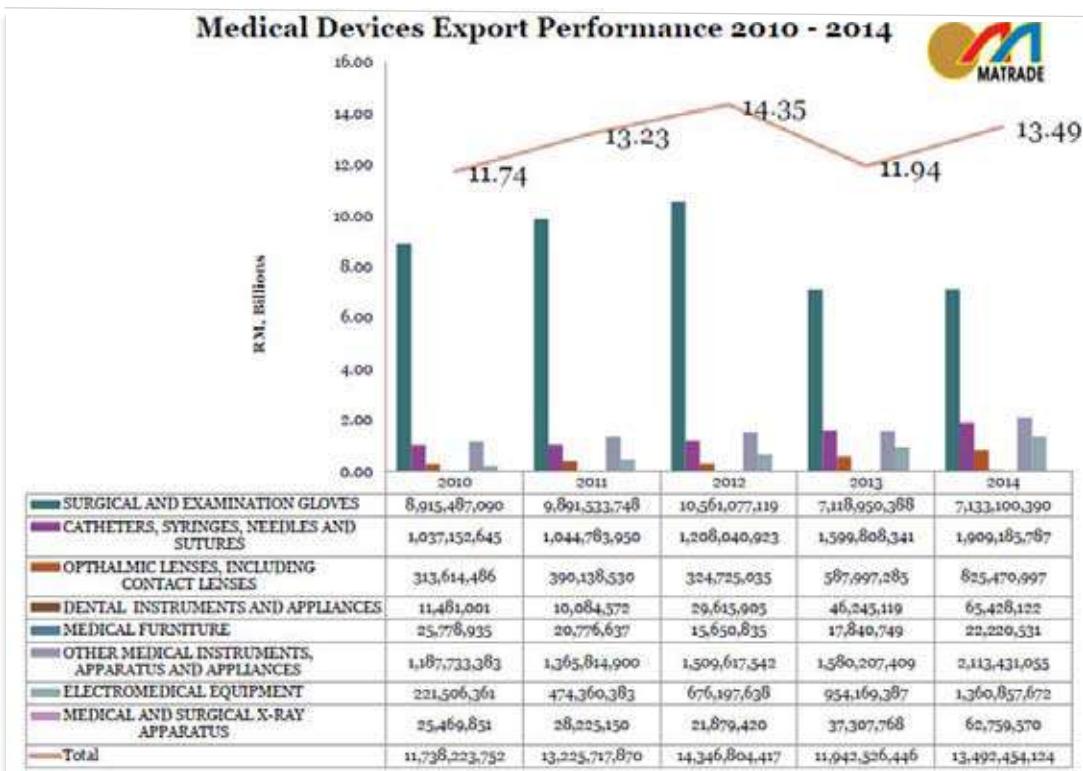


Figure 4.4 Medical Devices Export Performance 2010 – 2014

Source: MATRADE, 2014, "Export Opportunities in Medical Device and Pharmaceuticals Industry"

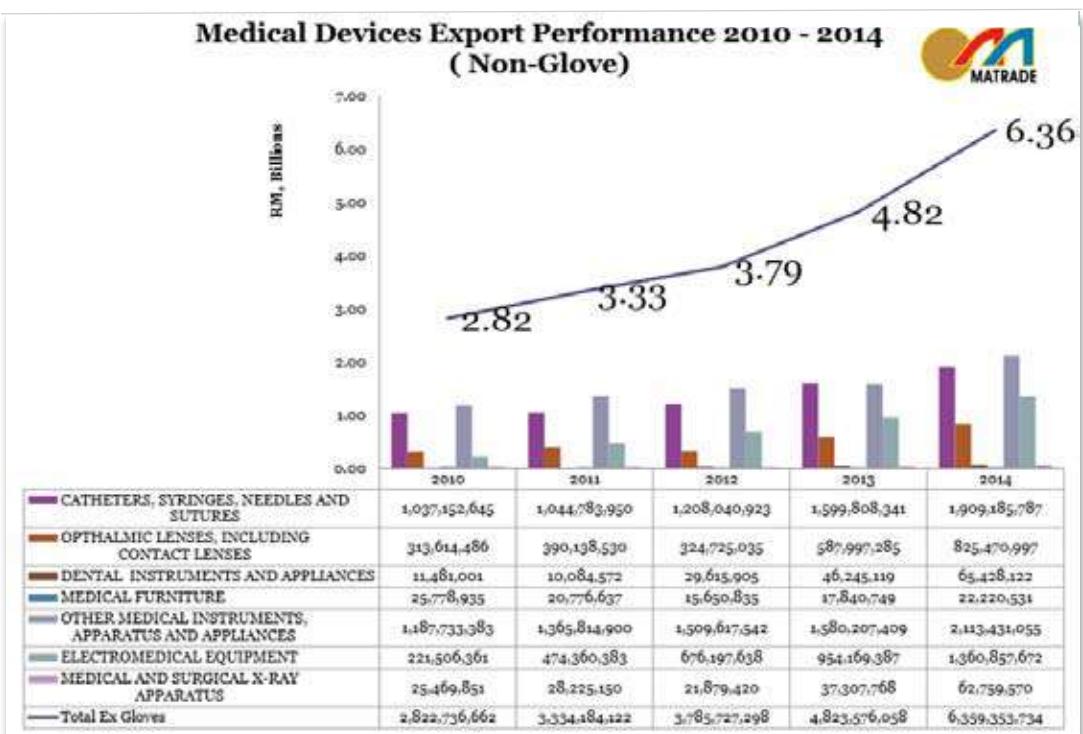


Figure 4.5 Medical Devices Export Performance 2010 – 2014 (Non-Glove)

Source: MATRADE, 2014, "Export Opportunities in Medical Device and Pharmaceuticals Industry"

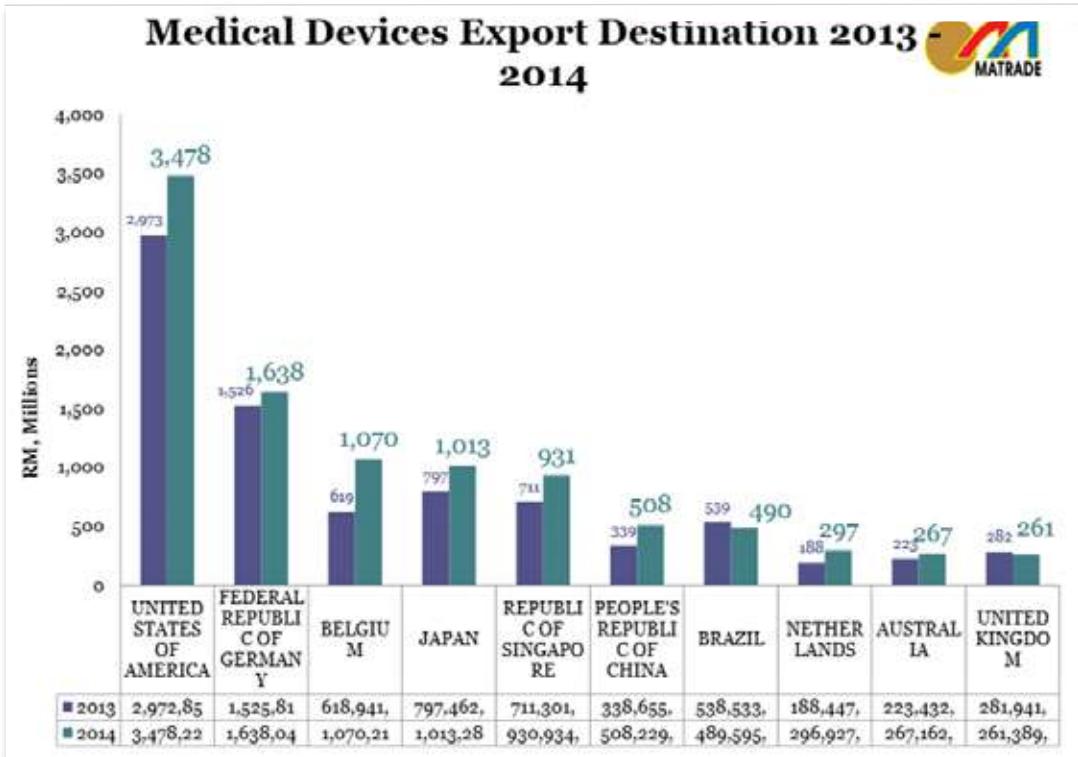


Figure 4.6 Medical Devices Export Destination 2013 – 2014

Source: MATRADE, 2014, "Export Opportunities in Medical Device and Pharmaceuticals Industry"

To be sure, however, Selangor now needs to develop an action plan that extends beyond generic manufacturing and surgical and examination glove manufacturing that is set in the national context to drive value-adding, while building quality capacity on the back of its existing institutional, infrastructural and market capabilities. There are coherent decisions to be made within and between sub-sectors/industries in the cluster. While there are existing areas of business specialisations, particularly medical gloves and generic pharmaceuticals, and future growth opportunities in areas such as bio pharmaceuticals and high value-added medical devices, there is also now an urgent need to understand how each existing and new specialisation areas impact one another, as well as their collective mutual growth. For example, growth in high value-added medical devices, In-Vitro Diagnostics (IVD) Test Kits, Hospital Hardware and Furniture are sought by the Malaysian government.

From a cluster perspective, growth in the healthcare sector requires the creation of a life sciences cluster action committee to streamline and optimise key manufacturing and service functions, processes and administrative systems. This will create opportunities through increased R&D and equity funding, better talent management, more patent applications and commercialisation of new product development, and enhanced efficiency in healthcare delivery.

From face-to-face interviews with large established companies in the life sciences cluster, many of them have relevant knowledge on their sector's growth potentials as well as their limitations. A Chief Executive Officer comments that:

“[To grow], there must [however] be a need to stay focus, do what we can, especially on local taxes and incentives. We also cannot be “all things to all people” but instead focus on what Selangor is good at and let other states do what they are good at.”

Stakeholders in the cluster could, therefore, do more to look at growth development that include other sectors/industries, and examine development potential from a cluster perspective. The same executive further adds:

“There is a need to go beyond “low equilibrium” [beyond where we are now] to a “higher equilibrium [to a more aggressive and progressive future growth].”

Simply put, we think that the CEO is implying that the health sector is missing out on significant growth opportunities, this despite *“Federal regulations being a major impediment, (agencies) operating with silos mentality, and often competing with each other,” and suggesting that “there is a need for government agencies to truly appreciate the cost of running the operations, with knowledge of incoming and outgoing funding source” [if the sector is to achieve “higher equilibrium”]*

Opportunity for the State to think of ways to actively bring together these stakeholders, creates new value beyond their respective industries, through cluster transformation, are also borne out by impressive statistics on growth in medical tourism and ageing population, with implications on healthcare and life-style management. Specifically:

- In 2013, the number of medical tourists was 770,134 (578,403 in 2011). Medical tourism receipts rose from RM509.77 mil in 2011 to RM680 mil in 2013. Estimated 2014 figures were 790,000 with earnings of more than RM730mil. Target for 2015 is RM1bil. Around 2 million medical tourists is expected to visit Malaysia by 2029, generating 10% of the annual revenue growth for the Malaysian economy.⁵²
- Malaysia is predicted to have an ageing population by 2030, in which 15% of the populations will be the elderly. Malaysia is also rated the top tropical paradise to retire in, clinching the Number One spot in the healthcare category of the International Living's Annual Global Retirement Index, 2015.⁵³

⁵² Starbiz, 2015

⁵³ Annual Global Retirement Index, <http://internationalliving.com/annual-global-retirement-index/>

4.4 Spatial Maps

Loosely translated and interpreted, and within the context of the nation's Healthcare National Key Economic Area (NKEA), there are huge development potentials in the State's life sciences cluster, in the areas of medical devices, pharmaceutical, biotechnology, in-bound medical tourism, travel and well-being. The State's link to established businesses, entrepreneurs, knowledge stakeholders, and its vast networks of health care infrastructure, is central to the process of cluster's development.

Strategically and operationally, there is an immediate need to highlight the opportunities and synergies that Selangor could offer in developing a strong life sciences cluster, to take the State's healthcare sector to a "higher equilibrium," built around:

- 10 public hospitals in Selangor, 1 in Kuala Lumpur.⁵⁴
- 31 private hospitals in Selangor, 27 in Kuala Lumpur.⁵⁵
- 9 out of 10 top multinational pharmaceuticals companies which are located within Selangor and Kuala Lumpur.⁵⁶
- 47 institutions in Selangor and Kuala Lumpur offer courses related to life sciences cluster, subdivided into 8 categories:
 - a. Health (Broad Programmes)
 - b. Medicine
 - c. Medical Services
 - d. Nursing and Caring
 - e. Dental Studies
 - f. Medical Diagnostics and Treatment Technology
 - g. Therapy and Rehabilitation
 - h. Pharmacy
- University Kebangsaan Malaysia (UKM) is the largest in term of type of courses offered.⁵⁷
- 37 major medical devices companies where about 60% (22) are located in Klang Valley.⁵⁸
- Approximately 104 pharmaceutical manufacturers are based in Klang Valley (89 in Selangor, 15 in Kuala Lumpur). Malaysia has more than 250 pharmaceutical manufacturers licensed by the Drug Control Authority.⁵⁹

Beyond the nation's low innovations in biotechnology, pharmaceuticals, food chemistry and medical technology compared with some of the neighbours, the State's healthcare infrastructure is significant and ought to provide the foundations in stimulating significant changes in the life sciences cluster. Huge opportunities exist within the walls of these various organisations and institutions to further optimise and streamline their manufacturing operations, systems and support services.

⁵⁴ Malaysia Ministry of Health Official Portal, 2015

⁵⁵ Association of Private Hospitals of Malaysia, 2015

⁵⁶ Selangor State Investment Centre (SSIC), 2015

⁵⁷ Malaysian Qualifications Register, 2015 (<http://www.mqa.gov.my/mqr/>)

⁵⁸ MIDA, 2014

⁵⁹ Selangor State Investment Centre (SSIC), 2015

Nature	Abbrev	Names	Nature	Abbrev	Names
Public Hospital	HAM	Hospital Ampang	Pharmaceutical	PAP	Apex Pharmacy
	HKJG	Kajang Hospital		PAZ	AstraZeneca
	HKL	Hospital KL		PBP	Bio-pharmaceuticals
	HUM	University Malaya		PBY	Bayer
	HAD	Ara Damansara Medical Centre		PEC	Euro Chemo-Pharma
	HASS	Assunta Hospital		PEL	Eli Lilly
	HBIS	Beacon International Specialist		PEP	Emerging Pharma
	HCAC	Columbia Asia Cheras		PEPP	EP Plus Group
	HCAP	Columbia Asia Puchong		PGM	Glenmark Pharmaceuticals
	HCAPJ	Columbia Asia Hospital PJ		PGSK	GlaxoSmithKline
Private Hospital	HCAK	Columbia Asia Kota Kemuning		PIP	Inova Pharmaceuticals
	HDE	Darul Ehsan Medical		PJC	Janssen Cilag
	HDM	Damai Service Hospital		PLP	Leo Pharma
	HGL	Gleneagles		PMSD	MSD
	HKJ	Kelana Jaya Medical Centre		PNV	Novartis
	HKPJA	KPJ Ampang Puteri		PPN	Pharmaniaga
	HKPD	KPJ Damansara		PPZ	Pfizer
	HKPK	KPJ Kajang		PRB	Ranbaxy
	HKPJS	KPJ Selangor		PRP	Range Pharma
	HKPJT	KPJ Tawakal		PSF	Sanofi-Aventis
	HMH	Malaysian Healthcare		PSV	Servier Malaysia
	HMV	Medivest		PZP	Zuellig Pharma
	HPA	Pantai Ampang	Devices and Supplies	DAA	Alpha Analytical
	HPC	Pantai Cheras		DAPS	A. P. S. Medical
	HPKL	Pantai Hospital KL		DASR	Antah Sri Radin
	HPMS	Puchong Medical Specialist		DBB	B. Braun Medical Supplies
	HPRC	Prince Court Medical		DBD	Becton Dickinson
	HPW	Hospital Puswari		DDE	Delphax Engineering
	HRSP	Ramsay Park City Hospital		DDK	DKSH Technology
	HSA	Shah Alam Medical		DDM	Dispo-Med
	HSAL	SALAM Shah Alam Specialist		DEM	Esco Micro
	HSI	Senawang Indah Medical		DFS	Fisher Scientific
	HSJ	Subang Jaya Medical Centre		DGAT	GAT Scientific
	HSL	Hospital Sungai Long		DGE	Genscience
	HST	Sentosa Medical Centre		DHM	Hospimetric
	HSW	Sunway Medical Centre		DHP	Hospitech Marketing
	HTS	Tung Shin Hospital		DJJ	Johnson and Johnson
	HUR	Hospital Umra		DLKL	LKL Advance Metaltech
Education	ECSI	USCI University		DLMS	LMS Scientific Solution
	EIMU	IMU Medical University		DNI	Nitritex
	EMH	MAHSA		DNS	NovaScientific Resources
	EMSU	Management Science University		DRD	Roche Diagnostics
	EMU	Monash University		DRI	Research Instruments
	ERSD	Ramsay Sime Darby Healthcare College		DSM	Siemens
	ETS	Tung Shin		DSS	Silver State Laboratory
	EUM	University Malaya		DTG	Top Glove
	EUP	University Putra Malaysia		DTL	Translab
Laboratory	LGB	Geneflux Bioscience	Insurance	DTM	3M Malaysia
	LLB	Laboff		DTP	Teguh Pharma
	LMT	Mettler-Toledo		DTR	Terumo Malaysia
	LPT	Pathology & Clinical Laboratory		DWC	Wellchem
	LQD	Quantum Diagnostics		DWG	Wiggenhauser (Asia)
	LSY	Synapse		DZP	Zeito Plastic
Association	AMMA	Malaysian Medical Association		IAIA	AIA Insurance
	APAM	Pharmaceutical Association of Malaysia		IBS	Berjaya Sompo Insurance
	APG	Pharmacy Government (KKM)		IMR	Malaysian reinsurance
	APH	Association of Private Hospital		ITU	Tune Insurance
Bio-pharma	BBV	Biovalence			
	BRM	Rottapharm Madaus			

Table 4.2 List of stakeholders and their nature of businesses

Source: Monash University Malaysia, 2016

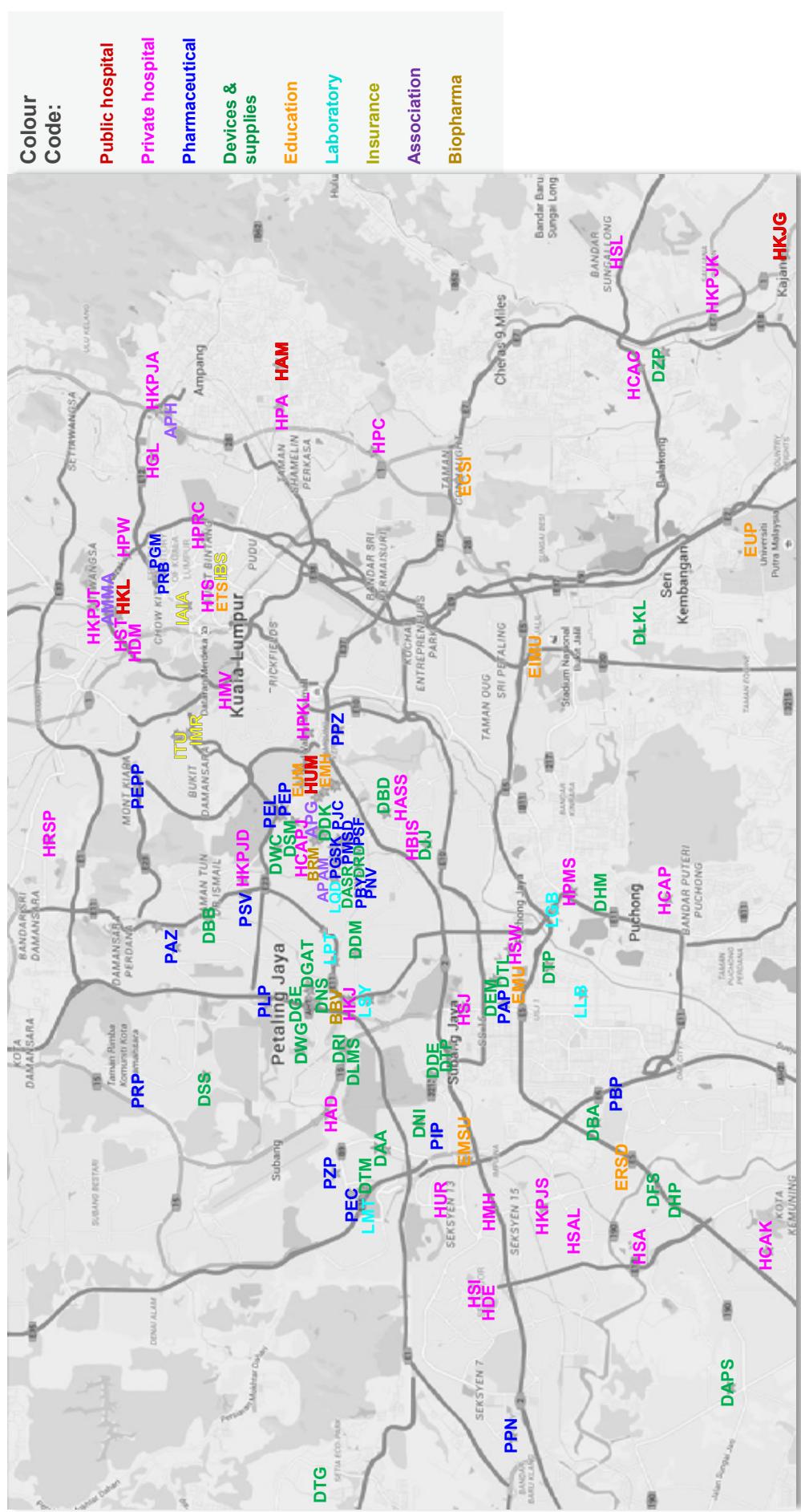


Figure 4.7 Spatial Distribution of Stakeholders in Life Sciences Cluster (Selangor & Kuala Lumpur)

Source: Monash University Malaysia, 2016

With this critical mass of services, facilities and outputs concentrated within the State, the need for strategic planning of a State's life sciences cluster deserves urgent consideration, especially when established large and Mid-Tier businesses and small speciality players are seeking growth opportunities.

The following analysis shows their location, concentration, context and the dynamics between them that would assist in the formulation of a State's life sciences cluster plan. Such mapping can be described as identifying the cluster's 'ecosystem'. Importantly, this ecosystem, comprising a concentrated mass of healthcare related cluster organisations serves as a melting point for businesses of different sizes and different areas of specialisations coming together, to collectively exploit their potentials and create a competitive life sciences cluster landscape. The identity of these stakeholders and the nature of their businesses, are next "captured" through a spatial mapping and analysis exercise (see Table 4.2 and Figure 4.7).

4.5 Location Quotient

We next undertook a location quotient analysis by looking at key figures such as the State's total employment of: (1) Human Health and Social Activities, and (2) Professional Scientific and Technical Services, compared with Johor, Penang and Kuala Lumpur, due to their well-established healthcare infrastructure. We source only these two sets of figures as they most closely resemble the types and composition of employed personnel operating in industries closely linked to the life sciences cluster. These figures also have state-specific granularities that provide basic but meaningful, indicative trends in terms of growth prospects, as they impact cluster's developments. The results of our analysis are tabulated in Tables 4.3 and 4.4, and shown in Figures 4.8 and 4.9.

The analysis, which determines the strength of regional areas of business specialisation in the life sciences, allows us to clarify whether there is sufficient critical mass in Selangor. The analysis shows that the overall Location Quotient for employment in Professional Scientific and Technical Services is second highest in Selangor compared with Kuala Lumpur.

Location Quotient (LQ) for Selangor averages 1.86 from 2010 – 2014 while Kuala Lumpur averages 2.68 for the same period. While LQ for Selangor remains stable at 1.8 in 2013 and 2014, the LQ for Kuala Lumpur has increased from 2.7 in 2013 to 3.0 in 2014. It stands to reason that employment in Professional Scientific and Technical Activities is just as important in Kuala Lumpur as it is for Selangor, with implications on competition for talent, R&D and innovation.

The location quotient in the employment of Human Health and Social Activities (HAS) is highest in Penang, averaging 1.3 from 2010-2014. Selangor averages 1.06 while Kuala Lumpur averages 1.08 over the same period. Noticeably, while the LQ for HAS employment was 1.1 and 0.9 in 2014 for Penang and Kuala Lumpur respectively (a decline when compared with 2013), Selangor's LQ of 1.1 in 2014 is the same as it was in 2013.

The findings are not surprising considering the heavy concentration of private and public hospitals in Selangor. Selangor is also the only State that has also consistently shown an increase in the number of people employed in HAS, from 60,100 in 2010 to 120,000 in 2014.

State	Number Employed ('000) in State	% Change	Share of Total Employed in Malaysia	Share of Total Employed in State	LQ
Selangor					
2010	114.5	-	40.1	4.5	1.9
2011	134.8	3.2	41.0	5.1	1.9
2012	127.6	3.6	41.5	4.6	1.9
2013	119.1	3.8	38.8	4.2	1.8
2014	128.7	2.7	39.2	4.4	1.8
Johor					
2010	23.3	-	8.2	1.6	0.7
2011	28.2	21.0	8.6	1.9	0.7
2012	26.6	-5.7	8.6	1.8	0.7
2013	26.0	-2.3	8.6	1.7	0.7
2014	28.5	9.6	8.7	1.8	0.7
Penang					
2010	14.3	-	5.0	1.9	0.8
2011	18.9	30.0	5.7	2.5	0.9
2012	16.4	-13.2	5.3	2.1	0.9
2013	18.5	12.8	6.0	2.4	1.0
2014	19.5	5.4	5.9	2.4	1.0
Kuala Lumpur					
2010	52.7	-	18.5	6.7	2.8
2011	52.5	-0.3	16.0	6.5	2.4
2012	49.4	-5.9	16.0	6.0	2.5
2013	54.3	9.9	17.7	6.2	2.7
2014	62.1	14.4	18.9	7.2	3.0

Table 4.3 Number of People Employed in Professional Scientific and Technical Activities (2010 – 2014)

Source: Department of Statistics, Malaysia

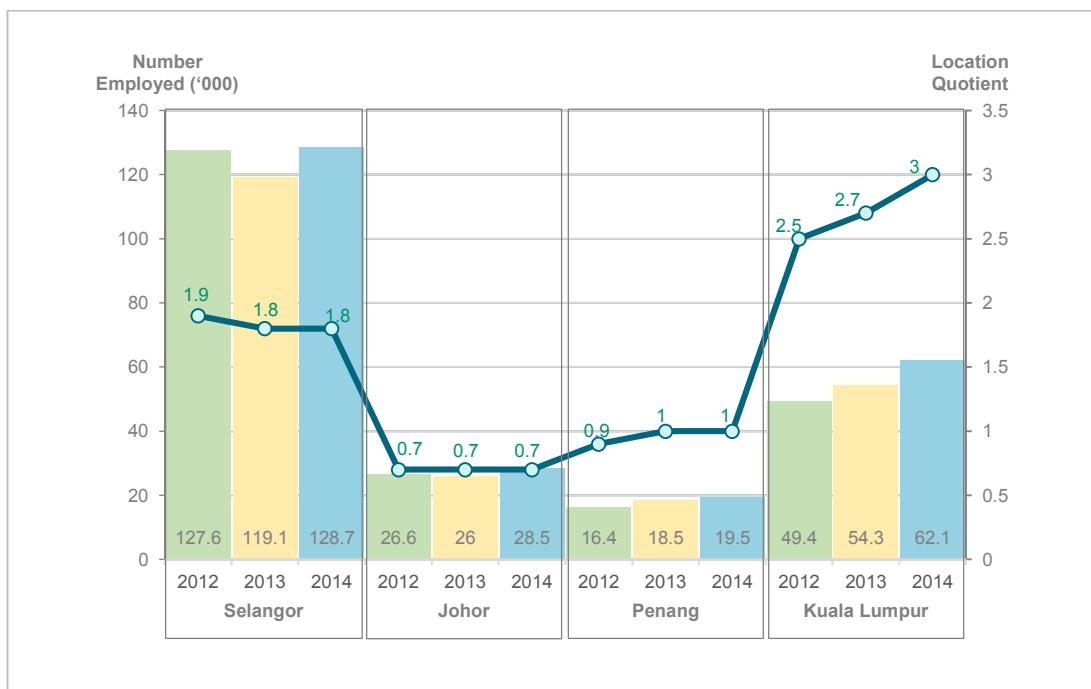


Figure 4.8 Breakdown of Employment in Professional Scientific and Technical Services (2012 – 2014)

Source: Department of Statistics, Malaysia; Monash University Malaysia, 2016

State	Number Employed ('000) in State	% Change	Share of Total Employed in Malaysia	Share of Total Employed in State	LQ
Selangor					
2010	60.1	-	21.4	2.4	1.0
2011	86.2	43.4	22.4	3.3	1.1
2012	92.0	6.7	22.2	3.3	1.0
2013	114.0	23.9	23.3	4.0	1.1
2014	120.0	5.3	22.6	4.1	1.1
Johor					
2010	23.8	-	8.5	1.7	0.7
2011	35.7	50.0	9.3	2.5	0.8
2012	33.3	-6.7	8.0	2.3	0.7
2013	51.4	54.4	10.5	3.3	0.9
2014	59.6	16.0	11.2	3.7	0.9
Penang					
2010	22.7	-	8.1	3.1	1.3
2011	33.0	45.4	8.6	4.3	1.4
2012	35.4	7.3	8.5	4.6	1.4
2013	38.3	8.2	7.8	4.9	1.3
2014	34.7	-9.4	6.5	4.3	1.1
Kuala Lumpur					
2010	21.1	-	7.5	2.7	1.1
2011	26.7	26.5	7.0	3.3	1.1
2012	31.9	19.5	7.7	3.8	1.2
2013	34.5	8.2	7.0	3.9	1.1
2014	32.2	-6.7	6.1	3.7	0.9

Table 4.4 Number of People Employed in Human Health and Social Activities (2010 – 2014)

Source: Department of Statistics, Malaysia

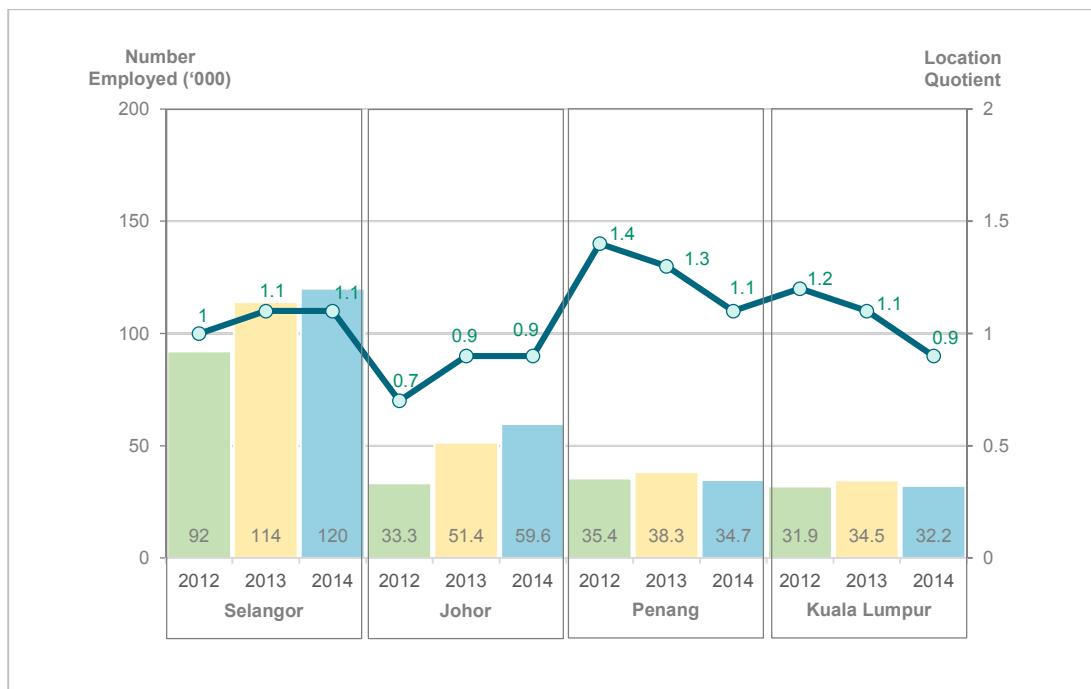


Figure 4.9 Breakdown of Employment in Human Health and Social Activities (2012 – 2014)

Source: Department of Statistics, Malaysia; Monash University Malaysia, 2016

4.6 Cluster Map

Numerous and various types of firms, associations, government bodies, suppliers, service providers and supporting networks and affiliations, at national and state level, make up the life sciences cluster. While it is difficult to account for all the various stakeholders, based on our secondary data research and interviews with senior executives, Figure 4.10 captures the broad spectrum of suppliers, service providers, supporting networks and outgrowths, as they impact directly and indirectly in the delivery of core cluster activities. These activities include pre- and post-medical treatments, clinical trials, manufacturing of pharmaceutical products, medical equipment and devices, as well as medical tourism, travel and wellness, biotechnology, innovation, patent and commercialisation, among others.

While public hospitals have historically served as a focal point, connecting directly or indirectly many stakeholders, changing market and social demands with a user – pay driven environment have resulted in a laissez faire business environment. There is now a rich and diverging mix of established businesses that are driving growth, emerging start-up companies and entrepreneurship spearheading innovation, with various industry associations and government agencies. The role of entrepreneurs and business scientists, in particular, are significant contributors in the value chain, as it relates to R&D, innovation, patent and commercialisation. Established entrepreneurs with substantive holdings in private hospital groups now offer more value-add in the cluster through business expansions.

Simply put, and when viewed from a cluster perspective, the individual and collective power of these stakeholders cannot be underestimated as a means of generating and identifying value-add solutions. Figure 4.11 looks at some of these value-creating solutions and/or services, within the overall industry cluster value chain. However, it is important to consider four elements that are not visible in this model, and that will have important bearings on the future development of the State's life sciences cluster. They include:

1. Attention to health care and preventive care management
2. The divide between private and public health care
3. Growth in in-bound medical tourists
4. Hybrid mix of health care and business like model

Issues one and two are commonly debated among all stakeholders in the value chain, in forums and through press releases, via opinion pieces. They are also, therefore, the issues likely to attract the most attention with policy and decision makers in the value chain. A dense population, influx of migrants and user-pay scheme also results in more attention and importance placed on these issues. The delivery of health care and preventive care management, especially among the upwardly, mobile middle-class income, and the value it creates for patients between public and private patients, are and will continue to reshape and redefine Selangor's current and future healthcare-based strengths and economic advantages for the region.

Issues three and four contributions to the sector's value chain have given major impetus to public-private sectors involvement in the cluster's value chain. The value chain shows there is value-add in R&D, especially on high-value added products, machines and services, training and development, engagement in joint government corporate projects, delivery of healthcare and well-being, and the production of specialist medical devices.

With small and mid-sized companies and specialty players getting more and more involved in market and innovation activities, in response to new promising products and treatments including Biomedical and Halal medicines, the prospects of life science cluster is slowly taking shape. There is also now a promising Malaysia's Biotechnology Clusters that are flourishing under the BioNexus incentives program and (is now) one of the potential countries for Biotechnology Investments.⁶⁰

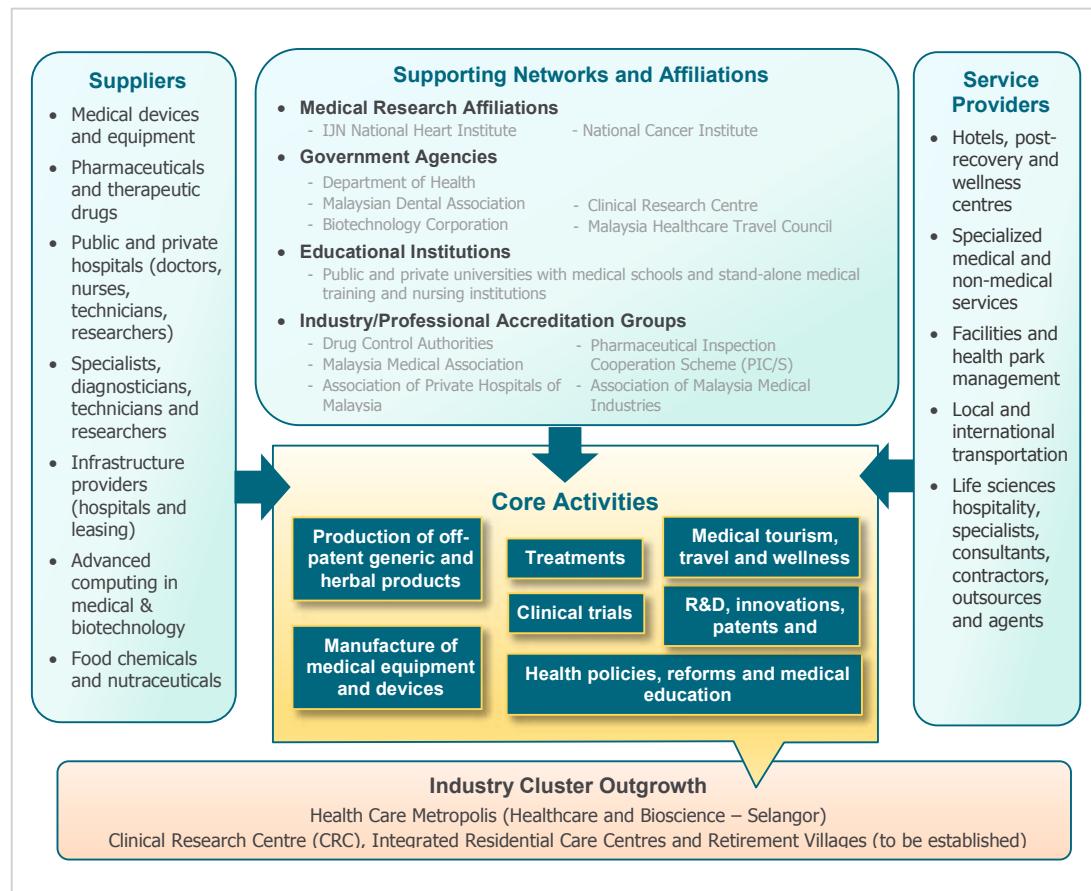


Figure 4.10 Cluster Map

Source: Monash University Malaysia, 2016

⁶⁰ Frost and Sullivan, "Benefits of Biotechnology Clusters in APAC", 2014

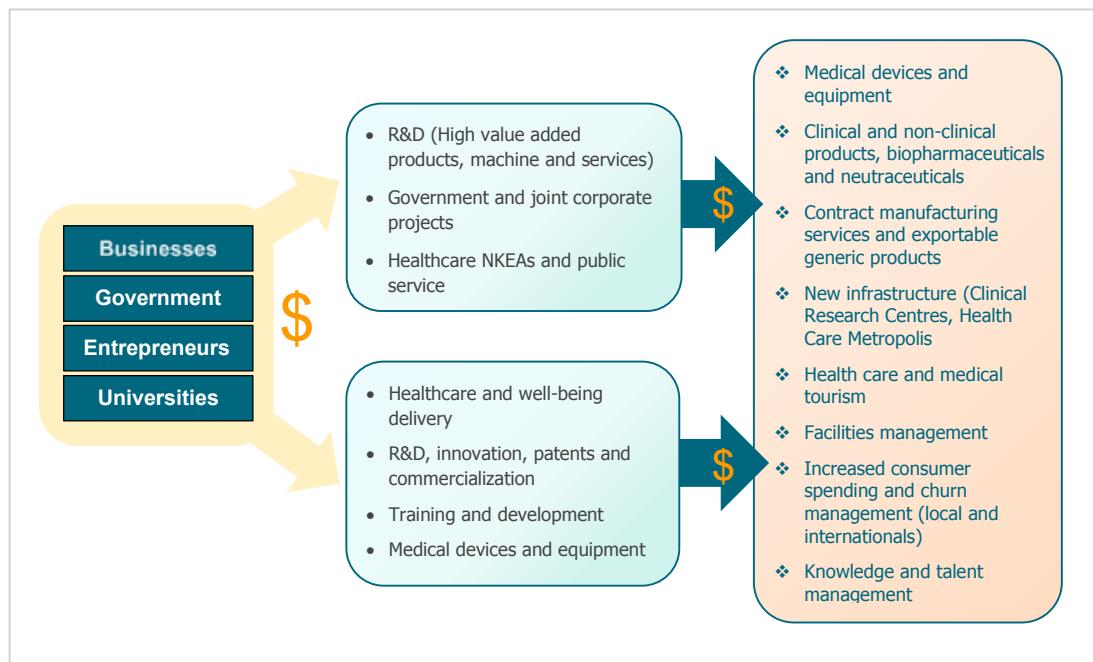


Figure 4.11 Inter-industry Chain Analysis

Source: Monash University Malaysia, 2016

4.7 Diamond of Advantage

Unlike the transportation equipment cluster, where one or a few entity captures the local innovation infrastructure, employment, and exercise significant leverage in federal funding support, such dominance does not exist in the life sciences cluster. From our interviews with large, established hospital groups, local and foreign MNCs involved in the manufacturing and distribution of medical devices and pharmaceuticals and federal government agency, there is instead a strong association between several stakeholders in the cluster.

Large local and international conglomerates oversee development and investment in health care infrastructure and provision of health care services. For example, these associations exist between public and private hospitals, between academic and research institutions with these hospitals, between private hospitals and medical insurance providers, and between medical devices manufacturers and pharmaceutical companies with their respective professional body and/or associations.

Results from our study also shows that unlike businesses in the electrical and electronics, and machinery and engineering equipment clusters, stakeholders in the life sciences cluster are of the opinion that their businesses are on a growth path. Local and international players are embarking on expansionary plans, particularly among major hospital groups, medical devices and pharmaceutical companies. While a healthy level of competition exists between them, according to interviewees, tensions exist, although they are communicable and resolvable.

For example, tensions exist between private and public hospitals over visitation and treatment cost as perceived by the public, often with minimal appreciation of the cost and funding models employed in the provision of private health care services and treatments. Tensions also exist over identification of agencies offering assistance in accessing equity funding of IP on drug development and trial programs that allows for future expansion in the pharmaceutical world. Tensions to pursue growth in high value-added medical devices, in addition to medical gloves are high on the agenda of medical devices companies.

These tensions will hamper commercialisation of cluster development and reinforce stakeholders' silo-like mentalities. But with healthcare being prioritised as a National Key Economic Area (NKEA), greater urgency is needed to develop a State Action Plan that impacts development in key sectors, and drive these sectors value-add in a national, regional and global context. Our research tells us that specific infrastructure needs include:

1. Providing much needed relief in capital investment through engagements with corporate healthcare entrepreneurs
2. Investing in development of specialised skills (examples include chemists, biomed engineers and diagnosticians) through engagement with teaching and research medical universities
3. Seed funding, private equity and venture capital especially with new, start-up companies, while concurrently developing their business development commercialisation skills

The government's role in regulations, dispensing, reimbursements, patents, R&D, and healthcare travel, together with increasing demand for health care and improved quality of life from a growing population, an emerging educated and a socially mobile population, are among some of the key demand conditions that will drive cluster's growth in Selangor.

Accessibility, affordability and quality of care are some of the major demand facilitators or inhibitors that are expected to reinforce the three distinct demand sub-segments – public, private health care and medical tourism. Inter-relationships between stakeholders through inter-ministerial coordination of existing State's facilitative and supportive role and the use of appropriate infrastructure levers (examples land and facility management, local council engagement with business community), will break down the walls between sectors. This ought to lead to better cooperation between government, businesses and community. The dynamics of these various input and demand conditions, their contexts and the impact on related and supporting industries, are captured in Figure 4.12.

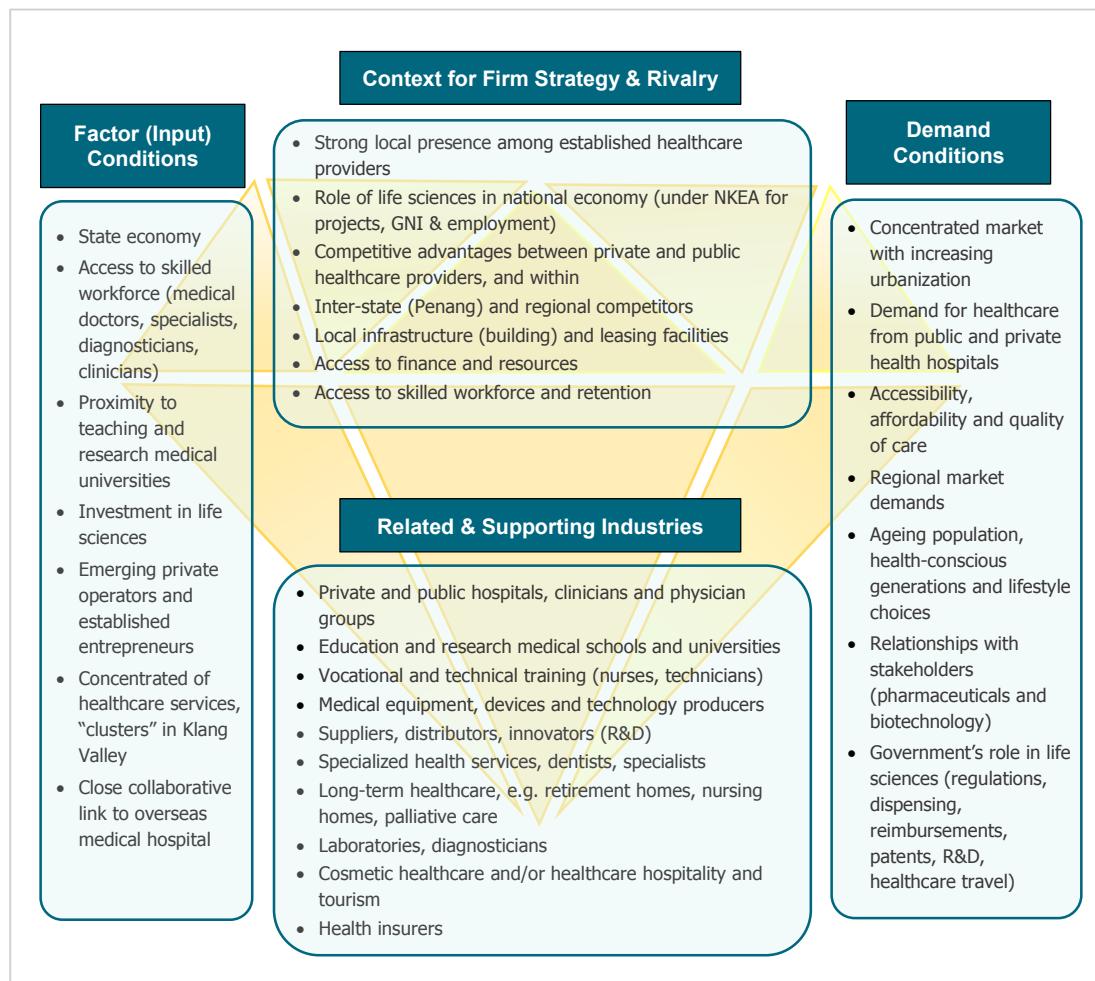


Figure 4.12 Diamond of Advantage

Source: Monash University Malaysia, 2016

4.8 SWOT Analysis

Businesses operating in the life sciences cluster are keenly aware that institutional and fundamental forces of change will impact on their businesses. In a networked of relational connections between suppliers, service providers and supporting agencies, changes in technological developments, regulatory policies, demography composition and business models, will transform sub-sectors in the life science cluster. Nowhere are these changes felt than through the following recent and/or forthcoming developments:

1. Consumers turn to private

The introduction of GST on 1 April 2015 when private medical bills became subject to a 6 per cent GST. Despite this, residents are turning to private healthcare industry, buying access to the 60 per cent of the nation's doctors who service less than 25 per cent of its available beds, and thus avoiding the long wait times in the public system. This is because Malaysia only has 1.2 doctors per 1,000 residents, less than half of the Organisation for Economic Cooperation and Development (OECD) average of more than three, and that only 40 per cent of these doctors service the 75 per cent of hospital beds in the public healthcare system in Malaysia, and thus a long wait times.⁶¹

2. Medical subsidies removal for foreigners

Medical subsidies for foreigners at government hospital will cease by 2017, whereby foreigners will have to pay the full cost of medical treatment at government hospitals and clinics, in phases beginning January 2015.

In the next three years, foreigners will be charged the full medical costs. In 2016, it will be increased by another 30% and subsequently be raised by 40% in 2017. By the end of 2017, foreigners will be paying 100% of the costs without any subsidy.⁶² However, from January 1, this year (2016), foreigners have begun bearing the full cost of medical treatment at government hospitals and clinics, a year ahead of initial plans as the ministry revised its healthcare subsidy for foreigners as a cost-cutting measure to weather current economic challenges.⁶³

3. Two-sided tale of Trans-Pacific Partnership Agreement (TPPA)

Malaysia's existing patent period is 20 years, in line with that required by the TPPA. This is also the case for data exclusivity, where Malaysia's provisions are already the same as that of the TPPA. Although international experience on intellectual property rights and the games that multinational pharmaceutical companies play has been a cause for concern,

⁶¹ Manulife Asset Management, "One Step Forward, Half a Step Back: Meeting Financial Goals in Asia", 2015 (<https://www.manulifeinvestment.com.my/servlet/servlet.FileDownload?file=00P9000000XY0thEAH>)

⁶² Yuen, Meikeng, "Subra: Medical Subsidies for Foreigners at Govt Hospital to Cease by 2017", *The Star*, November 12, 2014, (<http://www.thestar.com.my/news/nation/2014/11/12/medical-subsidies-for-foreigners-to-cease/>)

⁶³ Tharanya Arumugam & Beatrice Nita Jay, "No Health Subsidies for Foreigners since Jan 1", *New Straits Time*, January 15, 2016, (<http://www.nst.com.my/news/2016/01/122294/no-health-subsidies-foreigners-jan-1-video>)

surprisingly the Malaysian Organisation of Pharmaceutical Industries (MOPI) remains sedate on the likely impact of the TPPA on the local pharma industry. They do not think that the TPPA will have an impact on this sector.⁶⁴

Separately, it has been reported that the TPPA could boost long term prospects in Malaysia's pharmaceutical sector. According to CIMB Equities Research, the TPPA should reduce or remove the barriers of exporting drugs to other member countries (although) most local pharmaceutical companies focus mainly on the domestic market. Those with the ambition to expand beyond Malaysia, such as Hovid and Pharmaniaga, are eyeing the emerging markets like Nigeria, the Philippines, and Indonesia which are not involved in the TPPA.⁶⁵

The TPPA will subject government procurement and state-owned enterprises (SOEs) to greater competition as the Ministry of International Trade and Industry (MITI) was not able to totally carve out these areas from the TPPA.

4.8.1 Strengths

The large, established hospital network infrastructure constitutes one of Selangor's main strength, feeding into and creating an equally vast network of direct sector companies (pharmaceuticals, medical devices, and diagnostics equipment) and indirect sector companies that provide capital, business expertise, credibility (accreditations), and training and development. Other key strengths the State could capitalise on include:

- **Strong existing manufacturing capabilities**

Strong existing manufacturing capabilities (i.e. talent, infrastructure) with existing established manufacturers and manufacturing base for generic pharmaceutical products. Strong potential for increase efficiency in manufacturing leads to cost leadership, especially among manufacturers of specialised medical equipment in the global markets. This provides much needed incentives to invest in research and development, innovations and latest in production process technologies.

- **Access to talent pool**

There is a slow but increasing access to an educated pool of doctors, specialists, technicians, diagnosticians, chemists and nurses that are sourced from many teaching, research and supporting educational institutions in the State.

⁶⁴ Ronnie Teo, "TPP to impact pharmaceutical sector", *The Borneo Post*, October 15, 2015, (<http://www.theborneopost.com/2015/10/15/tpp-to-impact-pharmaceutical-sector/#ixzz3zoKFx1a5>)

⁶⁵ "The TPPA: Malaysia's leap ahead?", *Malaysia Chronicle*, February 06, 2016, (http://www.malaysia-chronicle.com/index.php?option=com_k2&view=item&id=610656:the-tppa-malaysia%E2%80%99s-leap-ahead&Itemid=3#axzz3zTOJSYVH)

- **Helping hands from government**

Effective government regulations and the State's growing regional and international reputation in providing professional healthcare (pre- and post-care) and wellness services to inbound medical tourists.

- **Cooperation and collaborative initiatives**

Progressive collaborative initiatives underway between stakeholders (public/private hospitals; universities/industry requirements; local/foreign pharmaceutical companies) that are aimed at reducing institutional tensions and realise cross-sectors and cluster-based commercial co-operations.

- **Extensive, supporting infrastructure**

Good infrastructure with high density and concentration of commercial buildings in major central business districts (CBDs) offers opportunities to streamline real estate management costs for specialists, diagnostic laboratories and pharmacies.

4.8.2 Weaknesses

The ability of large companies (private hospitals, Big Pharma and medical devices company), small to medium sized companies and specialty players to grow and drive activities in their respective sectors, are, however, limited by their ability to address key market and structural challenges. They include:

- **Change in mind-set needed**

A mind-set that is activity and not outcome driven, with a domestic market focussed, will limit growth and collaborative engagements.

- **Innovations in pharmaceutical**

Limited innovations in pharmaceutical will limit nation's international competitiveness beyond generics. While TPPA should reduce or remove the barriers of exporting drugs to other member countries, most local pharmaceutical companies focus mainly on the domestic market.

- **Breakthrough impeded by funding**

Limited access to equity funds for breakthrough innovations limits cluster development opportunities.

- **Gaps in talent**

Lack of quality talent including chemist, scientist, pharmacist, biologist, engineering technicians, biotechnologist and haematologist in the Pharmaceutical Manufacturing industry, surgeon, anaesthesiologist, internal medicine, cardiologists, among others, in the

healthcare tourism industry, as well as principal investigator (specialist/consultant), biostatistician, pharmaceutical scientist, among others, in the clinical research industry.⁶⁶

- **Holding the right hands with the right partners**

Lack of cooperation between public and private stakeholders, and between R&D companies and government agencies, and between teaching institutions and the industry.

4.8.3 Opportunities

Amidst the backdrop of these developments, what are the other key concerns businesses operating in the life cluster are facing that will impact on the State's cluster plan? Or what are some of the opportunities they could be exploring? We explore and highlight some of these concerns, opportunities, and capabilities below, with the objective that they can help Selangor identify existing and sustainable competitive advantage (See Figure 4.13). These opportunities include:

- **National initiatives in healthcare industry**

National Key Economic Area (NKEA), with a projected incremental gross national income (GNI) of RM35.3 billion and the creation of 181,000 new healthcare jobs. Collectively, 40 healthcare projects announced under Healthcare NKEA are projected to create 26,966 jobs and generate an income of RM6.59 billion, as well as RM4.96 billion in new investments by 2020.⁶⁷

- **Higher life expectancy and growing health-conscious population**

Increasing demand for healthcare and improved quality of life (Life expectancy of 75.7 years in Selangor compared with 74.8 years, nationally⁶⁸, with a growing population in Selangor (5.46 million people or 19.3% of the nation's population)⁶⁹, and a growing emerging educated, socially mobile population.

- **Continuous demand in health travel and medical tourism**

Demand for health travel, medical tourism (receipts of RM680 Million in 2013, to targeted RM1 Billion in 2015) and well-being will provide the impetus to invest in value creation initiatives. Stakeholders will take a broader view of their roles and responsibilities as well as the connection between market competitiveness (income earnings, salaries and number of employed) and their social responsibilities.

⁶⁶ ILMIA, 2012

⁶⁷ Performance Management & Delivery Unit (PEMANDU), 2013, (<http://etp.pemandu.gov.my/Healthcare-@-Healthcare.aspx#sthash.bvZelmZX.dpuf>)

⁶⁸ SSIC, 'Life Sciences Cluster in Selangor (Part 2: Medical Devices)', 2013

⁶⁹ Department of Statistics, Malaysia, "2010 Census"

- **On-going national healthcare reforms**

Opportunities listed above will provide strong motivation for local companies to invest and attract capital and R&D investments with more value-added in pharmaceutical, medical devices and biotechnology. Medical devices include MRI, CT scanners, Single Use Devices (SUDs), Orthopaedic as well as Medical Devices Contract Manufacturing. Under EPP3 Malaysia will execute a strategy to transform the nation into a major force in the export of generic pharmaceutical.

- **Malaysia's competitive advantages in the OIC countries**

Malaysia is the only OIC country that adheres to PIC/S guidelines (adopting cGMP). Established leader where halal is concerned, with Malaysia taking very strong initiatives in producing "Halal" certified medicine. This is reinforced by the nation's well-structured Islamic banking and financial infrastructure with bilateral arrangements between Malaysia and other OIC countries. Malaysia is currently negotiating FTA agreements with the GCC countries.⁷⁰

- **Merger and alliances activities**

Significant opportunities exist for large, established local manufacturers and private health care service providers, together with a pool of emerging entrepreneurs and business scientists, to act as contributors in the cluster's value chain, through joint venture, collaborative initiatives.

4.8.4 Threats

The emerging local and global competitive landscape, however, also reveals threats and tensions businesses in Selangor have to deal with, on top of existing and emerging local and international regulatory, technological and market frameworks. These threats include:

- **Drug makers to hold back product launches**

Over-dependency on imported raw materials in the production of generic drugs, GST, declining MYR, and removal of subsidies for foreigners on 1 January 2016, have significant cost implications and impact visitation. As generic drug makers rely on new product launches to offset the declining profit margin of older generic drugs, a longer exclusivity period (beyond the current 20 years) means that generic drug makers may have to hold back their product launches, and suffer an overall decline in profit margins.

⁷⁰ Pharmaniaga Malaysia, 'The Way Forward for Malaysian Pharmaceutical Industry', 2013

- **Lack of new trainees an on-going issue**

The promotion of Malaysia's Health Care expertise in cardiology, ophthalmology, orthopaedics and plastic surgery as well as diagnostic and healthcare screening packages, has the effect of shifting resources and training from less profitable fields of medicine (such as primary and preventive public healthcare), which finds it difficult to attract new trainees.⁷¹

- **High tech, high cost medical equipment**

The importation of high tech medical equipment (such as MRI and CT scanners), especially with private hospitals used to service foreign patients may also contribute to foreign debt. Such promotion of high technologies ultimately drives up the total healthcare costs for the local population.⁷²

- **Shortage of global venture capitalists**

There are continuing difficulties in attracting global venture capitalists in a knowledge, innovation and capital-intensive cluster, especially in the presence of more established regional healthcare sector and/or life sciences cluster, with significantly more investments in research and development and innovations, across key sectors including pharmaceuticals, biotechnology, food chemistry and medical technology (e.g. Singapore, China and Japan).

- **Competition with Penang state**

Penang's historical attractiveness as an industrial base in medical devices and pharmaceutical products, with a supporting network of health and health-related infrastructure could prove costly, as internal competition for FDI and talent intensifies, while externally, limiting the state's contribution in the regional value chain.

- **Competing internationally**

Businesses and entrepreneur willingness to share commercialisation, take collective risks and to invest in talent, as well as the ability of local companies to compete globally against established MNCs with global pharmaceutical brands in developed economies, will limit the cluster's developmental progress.

⁷¹ Whittaker, A., "The Implication of Medical Travel upon Equity in Lower- and Middle-income Countries", in Lunt, N., Horsfall, D., & Hanefeld, J., eds., *Handbook on Medical Tourism and Patient Mobility* (Edward Elgar Publishing, 2015).

⁷² Ibid.

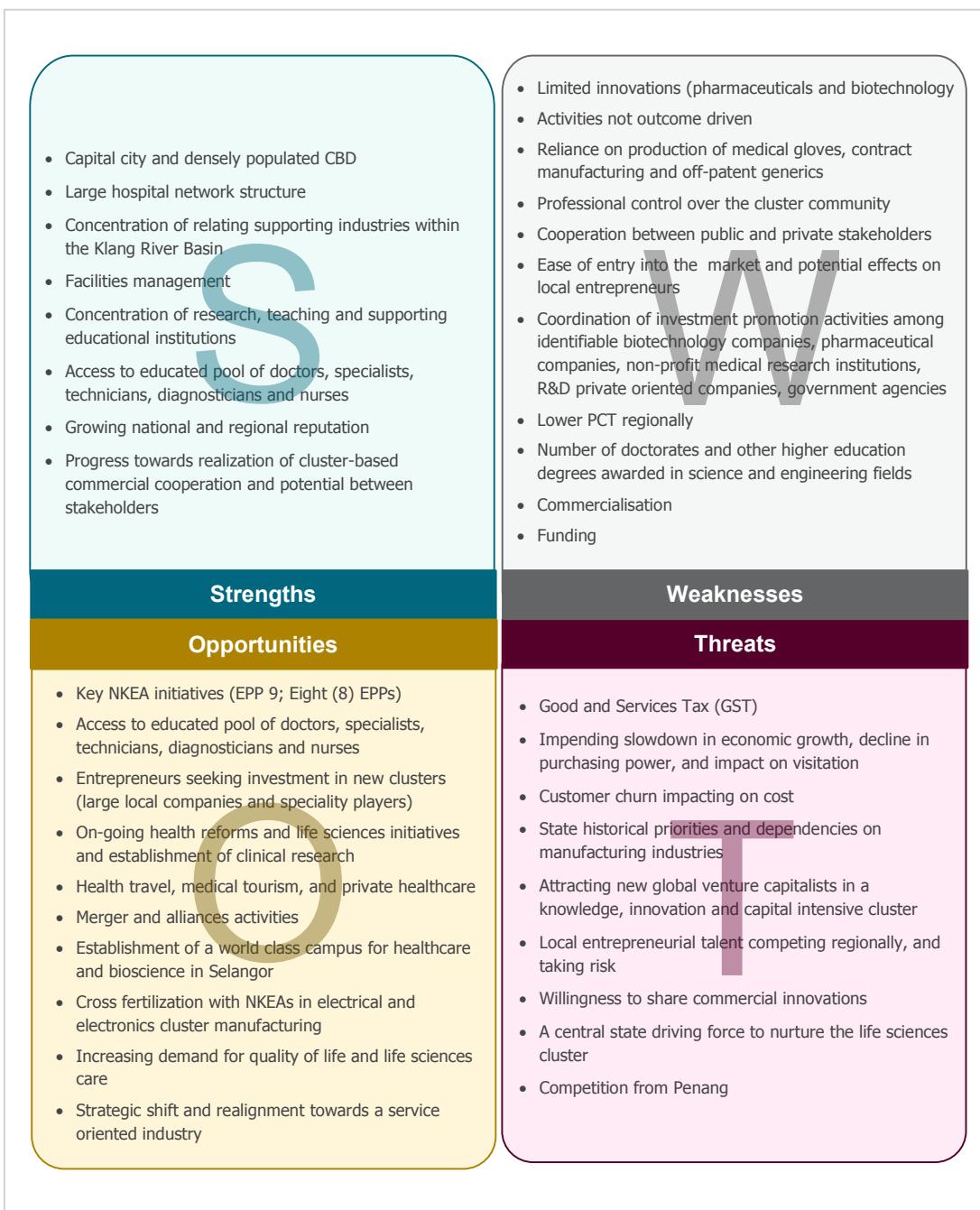


Figure 4.13 SWOT Analysis

Source: Monash University Malaysia, 2016

4.9 Relational Network Impact Analysis

The life sciences cluster comprises of a few sub-sectors that include healthcare, pharmaceuticals, medical equipment and devices, and biotechnology. In Malaysia, products corresponding to the health care equipment, medical devices and pharmaceuticals are housed mainly in MNCs and in large and Mid-Tier local companies. These companies manufacture a range of generic and specialist products that are sold and delivered locally to public and private hospitals and to wholesalers and retailers such as pharmacies. The products are primarily used by medical doctors and physicians, therapists or diagnostic/clinical laboratories in their respective professional use, servicing both the local market and inbound medical tourists.

What differentiates Malaysia and Selangor specifically, apart from the rest of the world in the development of the life sciences cluster are captured earlier in the SWOT analysis. For now, the interconnected networks of businesses in the life sciences cluster, in an increasingly open market is captured in Figure 4.14 (macro impact analysis) and Figure 4.15 below (micro impact analysis).

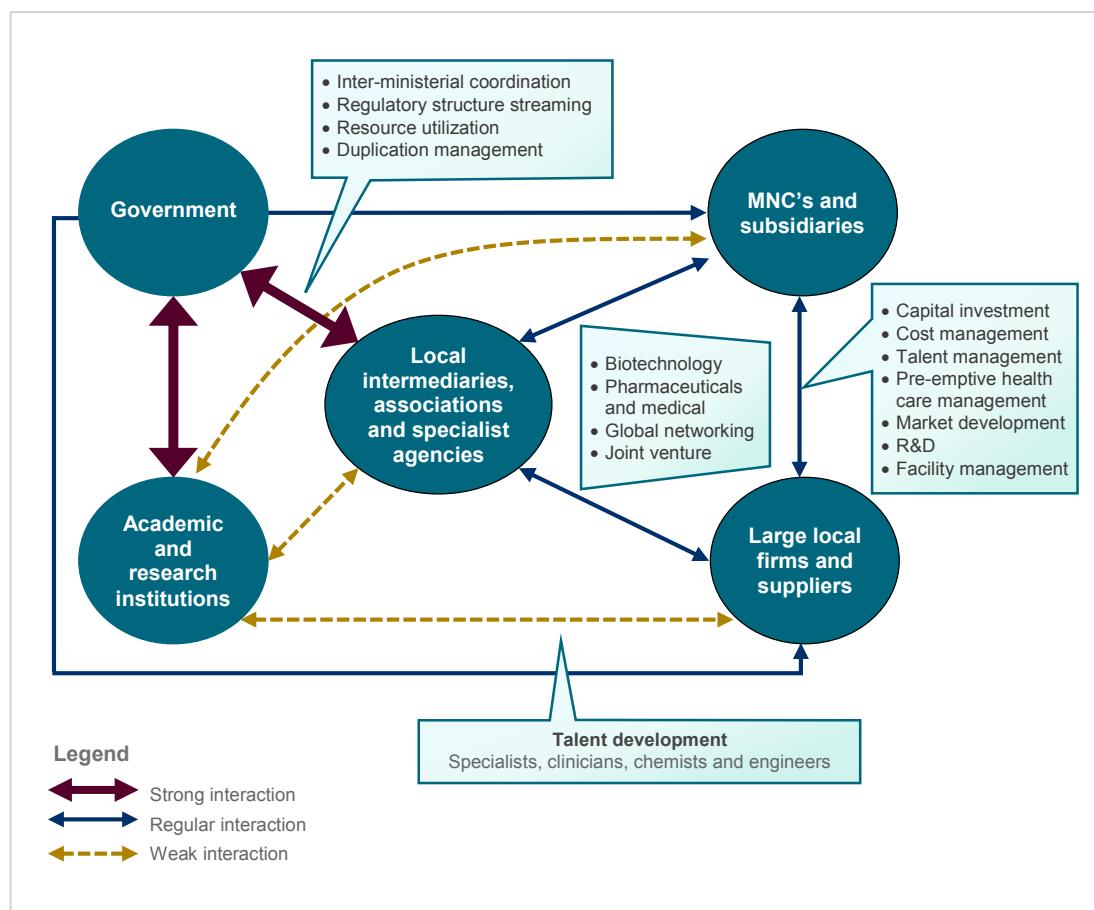


Figure 4.14 Macro Analysis

Source: Monash University, Malaysia, 2016

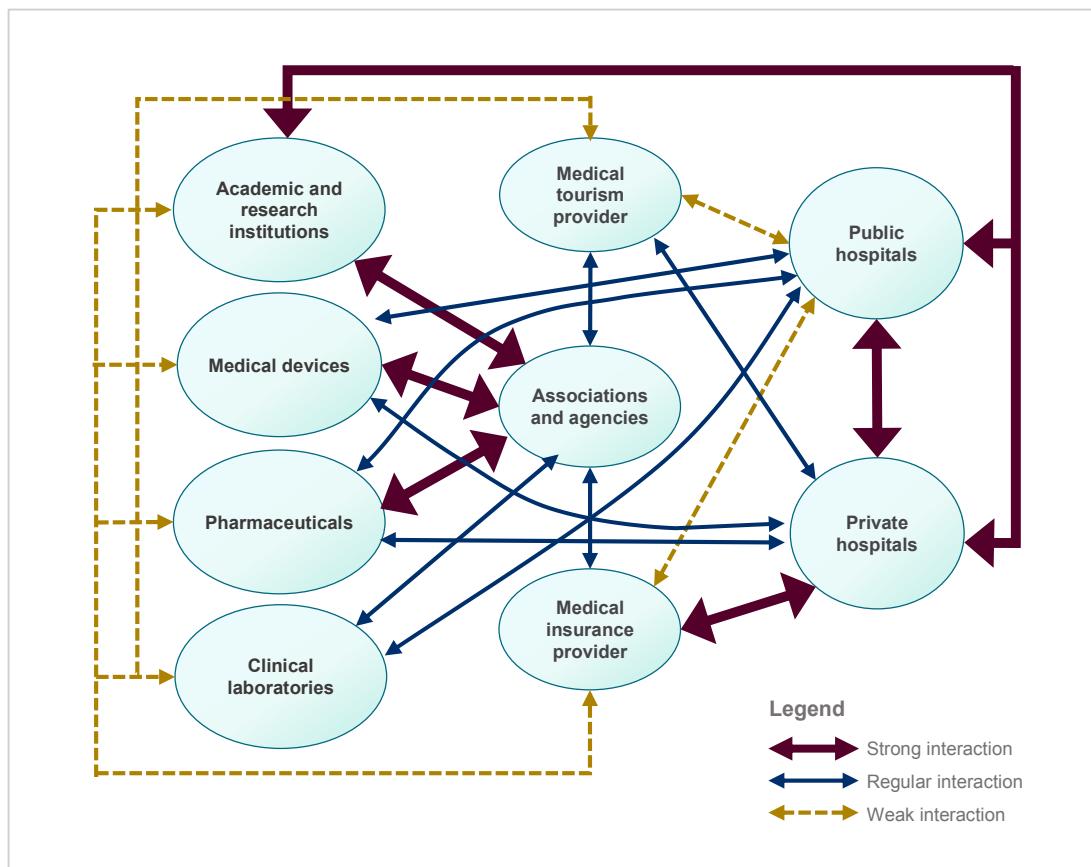


Figure 4.15 Meso Analysis

Source: Monash University, Malaysia, 2016

As the first step in nurturing the development of the State's life sciences cluster, there must be a general acknowledgement that public and private healthcare providers, healthcare equipment, medical devices and pharmaceutical industry, among others, is characterised by several distinctive attributes that will impact on our recommendations. These attributes are based on our analysis of relational ties that exist between key stakeholders in the cluster, on the basis of information gathered from interviews and secondary data sources. They include:

1. Rapid technological change and increasing pressures to invest in new product developments and seek high export market growth

Strong government controlled coordinated governance and regular interactions influence new legislation and policies (example Medical Device Authority Act 2012). The creation of various agencies such as the Biotechnology Corporation and the Malaysian Healthcare Travel Council compensates for business lack of internal resources and capabilities in new product developments and export marketing insights. Especially when these businesses need considerable amounts of resources like equity funds, R&D and innovation talent, and administrative, to develop new products, clinical trials and the application for government approval.

2. Interactions between stakeholders key to success

An emerging, life sciences cluster also requires strong interactions between government, academic research institutions, local and international professional agencies and medical institutions, to ensure proper and adequate educational training, development and talent portfolio management. However, while government and MNCs are expected to take a leading role in funding research and development, large local and Mid-Tier firms, suppliers and business entrepreneurs are also expected to have frequent interactions with academic and research institutions, beyond internship placements, especially when concerns are raised over the availability of quality talent.

With a concentration of medical, pharmaceutical and science (biotechnology and chemistry) institutions in Selangor, businesses and suppliers should be looking to partner with these institutions, track and work together on relevant skills set requirements, and develop scientific advances in pharmaceutical, biotechnology and medical devices, based on their respective ownership and roles in the value chain.

3. Silo-like environment to change

The present healthcare silos-like environment among stakeholders operating in various health care industries needs to change. In a connected environment consisting of various interlinked data networks, complex interconnections of health care equipment devices with computer-based hardware and software, and communication-based technologies that drive patient care procedures and reimbursement, the environment need to evolve into a cluster environment that provides seamless integration between patients, hospitals, pharmaceutical companies, health insurers, agencies and other healthcare stakeholders. This means changes to existing relational ties and interactions between healthcare stakeholders, moving between their silo mentalities to engaging in local and global bilateral and networked relationships.

For instance, in the field of Biotechnology, government funding supports links between local and international academic institutions that gives local businesses access to the extensive network of scientific or technological expertise and intellectual property advice. Local entrepreneurs are also encouraged to work with Biotechnology to start up incubation centres, including working closely with those based overseas. An inter-ministerial committee is set up to overseas allocation of public funds to initiatives that are designed to identify the commercial potential of new research, develop an entrepreneurial culture among researchers, and create opportunities and support to help life sciences businesses grow.

4. Sensitivity matters

Stakeholders, however, need to be sensitive to partner's resources, business activities, models employed and partner's links with others when modifying relational ties between stakeholders in the healthcare cluster. There is also a need to consider key market and institutional tensions that may exist between them and others in the networks. Attempts must be made to acknowledged and formalised relationships various stakeholders may have with each other, sharing them with others in the networks, and making public some of these relationships, especially to their associations. This helps to reduce stakeholders' cynicism and criticism of each other involvement, including the State government, to develop a competitive life sciences cluster.

A supportive State government is important, especially in driving the creation of a vibrant life science cluster. With more than 80% of businesses operating in the cluster describing the state government's role as being supportive or facilitative in the development of their industries, the State could consider leveraging off the existing relational goodwill with these businesses as well as industry associations, academic and research institutions. However, communication between stakeholders is particularly important, in attempting to shape and influence a paradigm shift towards the creation of an emerging life sciences cluster among the existing diverse networks of stakeholders operating in the healthcare sector. This may, in turn, lead to formally prescribed workgroups committee or coalitions that may emerge out of communications. Collective sharing of information and knowledge between stakeholders in Selangor's healthcare sector, with the State government in the driving supportive or facilitative seat, may result in identifiable infrastructure requirements.

4.10 Summary of Online Survey Findings

- **36 (22%)** businesses identify their company's business as primarily **operating in the life sciences cluster** from 167 interviews conducted on-line.
- **One in three** businesses in the cluster thinks that the business environment will either **change for the better or change for the worse** over the next 2-3 years. One in five (**22%**) think that business environment will remain **unchanged**.
- **72%** however remain **very confident or somewhat confident** about their company's business prospect over the next 2-3 years.
- **83%** describe their industry as "**highly competitive**", **58% and 44%** thinks that it is "an industry where buyers have **increasing bargaining power**" and "**technology-driven**" respectively.
- Strong local market wisdom (**61%**), heavy dependence on local market (**58%**), and "**heavy reliance on government support**" (**42%**) were identified as the top three capabilities of local firms and suppliers operating in the life sciences cluster.
- The issues with the most impact on businesses in the life sciences cluster over the next 2-3 years are **business environment (53%)**, **availability of talent (44%)** and **product innovation (39%)**.
- **81%** of businesses in the cluster describe the state government's role as being **supportive or facilitative** in the development of their industries. **17%** felt that it was **inhibitive or constraining**.
- **66%** (24 businesses) also describe the role of industry associations, academic and research institutions in the development of their industries as **supportive** or facilitative, with **19%** (7 businesses) describing the role **influential or significant**.
- Businesses operating in the life sciences cluster are **optimistic** about their growth potential in Selangor with **61%** ranking the cluster among the **top two growth cluster**.
- **83%** of businesses in the life sciences cluster indicate their sales and marketing priority for the next 2-3 years is to concentrate on existing or develop new products/services but seeking new markets.
- **Less than 9%** of businesses in the life sciences cluster reported export **sales of more than 30%**. **67%** of businesses focus exclusively on the **local market**.

4.11 Conclusion and Recommendations

The 2014/2015 National Business Sentiment Survey by Monash University found that 56% of a sample size of 174 respondents nominated the healthcare sector as one with the most growth potential over the next 2 to 3 years. This finding is consistent with a survey of 167 businesses in the quantitative phase of this study, with 25% ranking life sciences cluster as the top two growth cluster in Selangor over the 5 years, closely following the 28% that nominated the food cluster. Interestingly, while 61% of businesses in the life sciences cluster nominated it as among the top and second top growth cluster in Selangor over the next 5 years, businesses in the food cluster are more optimistic with growth potential in the life sciences cluster, with 68% expressing this sentiment.

It stands to reason that the future of healthcare sector in the State is very bright. Crucially, it offers an excellent opportunity for the State to leverage existing competitive advantages, especially its health care infrastructure, to spearhead the development of a nascent life sciences cluster. For now, the “cluster” comprises of a loose collection of stakeholders, each with their sector-specific business and market development agenda. There is no specific cluster-led support initiative and alignment of key stakeholders to drive cluster development. For this to happen,

...any progressive development of a life sciences cluster in the State would therefore be cumulative, with many stages of integration between stakeholders, but with the State providing much needed driving force.

Some promising, focussed developments are under way. In a spatial context, the State has a “dedicated” Central Region Biomedical cluster comprising stakeholders like Invest Selangor, Invest KL, InQpharm, Quintiles, Xepa, CCM, and University Malaya, among others.

The development of Health Care Metropolis on the site of University Malaya identified under EPP 6 ought to provide much needed focussed and directed efforts in nurturing the creation of a life sciences cluster not dissimilar to Canada’s Ontario Hamilton life sciences cluster, Flanders life sciences cluster in Belgium, and closer to home, Singapore’s Tuas BioMedical Park and BioPolis. **Housed within this cluster could be an entire value chain for biomedical sciences, from R&D to manufacturing and healthcare delivery and/or a value chain that could leveraged off new and existing relationships** these businesses may have with more established BigPharma with increasing R&D investments, large Medical Technologies companies in the Klang Valley, and health care entrepreneurs and industry leaders.

The one greatest resource (i.e. rubber) that has given Selangor a powerful opportunity to secure competitive leverage in their chosen sector, namely manufacturing of surgical and examination gloves, has, also paradoxically, increased the nation’s reliance on these products in generating export revenue, accounting for 53% of all medical devices exported in 2014.

While companies such as Top Glove and Hartelega are seeking more export opportunities, investing in new production process technology, and engaging in innovative R&D initiatives, **growth is also sought in medical devices contract manufacturing, refurbishment of medical equipment, hospital hardware and furniture, and single use devices**. In this context, the State

government could provide incentives for existing medical devices companies for research and development, as well as to encourage established, specialised manufacturers in their sector to, perhaps, consider expanding their product lines. A 100% income tax exemption for 10 years from the first year the company derives profit or Investment Tax Allowance of 100% on the qualifying capital expenditure incurred within a period of 5 years to achieve a BioNexus status in the field of Biopharmaceuticals⁷³ ought to add much needed vibrancy to the development of a nascent life sciences cluster.

Greater urgency is placed on the importance of undertaking R&D in drugs, therapies and devices, and to increase the number of trials conducted from approximately 150 currently to at least 1,000 by the year 2020. The problem is that many MNCs do not have an abundance of laboratories. Neither do they conduct clinical trials. While the NKEA has “transformed the Malaysian healthcare sector, bringing a set of opportunities for many stakeholders, more needs to be done in order to increase the effectiveness of the NKEA. In order to boost EPP 2 (Creating Supportive Ecosystem to Grow Clinical Research) and 3 (Malaysian Pharmaceuticals – Increasing Local Generics Manufacturing for Exports), ***we need to have the right incentives in place, which have not been present so far. This means better tax incentives, faster regulatory approval and innovative medicine funding.***⁷⁴

Simply put, do businesses operating in their respective sub-sectors within the health care sector think and act as participants in the cluster? Responses from our interviews with these executives suggest that this is not the case. We think this is mainly due to the differences in the nature and structure of the sectors they operate in, the somewhat specialised capabilities of local players over a long period of time, their limited resources in R&D and weaknesses in seeking out advanced technologies. A supportive and/or facilitative State government, reinforced by findings in the quantitative phase of this study, and a cluster governance that is seeing more coordination between government and local intermediary institutions coordinated points to better and stronger coordination in the administrative development of cluster governance. We captured these differences and similarities, and summarised them in Table 4.5.

4.11.1 Recommendations

Despite the State’s many accomplishments and competitive standings in the world (examples in medical tourism, strong health care infrastructure, dominant presence in the manufacture of surgical and examination gloves,) from a cluster perspective, this study provides recommendations that the State could undertake to make growth happen in the health care sector, and with this sector serving as the point of leverage. They include (in addition to the ones provided and/or reinforcing recommendations made earlier):

1. Role of state government to include a more top-down approach building on the State’s existing supportive and/or facilitative role in the health care sector. This, must however be driven by the need to organise collective actions between sectors to create a life sciences cluster beyond the current individual sector, myopic focus on individual growth. ***The State’s***

⁷³ BioTech Corporation, 2014

⁷⁴ President of PhaMa, 2015

vision to create a life sciences cluster will require participatory regulations, with the State government playing a leading role. In administrative context, a working committee could be formed.

Like-minded companies that could see the benefits of growth beyond a myopic sector focus should be encouraged to join a State's life sciences cluster committee. In real estate, cluster spatial context, the Health Care Metropolis on the site of University Malaya could be carried out through the designation of land parcels and buildings for specific use, recruitment of key tenants that could forms an important cog in the life sciences cluster value chain, from teaching (including specialists teaching) and R&D, to manufacturing and healthcare delivery.

2. ***Promote dialogue, continual improvements and linkages between one or two key identifiable sectors in the State, particularly key industry players with strong local manufacturing and R&D operations, and global market appeal to attract big pharmaceuticals and medical devices R&D centres.*** Companies like Top Glove and Hartalega in the medical devices sector, emerging SMEs in Biotechnology (example Bioven Selangor), and established large local pharmaceutical companies (examples CCM, Pharmaniaga). A cluster perspective with an emphasis on engagement and dialogue process, stakeholders could see the benefits of "the sum of the parts and not the individual parts" that will redefine and reshape their contributions to and from their participation in cluster's activities.

This, of course, will take time and will only happen over many interactions and through the development of trust, commitment and adaptation between stakeholders. The aim is to attract an agglomeration of industry leaders to relocate to Selangor, including their production plants, setting up of R&D centres to perhaps, drive specific mission oriented programs such as biopharmaceuticals. The longer term goal must be to create synergistic technology platforms to facilitate research and innovation translation needed to drive the creation of a sustainable life sciences cluster.

3. ***Developing and building a leveraging strategy on the back of the State's existing network of health care infrastructure is needed to drive sub-sectors in the health care sector's connectedness and promote life sciences cluster's development.*** Together with Selangor's bustling urban environments, location to top universities offering cutting edge research programs, including large independent or university operated teaching hospitals, access to a highly educated workforce, including a large segment of recent college graduates in fields such as science, technology, biology and engineering, will provide much needed impetus to nurture the development of the life sciences cluster. However, Selangor also needs to reconcile local and regional competing forces to advance its role as the nation's leading life sciences cluster. In terms of infrastructure, this will require the State to:
 - Examine ways to incentivise BigPharma from Europe, especially those with extensive R&D to relocate to Selangor.

- Facilitate targeted technology transfer, particularly in medical devices that extends beyond surgical and examination gloves and possibly, Single Use Devices (SUD).
- Encourage more Biotech startup through international collaborative initiatives, with a view to encouraging more R&D, innovation, patent applications and subsequent commercialisations.
- Invest in R&D in specialised projects such as Biohalal medicines with the aim of targeting the attractive OIC markets where Malaysia has advantage.
- Increase supply of capital investment to promote entrepreneurial growth and develop the wealth of researchers, engineers and technicians that are needed in clinical trials.
- Heightened existing efforts in health care management productivity and processes as they impact on (a) labour productivity; (b) cost management; (c) knowledge generation, product requirements (pharmaceuticals, medical devices), and skills set determination (clinical trials).
- The strong potential for value-chain integration between healthcare, medical tourism and the food sector should be combined with new marketing and technological opportunities, given the increasing demand placed on quality of life and wellbeing.
- Provides much needed support to an industrial base comprising of established businesses, engaging with local serial medical entrepreneurs and ensuring their ongoing support in aligning stakeholders in the healthcare sector, to facilitate the nurturing of one major cluster project that could be built around a major theme.
- For example, a possible major strategic development project in the cluster could be an advanced postgraduate medical training and research project between businesses, universities and the hospital sector, with a view to increasing the number of trained medical specialists resources (e.g. chemists, scientists, diagnosticians), pursuing research and development in targeted areas of biotechnology (including Biohalal), medical technology and pharmaceuticals (including traditional medicines), and increasing the number of PCT (Patent Cooperation Treaty) applications.
- A strong local market wisdom, heavy dependence on local market and heavy reliance on government support (possibly as a buyer) would suggest that local manufacturers' reliance on domestic markets will not reduce any time soon. However, this should not be at the expense of seeking the larger export markets especially for generic version of drugs with newly expired patents, such as Singapore, Thailand, United States, and Hong Kong. Focussed efforts should be made in reinforcing existing local and international marketing, brand and reputation development efforts (e.g. medical services, pharmaceutical and biotechnological products and medical devices) in targeted markets.

4. To further encourage investments, drive innovations and patents, the above mentioned gaps in the infrastructure need to be deliberated and agreed upon uniformly by relevant stakeholders that are primary and secondary “contributors” to these gaps. That means opening and sharing data and information so that stakeholders could collectively add-value through collaborative engagement, production and delivery of cluster-based activities and resource allocation. This may prove to be hard as sharing information is not a necessarily a part of local businesses DNA, especially given their heavy dependence on the local markets and hence, increased market competition, as well as competition for local talents.

4.11.2 Summary of Cluster Characteristics and Governances

Characteristics of Life Sciences Cluster								
Cluster	Nature and Structure of Industry			Capabilities of Cluster Actors			Cluster Governance	
	Capital Intensive	Technology-driven	Structure of Cluster Ownership	Local Private Firms / Selangor	Intermediary Institutions (association, academic, research institute)	Government Agencies / Selangor		
Biotechnology	Medium	Fast changing technology	Clusters of collaborative initiatives	Local firms somewhat weak in advanced specialised materials and technical services	Limited resources and weak leadership	Pragmatic and supportive	Local intermediary institution and government coordinated	
Pharmaceuticals	Medium	Medium	Clusters of MNCs subsidiaries and emerging middle-tier local manufacturers (contract manufacturing)	Weak in technology	Limited resources. Reliant on MNCs and some large local firms	Pragmatic and supportive	MNCs dominated and government coordinated	
Food Chemistry	Medium	Medium	Clusters of local suppliers	High level of local wisdom, expertise & specialisation	Limited resources and weak leadership	Pragmatic	Local intermediary institution and government coordinated	
Healthcare and Medical Technology	High	Fast to moderately fast changing technology	Clusters of Mid-Tier and large local and foreign players and subsidiaries of MNCs	Weak in advanced technologies (besides medical gloves) with strong supporting services	Good availability of resources and emerging strong leadership with strong networks within and between industries	Pragmatic and supportive through NKEA with 8 EPPs	Local intermediary institution and government coordinated	

Table 4.5 Summary of Cluster Characteristics and Cluster Governances

Source: Monash University, Malaysia, 2016

4.12 Best Practices

We sourced and identified four case studies and/or reports from which useful and important pointers could be drawn in developing a life sciences cluster in Selangor. They include:

Case Study 1: Building a Life Sciences Cluster: A Case for Hamilton

Background

Hamilton possesses Ontario's second-largest hospital network and a formidable health research infrastructure. Its health institutions have created specialised knowledge and developed talent that is not easily found elsewhere in the world. In fact, Hamilton has assets in this sector that take decades to nurture. In this sense, the city has an abundance of the most elusive, valued and essential preconditions for a vibrant life sciences industry cluster.

Relevance

In 2013, the Hamilton Chamber of Commerce's Innovation and Technology Committee took a leadership position on this issue and formed a subcommittee to investigate the preconditions driving successful industry clusters elsewhere around the world.

Findings

Five features are essential for cluster to form and thrive. They include:

- i. Knowledge and talent
- ii. Support of an industrial base comprising of established businesses
- iii. Infrastructure and funding
- iv. Support and alignment of stakeholders
- v. Driving force

Source: http://www.lifesciencesontario.ca/_files/file.php?fileid=fileOfQuhTMjbF&filename=file_LifeScienceClusterReport2014Final.pdf

Case Study 2: Key Success Factors for a Life Sciences Cluster: The Case of Flanders

Background

Flanders only comprises 13,500 sq km and houses no less than 115 companies with biotech activities, employing over 10,000 employees and generating a total turn-over of close on €2.9 billion. Together they are responsible for ca. 20% of the total private R&D expenditure in Flanders. The money is well invested: 33 of these companies own 941 patents, resulting in a powerful patent position of 29 patents, on average, per company. Since 2005, 5 Flemish biotech IPO's have raised, between them, €213 million. Life science is a booming business in Flanders.

Relevance

The Flanders life sciences cluster is an example of the importance of close collaborations with the local knowledge institutes and the widely available possibilities for funding creates a vibrant cluster. Crucial factors like these have turned Flanders into a flourishing life sciences cluster with a wide range of active SMEs and international corporations. They find themselves well surrounded by organisations that uphold their interests and by a flexible government with a listening ear and wide-open eyes on the future.

Findings

A vibrant innovation system is essential in creating a life sciences cluster. Elements of this system include:

- i. Supportive government
- ii. Serial entrepreneurs
- iii. Industry leaders
- iv. Incubators and accelerators
- v. Seed funding, private equity, and venture capital
- vi. Human capital
- vii. Excellent R&D infrastructure
- viii. Community builders

Flanders now has all the key ingredients to drive the cluster, in particular:

- i. Highest concentration of big Pharma with extensive R&D (which we do not have in Malaysia and hence incentives needed for R&D. Is this happening now?), regulatory, manufacturing and logistics facilities
- ii. Large Med Tech companies with EU HQ (e.g. Singapore)
- iii. Fast growing Biotech start-ups
- iv. Wide range of medtech companies
- v. Dynamic clusters organisations

Sources: <http://cinbios.be/files/downloads/LifeSciences.pdf>, <https://www.bio.org/sites/default/files/16h50%20Jan%20Wauters.pdf>

Case Study 3: Myriad of successful Life Sciences Clusters in the United States

Background

Some of the most successful clusters within the U.S. include the Greater Boston area, Raleigh-Durham in North Carolina, San Francisco on the west coast, and the twin cities of Minneapolis-Saint Paul in Minnesota. These strategic areas attract such promising start-up ventures, as well as world-class pharmaceutical, biotech, and medical device firms.

Relevance

These are examples of successful life sciences clusters, particularly the Critical Success Factors (CSF).

Findings

Those clusters in those areas are successful because:

- i. They are cities with bustling urban environments;
- ii. The areas are anchored by top universities offering cutting edge research programs;
- iii. They are often co-located with large independent or university operated teaching hospitals;
- iv. They possess a highly educated workforce, including a large segment of recent college graduates in fields such as science, technology, biology, and engineering; and
- v. There is an abundance of laboratory and manufacturing space equipped to produce a myriad of drugs, therapies, and devices.

Source: <http://www.eqlifesciences.com/blog/life-sciences-clusters#sthash.FGhZTs6d.dpuf>

Case Study 4: JLL's Global Life Sciences Cluster Report

Relevance

The JLL's report presented two mini cases of key developments in Singapore life sciences cluster, namely Singapore Tuas's BioMedical Park and BioPolis.

Findings

Among numerous key findings in the report, it is worth noting, and with a premium place on innovation, that Asia has surpassed both North America and Europe in overall Patent Cooperation Treaty (PCT) applications, with Japan, China and Korea accounting for 22.4%, 9.5% and 6.1% respectively of all PCT all PCT applications in 2012.

The study identified the following factors in the development of a successful life sciences cluster:

- i. Effective government regulation
- ii. Technology transfer
- iii. Foreign direct investment
- iv. Higher education institutions
- v. Investment in research and development are key foundational components to cluster development, and are also critical to labour productivity

Mini Cases for Singapore's Tuas BioMedical Park (TBP and BioPolis)

The Tuas BioMedical Park (TBP) were part of Singapore's plan to build up an entire value chain for biomedical sciences, from R&D to manufacturing and healthcare delivery. The parks are strategically located to provide pharmaceutical manufacturers access to skilled labour force, research expertise and air and sea logistics. Upcoming developments include a biomedical hub which will cater to SMEs to complement existing global giant industry based in TBP.

Biopolis is a purpose-built biomedical R&D hub for both public and private research agencies. The creation of this hub aims to generate informal networks to benefit from knowledge spill-over and speed up the growth of critical mass of biomedical expertise in Singapore, facilitating its development as the biomedical R&D hub of the Asian region.

Source:<http://www.jll.com/services/industries/life-sciences/global-cluster-report/global-trends-in-life-sciences>

Cluster Specific Insights 04

Machinery and Engineering

5.0 Machinery and Engineering Equipment Cluster

The success of the region's M&E cluster will be shaped by the State's ability and capacity to develop core competencies in selected M&E segments (e.g. custom-made machinery and equipment for power generation, specific and specialised processing) that leverage off specific applications (e.g. E&E, aerospace, automotive, and medical), through targeted labour development and R&D&D built on the back of the region's strong ESI infrastructure and heritage provided for by SMEs.

Key Takeaways:

- The State has an abundance of some of the most valued and essential preconditions for an M&E industry cluster that could be nurtured.
- Key industry stakeholders in M&E and Engineering Support Services industry should convene and identify respective and collective goals, and act as a collaborator group to create a regional, cross-industry competencies and specialisations.
- The State should revisit current funding and support in R&D investments, with a view to creating a State's-based R&D&D centre in Machinery and Engineering Services, with private sector participation and contributions.
- Pockets of excellence for R&D&D should take into considerations: (a) existing SMEs' skill sets and entrepreneurial flair, (b) their OEM and trading know-how, and (c) priority in upgrading and refurbishing existing business, training activities and facilities, including equipment.
- More and better vocational hands-on training and development programs that combine the benefits of classroom-based and on-the-job training are needed to meet industry needs.
- Building up a workforce through subsidies and incentives to coincide with location-based incentives, targeted M&E subsectors and industries (e.g. high end precision engineering, surface engineering and mouldings in agricultural (oil palm, Bio Tech), electrical and electronics (IoT) and transportation (aerospace)).
- Provide incentives for investment projects among technologically start-ups and/or among existing businesses, especially if they fit the needs of M&E and ESI businesses' diverse economic activities, at different stages of the production and/or investment process.

5.1 Introduction

Given the magnitude of machinery and engineering equipment (M&E) activity in the region and the fact that M&E is expected to remain an integral part of the State's economy, it is safe to assume that the future economic prosperity of the M&E industry will be determined in large part by the steps the State takes to leverage the existing M&E assets that have been cultivated over the years. Indeed, and despite the fragmented nature of the M&E industry, Selangor possesses a formidable M&E infrastructure with businesses crafting and catering their specialised knowledge and developed talent to their customers, in areas such as moulds and dies, metal casting, machining, forging and metal fabrication.

Over the years, Selangor has nurtured assets in this sector providing much needed support to M&E businesses that are involved in the manufacturing and production of a range of custom – made machinery and equipment for power generation, specific and specialised processing, metalworking and general industrial activities. In this sense, the region has an abundance of some of the most valued and essential preconditions for an M&E industry cluster.

Still, opportunities exist to realise cluster-based, commercial co-operation that focused on Selangor's M&E and ESI assets. For now, there is no systematic inter-relational engagement of multiple stakeholders such as businesses, institutions, associations and agencies working together to capitalise on Selangor's wealth in M&E and ESI, especially as they relate to general and specific applications in vertical market sectors.

These sectors include oil and gas, aerospace, automotive, agriculture, and medical. And with other countries around the world and region aggressively developing their M&E (from M&E in power generation and specialised industries) and ESI strategies (from mould and dies to metal fabrication), the State's opportunities to derive commercial value and move up the value chain, based on quality research and technical expertise, diminishes yearly. With import outstripping export in each of the four major M&E sub-sectors, each passing year also represents a slip in the State's competitiveness, further undermining the M&E industry and its role in promoting and facilitating developments in the manufacturing industry.

For Selangor, getting businesses in the M&E and ESI industries thinking and behaving alike from a cluster perspective will require collaborations that extends beyond their current limited domestic-focus markets and customer base. From interviews with business executives, results from our online survey, as well as extensive review of published materials, answers to the following questions will provide the State with key insights on how best to move forward. They are:

1. **With a vast expansive network of SMEs operating in the ESI, could the State's develop an M&E action plan to drive-value add in manufacturing and production, in a regional and global context, and at the same time build economy of scale?** Especially when different types of technical skills and technology are required for a host of ESI activities (e.g. metal casting, metal stamping, and surface engineering)? Or when many SMEs are importing similar, but technologically superior and price competitive products from China and Vietnam, just to stay in the business?

2. Given both M&E and ESI are intricately linked to and driven by industry requirements, especially in M&E for specific industries and power generating, **is there a need for an action plan that focus on core industry sectors in Selangor?** For examples, concentrating on allocating resources on value-adding activities in the automotive, aerospace, electrical and electronic (particularly consumer electronics), medical and food?
3. **Nationally and regionally, should the State also focus on pockets of excellence for D&D and R&D** (e.g. surface engineering and forging) while: (a) building on existing SMEs' skill sets and entrepreneurial flair, (b) complementing their OEM and trading know-how, and (c) upgrading and refurbishing existing business, training activities and facilities, including equipment?

One interviewee's view of the M&E industry captures the essence of the above questions when he says,

"M&E is something very fundamental and it is also something I feel is very brick and mortar. It is very rigid in the sense that it is something already there and nothing much you can do in the M&E side. It is an established industry. I think for big variation of change, it won't come from that (within the industry). This (the industry) can only grow in support of something new."

Of course, to get the SMEs to work together with foreign MNCs, and large local companies to generate export earnings and hire more people to drive cluster's growth, instead of competing with each other, will prove challenging. Especially, when ESI providers and players in the M&E industry have so far focus on the domestic markets, often with minimal value-add to equipment manufacturing (e.g. boilers, lifts, and cranes). The small capacity of the local market, limited access to financial assistance and technology, and availability of cheap imports, are instead cultivating a business mind-set that promotes modular assembly, OEM, contract manufacturing and distribution and trading, with minimal value - add in the production and manufacturing processes.

A rethink is necessary if the State of Selangor wants to reboot the M&E industry. Support in terms of tax and financial incentives to engage in R&D and D&D is needed to promote technology adoption initiatives. The State might have to consider setting up an all - encompassing M&E research centre, with a strong technical imperative. This would, however, require stakeholders in M&E, ESI, specific industry sectors and the State Government to identify sectors or cross-sectors cooperation to drive a manufacturing agenda, beyond the current trading and single customer reliance, business model. That requires combining technical, technology and talent, or what we termed the 3T's. As one executive notes,

"How do they go to the next phase of technology for this kind of machine is a major challenge? Right now, there is no incentive to go further beyond doing what we have been doing for so long. And now, with the poor economy, it is survival that we have to focus on."

5.2 Scope

The M&E industry manufactures a range of custom – made machinery and equipment for power generation, specific and specialised processing, metalworking and general industrial activities. They include machine tools, material handling, robotics and factory automation equipment, packaging machinery, and specialised process machinery or equipment for specific industry. Industries in M&E cluster also support a range of direct and indirect engineering services industry covering a machining, metal casting, sheet metal working, general fabrication, design, development and prototyping, as well as testing and certification services. Beyond and within the M&E scope, several key analytical observations are made, including:

1. Domestic-oriented M&E industry

In 2013, exports of M&E exceeded more than RM27.3 billion (US\$9.1 billion). It is expected to grow at an average annual growth rate of 6.7 per cent to reach RM48.3 billion (US\$16.1 billion) in 2020 (See Table 5.1 and 5.2).⁷⁵ Imports, however, have also increased to RM54.5 billion (US\$18.2 billion) in 2013.⁷⁶ The sector General industrial M&E and M&E for specific industries takes up a substantial proportion of total M&E imports and exports. Imports of power generating M&E are, however, slowing increasing. The ratio of imports to exports for power generating M&E is 5:1, while the ratio for both General industrial M&E and M&E for specific industries is 2:1.

The approved investments in M&E averages RM2.1 billion from 2012-2014 with investments totalling RM2.4 billion in 2014. This compares with RM1.1 billion in approved investments in Engineering Support Industry (ESI) in 2014. Investments in machining accounts for 41.3% of total investments in ESI (RM441 millions), followed by metal casting (27.2% or RM 290.6 millions) and mould & die (21.3% or RM 227 millions).⁷⁷

The higher import export ratio for power generating M&E reflects the growth and contributions of the M&E industry to the nation's manufacturing industry, across numerous vertical industry sectors. These sectors include oil and gas, agricultural, electrical and electronics, transportation and health care. Importantly, we see more opportunities for ESI's to play a strategic role in promoting support of market-driven M&E innovation and R&D processes, cultivate new opportunities for the creation of shared manufacturing services with M&E, enhanced talent development, while promoting manufacturing and operational excellence which is crucial to the survival and regeneration of the overall M&E industry.

⁷⁵ MIDA, 2014, "Malaysia's Machinery & Equipment and Engineering Support Industries"

⁷⁶ Ibid.

⁷⁷ Ibid.

Sub-sectors	2008	2009	2010	2011	2012	2013	Major Sources
	RM bil						
Power generating M&E	10.3	9.3	8.7	9.2	10.7	10.9	US, Japan, Singapore, China, Thailand
M&E for specific industries	12.3	10.4	13.7	15.6	15.5	16.3	Japan, Germany, US, Taiwan, Singapore
Metalworking M&E	4.0	3.0	4.5	4.1	4.8	4.2	Japan, Germany, US, Taiwan, Singapore
General industrial M&E, components and parts	16.7	15.4	17.0	18.1	21.9	23.1	Japan, US, Germany Singapore, Taiwan
Total	43.3	38.1	43.9	47.0	52.9	54.5	

Table 5.1 Malaysia Engineering & Equipment Supporting Industries – Imports (2008 – 2013)

Source: MIDA, 2014, <http://www.foundry-planet.com/fileadmin/redakteur/pdf-dateien/24-11-14-MIDA.pdf>

Sub-sectors	2008	2009	2010	2011	2012	2013	Major Sources
	RM bil						
Power generating M&E	2.7	2.2	2.4	2.4	2.2	2.0	Singapore, US, Japan, Germany, UK
M&E for specific industries	5.7	5.8	6.9	7.7	8.6	9.8	Singapore, US, Japan, Indonesia, Thailand
Metalworking M&E	1.4	0.9	1.2	1.4	1.2	1.3	Singapore, Hong Kong, Japan, US
General industrial M&E, components and parts	12.1	10.2	10.9	12.2	13.2	14.2	Singapore, Hong Kong, Japan, US, Australia
Total	21.9	19.1	21.4	23.7	25.2	27.3	

Table 5.2 Malaysia Engineering & Equipment Supporting Industries – Exports (2008 – 2013)

Source: MIDA, 2014, <http://www.foundry-planet.com/fileadmin/redakteur/pdf-dateien/24-11-14-MIDA.pdf>

A 2014/2015 Productivity Report on the Productivity Performance of the Manufacturing Sector by Malaysia's Productivity Commission further identified Machinery & Equipment as one of several sub-sectors with a domestic orientation (See Table 5.3). The other sub-sectors, namely, pharmaceuticals, transport equipment, and food products & beverages are notable, as they are among the sub-sectors that were examined in the life sciences, transport and equipment, and food cluster, respectively, in the present Cluster Study. With the exception of electrical & electronics products, deemed an export-oriented sub-sector by the Productivity Commission, and “correlating” with the electrical and electronics cluster examined in this study (See Table 5.3).

Export-oriented Subsectors	Domestic-oriented Subsectors
• Chemicals & chemical products	• Basic metals
• Palm oil	• Pharmaceuticals
• Refined petroleum	• Machinery & equipment
• Electrical & electronics	• Transport equipment
• Textiles	• Food products
• Wearing apparel	• Other non-metallic mineral products
• Wood & wood products	• Fabricated metal products
• Paper & paper products	• Beverages
• Rubber & plastic products	

Table 5.3 Productivity Performance of the Manufacturing Sector

Source: Malaysia Productivity Commission Corporation, 2014/2015

2. Weak backward and forward linkages of M&E subsector

The Malaysian Productivity Commission Corporation in their study of the productivity performance of the manufacturing sector also provided some interesting insights, as they relates to some of the sub-sectors and/or industries within and between clusters that were examined in this study. They include:

- The industrial machinery and equipment, like the electrical and electronics, and transport equipment and other equipment, have weak backward and forward linkages (See Figure 5.1, Quadrant 3). According to the Commission, thus is because they use a large portion of imported inputs relative to other sectors, and most of their products are sold for final consumption.
- Food, beverage & tobacco products, one of the key industry in the food cluster, have strong backward but weak forward linkages (Quadrant 2). This is because while the subsector uses a substantial amount of other sub-sectors' products as inputs, most of its products are also sold for final consumption.
- Manufacturing industries such as wood products, paper & paper products, furniture and publishing, Non-metallic, mineral products, basic metal and fabricated metal products as well as chemicals & chemical products have strong backward and forward linkages (Quadrant 1). That is, they use a significant amount of other sub-sectors' outputs as their inputs, while considerable amounts of their outputs are also sold to other sub-sectors as inputs.

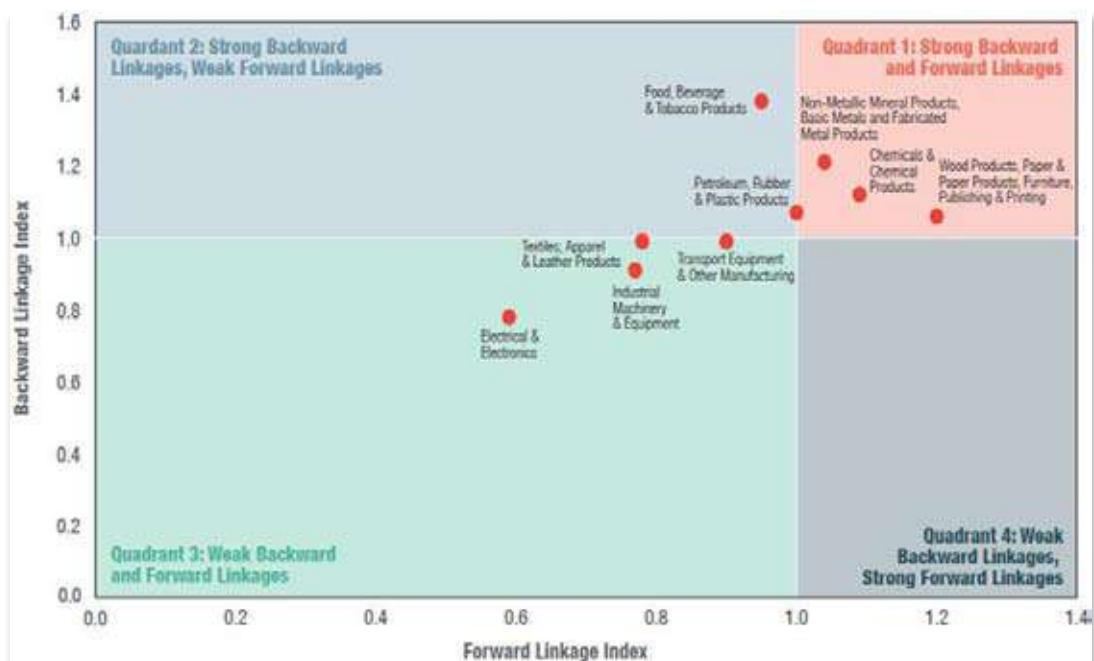


Figure 5.1 Productivity Performance of the Manufacturing Sector

Source: Malaysia Productivity Commission Corporation, 2014/2015

3. Strong, consistent location quotient and employment in manufacturing

Our analysis of employment and location quotient in the State's manufacturing sector from 2010 to 2014, further reveals the following trends:

- On average, more than 534,000 people are employed in the State's manufacturing sector. They account for more than 24% of the national total that are employed in this sector, followed by Johor with 404,000 people and 18.3%.
- While the total number of people employed in Penang's manufacturing sector averages 249,000 during the 2010-2014 period, and accounts for roughly 11.2% of the national total, employment in the State's manufacturing sector constitute more than 32% of total employed in the State. This compares with 27% for Johor and 19.5% in Selangor.
- Not surprisingly, Penang has a Location Quotient averaging 1.9 during the period 2010-2014 compared with 1.5 in Penang, and 1.1 in Selangor. The LQ for Kuala Lumpur is slightly more than 0.4.
- Nationally, the majority of people employed in the manufacturing sector are employed in the electrical and electronics sector E&E was the biggest employer with 471,672 workers, followed by the plastic and rubber products (314,305 workers) and the food sub-sectors (188,950 workers). Total number employed in the Machinery and Equipment industry is estimated at 76,000 (3.3% of 2.3 million employed in the manufacturing sector).⁷⁸

⁷⁸ Malaysia Productivity Commission Corporation, 2014/2015, "Productivity Performance of the Manufacturing Sector"

State	Number Employed ('000) in State	% Change	Share of Total Employed in Malaysia	Share of Total Employed in State	LQ
Selangor					
2010	496.4	-	23.5	19.4	1.1
2011	535.1	7.8	24.1	20.3	1.1
2012	546.5	2.1	24.5	19.8	1.1
2013	535.2	-2.1	24.1	19.0	1.1
2014	559.2	4.5	24.7	19.2	1.1
Johor					
2010	404.4	-	19.1	28.5	1.6
2011	400.2	1.0	18.0	27.5	1.5
2012	398.7	-0.4	17.9	27.0	1.5
2013	404.4	1.4	18.3	25.9	1.5
2014	410.4	1.5	18.1	25.7	1.5
Penang					
2010	248.4	-	11.7	33.5	1.9
2011	259.7	4.5	11.7	33.9	1.9
2012	240.4	-7.4	10.8	31.2	1.8
2013	242.1	0.7	10.9	30.9	1.8
2014	253.7	4.8	11.1	31.4	1.9
Kuala Lumpur					
2010	59.1	-	2.8	7.5	0.4
2011	67.6	14.4	3.0	8.3	0.5
2012	73.1	8.1	3.3	8.9	0.5
2013	57.6	-21.2	2.6	6.6	0.4
2014	57.4	0	2.5	6.7	0.4

Table 5.4 Number of People Employed in Manufacturing (2010 – 2014)

Source: Department of Statistics, Malaysia

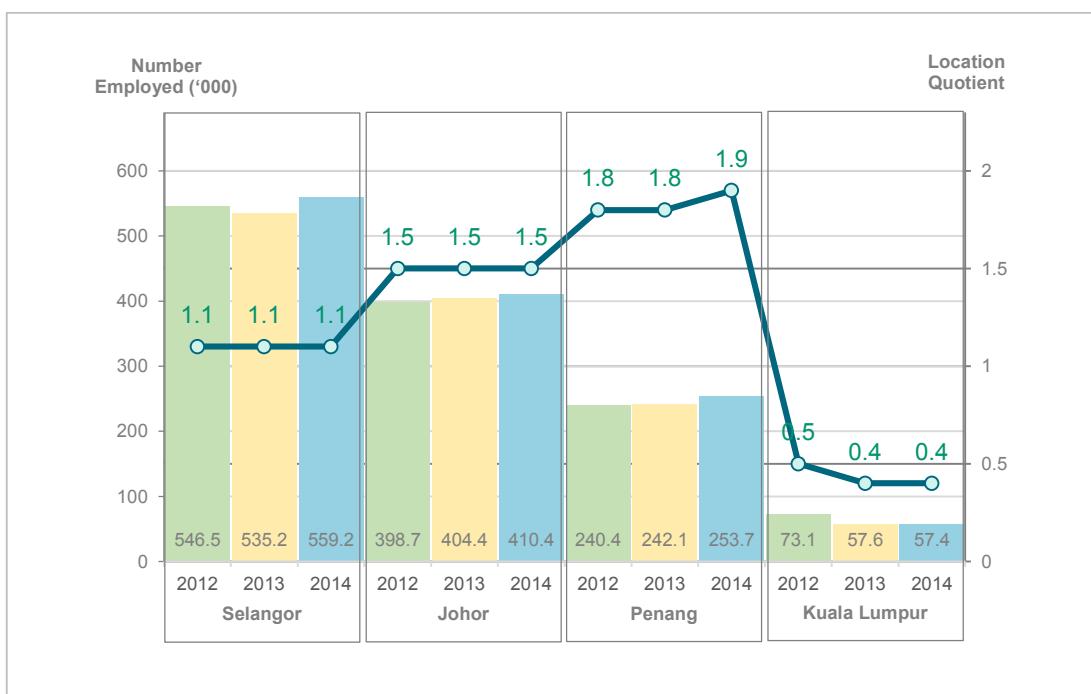


Figure 5.2 Breakdown of Employment in Manufacturing (2012 – 2014)

Source: Department of Statistics, Malaysia; Monash University Malaysia, 2016

5.3 Cluster Map

Unlike the expansive Life Sciences and Food cluster, the M&E cluster comprises of businesses that are involved in the production of machineries in four main sub-sectors. They include power generating M&E, M&E for specific industries, metalworking M&E, general industrial M&E, components and parts. They make products such as turbines, boilers, elevators, lifts and specialised M&E, and a range of generic and specialist engineering. These products are sold and delivered locally and overseas to companies in the oil and gas, automotive, agricultural, packaging, aerospace and electrical and electronic industry.

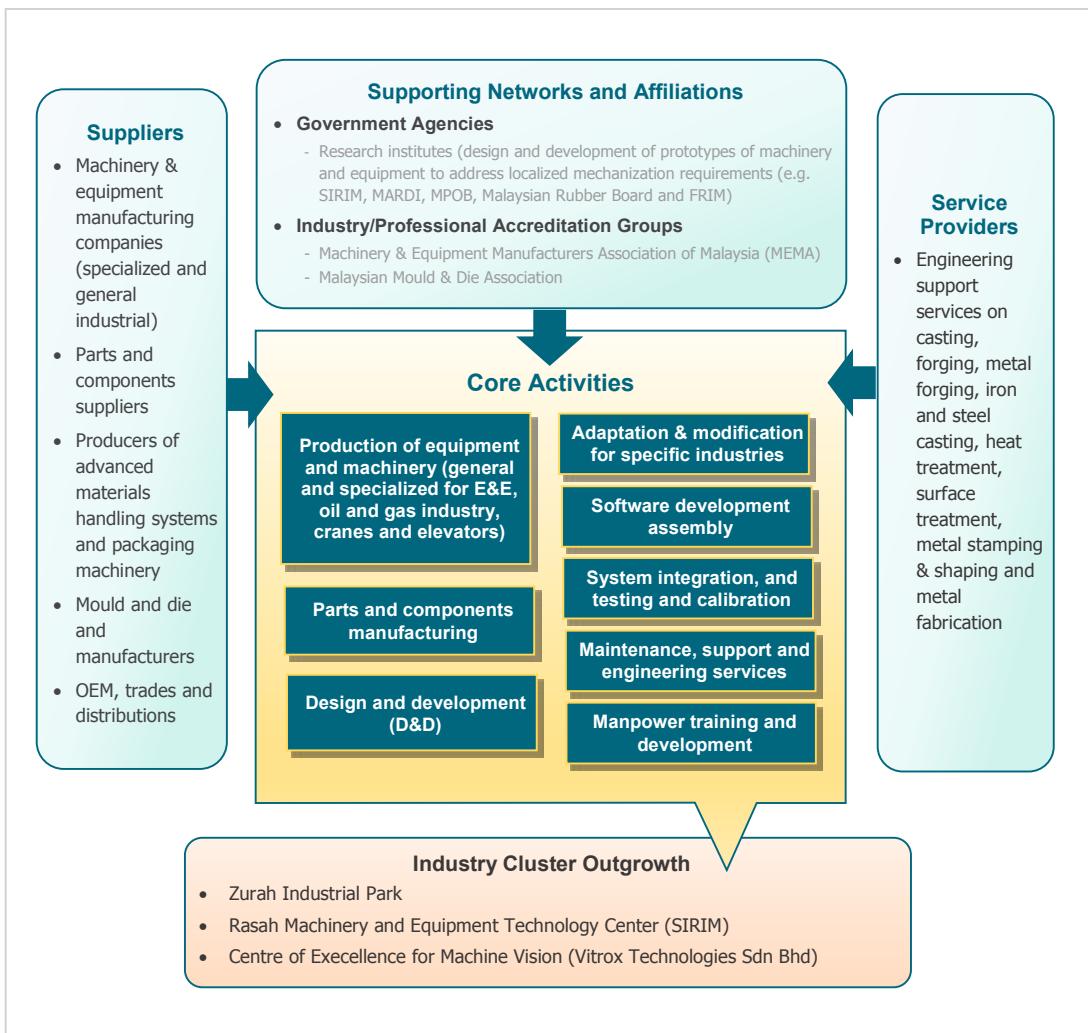


Figure 5.3 Cluster Map

Source: Monash University Malaysia, 2016

Figure 5.3 also includes a broad category of service providers operating in engineering support services industry. Major local companies in Selangor include **Atasmi Precision Machinist Sdn Bhd (Selangor)** and **Kein Hing International Bhd (Selangor)**. What is not highly visible are the more than 1200 ESI companies in Malaysia providing products and services ranging from moulds and dies to metal fabrication. A sample of these companies and their main business activities are shown below.

- a. **MCK Tooling Sdn. Bhd**
Precision tools & dies
- b. **CNC Machining Services**
All kinds of plastic moulding
- c. **Meltech Precision Sdn Bhd**
Complete solutions to the manufacturing industry. Product range includes hardware, plastic mould & die components, automotive parts, semi-conductor, micro tool and etc.
- d. **NSC Plastic Products & Engineering Sdn.Bhd**
Leading manufacturer and subcontractor of precision moulded plastic components for computer, electronic, telecommunications, medical, consumer, construction, automotive and food industries.
- e. **Proheat Treatment Precision Sdn Bhd**
Moulding and casting, tools and dies, metal sheet stamping and fabrication, automated production machine designing and fabrication.
- f. **Saeilo Japan (M) Sdn Bhd**
Machine tools, forming dies, automation parts, electrical parts.
- g. **Industrial Production Equipment Sdn Bhd**
Distributor, dealer in plan & machinery tools and production equipment.
- h. **KMK Industries (M) Sdn Bhd.**
Specialist in designing and manufacturing of various types of precision engineering tools.
- i. **TPL Precision Engineering Sdn. Bhd**
Specialist in machinery & engineering, main product is moulds, tools, dies & precision machined parts.
- j. **Mayplas Packaging Sdn Bhd**
Injection mould manufacturer.
- k. **HOPPT-M Precision Engineering Sdn Bhd.**
Manufacturer of quality standard & custom made mould base.

Other business activities in the M&E industry and their respective key players include⁷⁹:

- **Machine Tools Segment**

Leading companies in operation in Malaysia are **Aida, Hydra-Link, Li Chin (S.E.A), Sunfluid Engineering, and Technology Park Malaysia.**

- **Materials Handling**

There are about 20 manufacturers of material handling equipment in Malaysia. Leading companies in this industry are **Favelle Favco** (a top ten world leading manufacturer of tower cranes), **Impsa, Excellift, MHE-Demag, Cheng Hua Engineering and Matromatic Handling Systems.**

- **Robotics and Factory Automation Equipment**

Currently, imports are mainly from USA, Japan, Singapore and Germany. There are about 30 companies manufacturing factory automation equipment for E&E, food processing, automotive, agricultural industry such as **Kobay Technology, ViTrox, Genetec, Greatech, Polytool Automation, Pentamaster and Keu Control.**

- **Packaging Machinery**

Currently, imports are mainly from Germany, Italy, Japan, USA, and Taiwan. There are about 4 manufacturers of various packaging machinery in Malaysia. They are **Sama Plastics Machinery, Serac Asia, Limax Industries and Fluidmech Engineering.**

- **Specialised Process Machinery or Equipment for Specific Industry**

M&E in this category are machinery and equipment specifically designed for use in any particular industry or process. Designated a very high priority category M&E for investment promotion. Presently, Malaysia is the leading manufacturer of specialised equipment for the E&E industry in the ASEAN region.

From the list above, some of the key activities M&E and ESI undertakes include the production of equipment and machinery, and provision of service support across sectors such as electrical and electronic, agricultural, automotive, oil and gas, among others. They include adaptation and modification of parts and components for these industries, design and development, software development assembly, and maintenance of machinery.

But unlike developed countries with an established manufacturing sector but technology-driven M&E industry, technology and investment in R&D and D&D in Malaysia have yet to play a much bigger and key role, say in terms of high value added precision engineering, casting and forging. Particularly, in response to customer requirements in sub-sectors of the manufacturing industry seeking upgrade in their production process, packaging and handling technology.

⁷⁹ MITI, 2015, "Machinery and Equipment Industries"

In a competitive local market with limited access to finance for growth and expansion, this, however, is not happening. Instead, many have and are now, venturing further into OEM, modular assembling of parts and components, refurbishment of old machinery, and trading and distribution activities, with minimal value-add and export earnings potential.

Industry association groups such as the Machinery & Equipment Manufacturers Association of Malaysia (MEMA) and Malaysia Mould & Die Association (MMDA) represent members' interests, by maintaining a close cooperation with various Federal Government agencies in the development and pursuit of the industry's goals and visions. Key agencies, especially research, that are involved in the design and development of prototypes of machinery and equipment that address localised mechanisation requirements includes SIRIM, MARDI and MPOB. Major recent industry outgrowths in the M&E cluster in Selangor includes the Centre of Excellence for Machine Vision, Rasah Machinery and Equipment Technology Centre and the Zurah Industrial Park.

Figure 5.4 identifies various value adding opportunities across all four sub-sectors in the State's M&E industry, across a mix of production and R&D activities. They include cross-sub-sectors government funded and MNCs collaborative manufacturing and engineering projects (e.g. automotive and rail), and collaborative specialised mechanisation initiatives. While the State government through participative regulations undertakes some of these initiatives, it lags somewhat in developing value for the region in R&D, D&D and manpower training and development.

The problem is particularly acute in the E&E sub-sector that is highly dependent on a highly skilled workforce with expertise in areas such as research, design and development (R&D&D) and electrical engineering.⁸⁰ It employs about 472,000 workers, about 30% to 40% of which are engineers and managers. However, there is an acute shortage of experienced engineers within the sub-sector, and the quality of engineers that are available has fallen below employers expectations. These shortages are holding back D&D efforts and making it difficult for the sub-sectors to move up the value chain.⁸¹

And despite access to a network of SMEs, the State's need to further capitalise on SMEs machining, engineering and entrepreneurial heritage and strengths, to create economic development and drive value adding R&D activities, beyond the traditional brick and mortar M&E and ESI business.

⁸⁰ Malaysia Productivity Commission Corporation, 2014/2015, "Productivity Performance of the Manufacturing Sector"

⁸¹ Ibid.

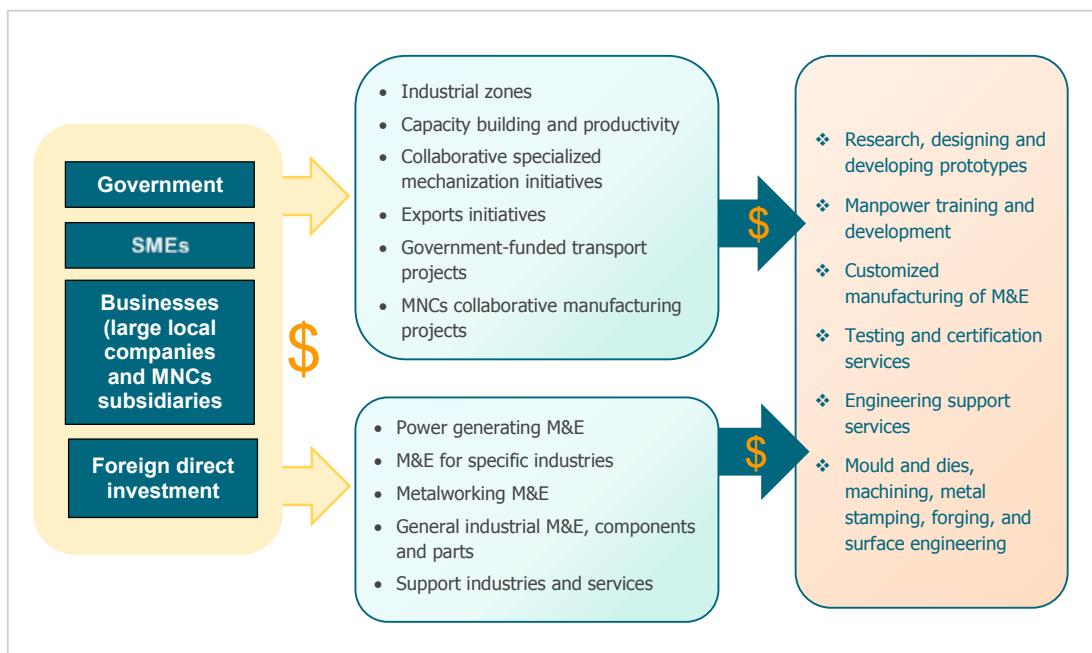


Figure 5.4 Inter-industry Value Chain Analysis

Source: Monash University Malaysia, 2016

5.4 Diamond of Advantage

While growth prospects for industries in the M&E cluster could be described as modest, there are pockets of excellence and optimism to secure competitive leverage in identifiable industries. For example, demands for M&E for specific industries in electrical and electronics, agriculture, aerospace, medical and oil and gas, among others, offers prospects for continuing survival. While senior executives are currently less optimistic as the industries come to terms with a mix of structural and market issues, including cheap imports, they also recognise the longer term export potential in cross-fertilising their expertise in M&E with customers' requirements in specific industries. Confidence is high to develop further their relationships with foreign experts. However, government role on tax incentives, reinvestment allowance and import duty exemption could disrupt growth potential.

At a regional level, and for Selangor, particularly with businesses operating in the metal working M&E and general industrial M&E, access to financial support from the government and banks, sympathetic local councils on matters of land acquisition to facilitate expansion, and access to skilled engineering workforce, are areas of most concern to M&E businesses. These input factors limits their ability to invest in research and development, expand current capacity, and engage in high - value adding production process activities (See Figure 5.5).

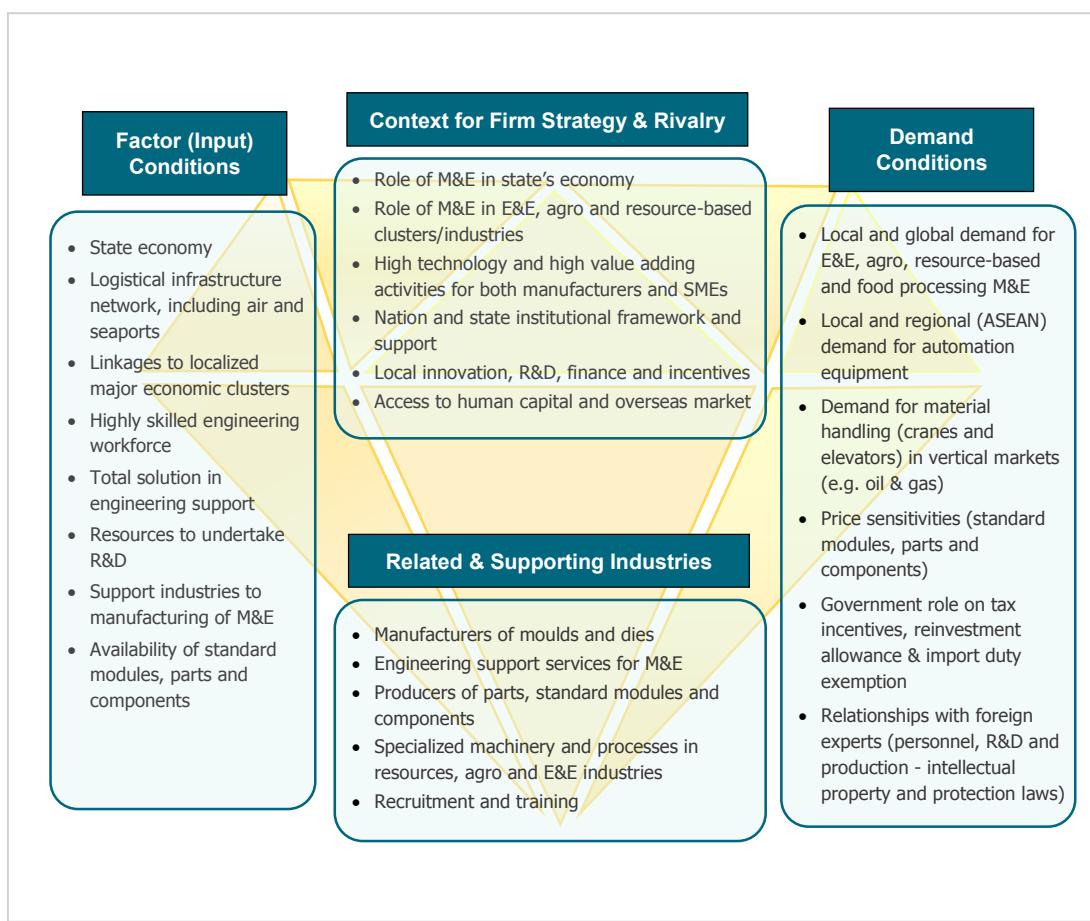


Figure 5.5 Diamond of Advantages

Source: Monash University Malaysia, 2016

Not surprisingly, they are anxious about their future, as they grow increasingly reliance on foreign imports to fill gaps in the value chain. The speed of technological change and innovation in production are threats that will result in more businesses focusing on low value-adding modular manufacturing and trading activities, to maintain customer business and trust. As one executive notes,

“Our competitors are getting more high-tech mainly because they have more resources, more supportive industries. We feel there’s a need to do more catch up. So what we do is, when we work with OEM or service providers in overseas, we actually cut short our learning curve”

The context in which firm strategy and rivalry will evolve will be shaped by firms' entrepreneurial drive for survival, in the presence of intense local competition, with declining profit margins. Investment in R&D and innovation, and a business model that increasingly includes trading and original equipment manufacturing, forms the context for firms' strategy and rivalry. In Selangor, there is also the by-laws issue.

As one executive says,

"Because to set up business, ok, to set up a company, in Selangor itself, there are a lot of by-law that we have to comply with, and a lot of these by-laws are not business friendly".

Ironically, the call for more collaborative relationships between firms, and between firms and government that can strengthen the ecosystem of partnerships that businesses need to effectively leverage their capabilities is not lost among the executives we talked to. Says another executive "Most of the time, they know what's going on in our own industries, but I feel that the relationship between the whole cluster here can still be improved.

Working together takes on greater urgency, especially among SMEs in pure play general industrial or metalworking M&E, or as a key player in engineering support services (moulds and dies, casting machining, metal stamping, machining). Working together is necessary, in ensuring more balanced cluster development outcomes that consider SMEs perspectives. The loose clustering of SMEs that are involved in manufacturing of moulds and dies, various types of metal stamping that is typical of a matured "brick and mortar" industry, could, therefore be better coordinated with other supporting industries, such as recruitment and training.

As it stands now, the supporting industries in Selangor is a major gap in the value chain. As one executive observes,

"In Taiwan, their secondary or supporting industries are very strong. If you want to make something, you can go to an area that they have so many companies making the same thing or willing to study your requirements to come up with some R&D. In Malaysia, if we want to make certain parts or systems, we have to deal with so many people, explain to so many people so many times. We hope there's one centralised R&D centre for us to go to for help"

5.5 SWOT Analysis

Within the machinery and engineering equipment (M&E) cluster environment, senior executives are very wary of a broad range of macroeconomic threats (See Figure 5.6). The difficulty in attracting producers of high technology machinery from developed countries to expand operations in Malaysia is a major concern. Concerns over competitive threats posed by regional players and cheap imports from China and Vietnam, greatly complicate local players' motivation to engage in high value adding R&D and D&D initiatives. The inability to comply with quality of production standards, not just local safety standards, also limits export opportunities.

Despite these challenges, executives sees strong demand for highly specialised and high tech precision machinery and equipment in electrical and electronics, oil and gas, transportation,

agriculture and food manufacturing industry. They also recognised development of prototypes for localised mechanisation requirements.

These opportunities, as one senior executive says,

“...allow them to leverage off what has essentially being a brick and mortar business, to one that transcend this or complement their existing focus.”

While a large number of SMEs (80%) that are capable of producing machinery and equipment forms the bulk of the M&E cluster, they are also supported by a wide range of engineering services, which are also mainly SMEs.

Getting the SMEs to work together, across both the M&E and ESI, to build capacity and to drive growth through export, rather than competing internally with each other, of course, is easier say than done. The heightened awareness of the need for the State government to work with M&E and ESI businesses, through proactive initiatives like better communications, trade shows, and incentives for investment and R&D&D projects, are among some suggestions put forth by executives during the face-to-face interviews.

While businesses in the M&E and ESI are working hard to survive, there are also structural and market weaknesses and/or gaps in the value chain that impacts on continuous and sustainable technical, technology and market engagements. They have concerns over limited access to finance, technology, talent, and availability of reasonably priced land, to expand their business. While reliance on imports is needed to drive growth in the manufacturing industry is a business reality, the State will, at some time, need to find new ways of thinking, working and driving high - value adding production and R&D activities in the State's' M&E industry.

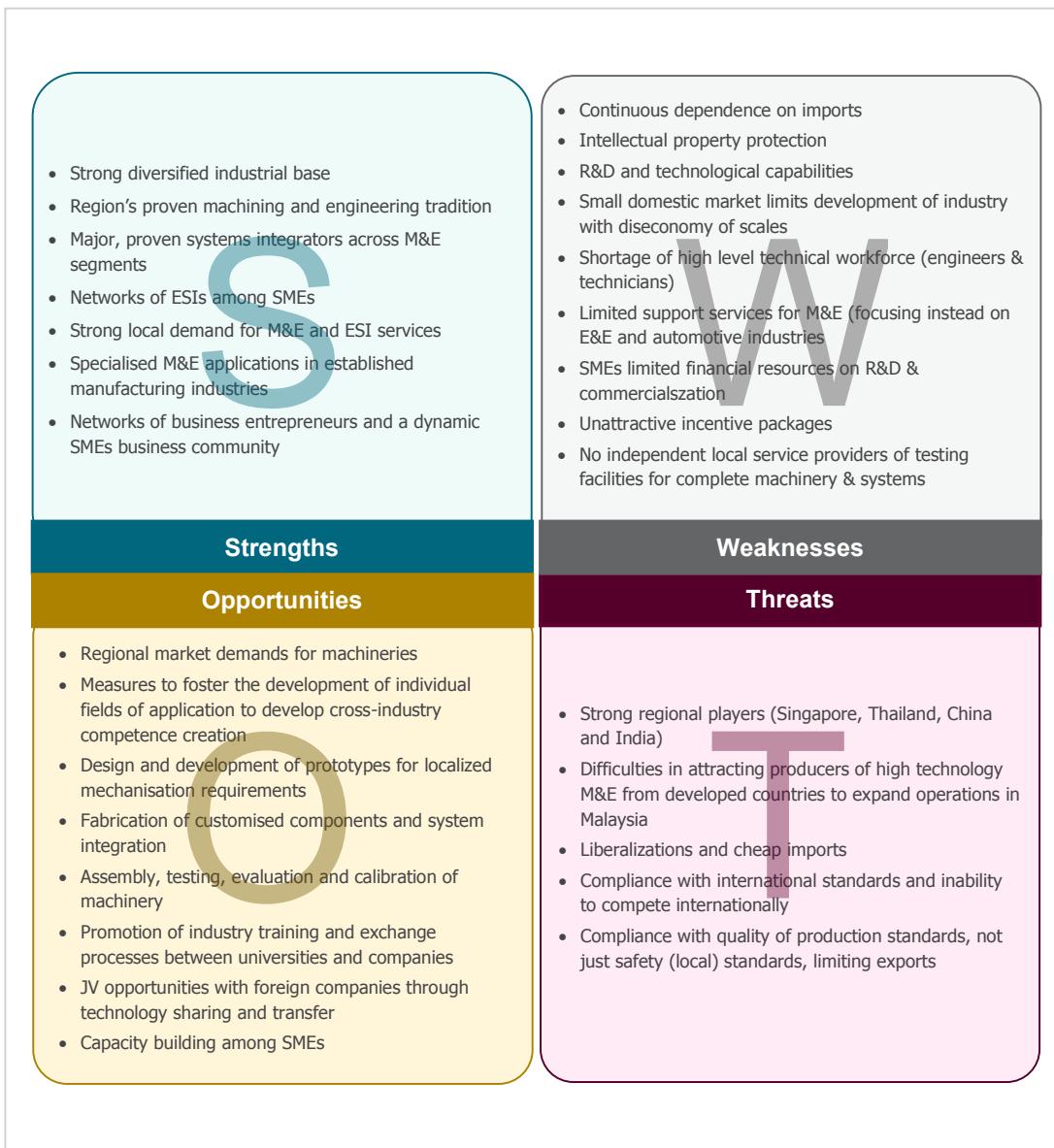


Figure 5.6 SWOT Analysis

Source: Monash University Malaysia, 2016

5.6 Relational Network Impact Analysis

In view of the technical complexity of specialised, often low volume parts and modules, as input factors to cater for the outsourcing and procurement needs of demanding customers for an integrated or total engineering solution, it is not surprising that strong interactional ties exists between key stakeholders in the cluster (See Figure 5.7). Products corresponding to the machinery and engineering industry, such as turbines, boilers, elevators, lifts and specialised M&E for specific industries, are typically housed and assembled in MNCs, large and Mid-Tier local companies. They manufacture a range of generic and specialist engineering that are sold and delivered locally and overseas, to companies in the oil and gas, automotive, agricultural, packaging, aerospace and electrical and electronics industry.

Relational ties between MNCs and SMEs that are involved in the ESI are typically more transactional in nature. With limited access to finance, increasing presence of foreign competition through cheap imports, and limited opportunity to innovate and engage in R&D activities, SMEs are focusing more and more on MRO, refurbishing old machineries, and engaging in front end applications and OEM.

To compensate for SMEs lack of internal resources and research capabilities, and to compete with emerging ESI power houses in the regional markets, there is a need to rethink (and reboot) SMEs contribution in the M&E value chain, particularly in ESI. As one executive explains,

“A majority of the components to make a mould are coming from overseas because we do not have a big market, and we are not competitive if compared to China and Taiwan. Compared with the Europeans, price-wise we will be competitive, but in terms of quality we are not. For very highly sophisticated mould and die, we used parts and components from Europe, but for very cheap moulds, we use components from China and Taiwan.”

A strong, resilient engineering support services sector that plays a strategic supportive role in the production of machinery and equipment, however, requires strong relational ties between government, academic and vocational institutes. At a State level, there is a need to ensure adequate resources are allocated to R&D, training and development of engineering talent are identified, and investments are made in updating training equipment. While the Federal Government, MNCs, intermediaries and associations are expected to take a leading role in funding R&D, innovation and training, purposeful and sustained commitment is needed if Selangor is to have a much more competitive presence in the M&E space.

One senior executive speaks for his peers in the State's ESI industry on the importance of R&D saying,

"How (why) the Selangor government should seriously look at starting an R&D supporting centre. Just that whatever is being done (so far), the money they have invested on any research centre, they have not live up to the expectations. (And there is an opportunity) where the government can step in and do something for the investors in the industry here in Selangor. In the R&D site, provide certain funds and get the private sectors to be involved and see what they want and the things that they can do."

From the existing network of unknown, and at times, distant and competitive relational ties between stakeholders, the State government ought to take a holistic approach in ensuring stakeholders operating in various sectors in M&E and ESI work together. Citing Singapore as a case study, one senior executive says,

"It (Singapore) is one manufacturing centre. You go in, they give you a list of machinery and equipment they have (always the latest they have in the world where you can buy.) They would be all there. And the centre has 500+ staffs. Out of the 500+ staffs, more than 50% are PhD and post-PhD. And they work very closely with the industry. They need the industry. Because they work with government, when government want to bring aerospace or further develop aerospace, these are the people who study the process. For aerospace components or for engine, whatever you need is available. How many hundred pieces of equipment or parts we need. How many we can make in Singapore. They already studied. They already give you the success. So they build the cluster. So the cluster will be very easy to go there and access the technologies they have."

On the regional and global front, our research suggest that opportunities exist for Selangor to add value to the machineries they are making for: (a) specialised M&E in established industries (e.g. food processing, automotive, aerospace, medical rubber gloves, electrical and electronics) and, (b) for emergent industries (examples high value-added medical devices, pure play engineering in Aerospace, precision and surface engineering in M&E).

As another senior executive says,

"In the field of metal casting, the really high - value added is investment in casting. You know, casting for aerospace and turbine. If you talk about future, about high value added, it is all these investment casting. But we don't have them here."

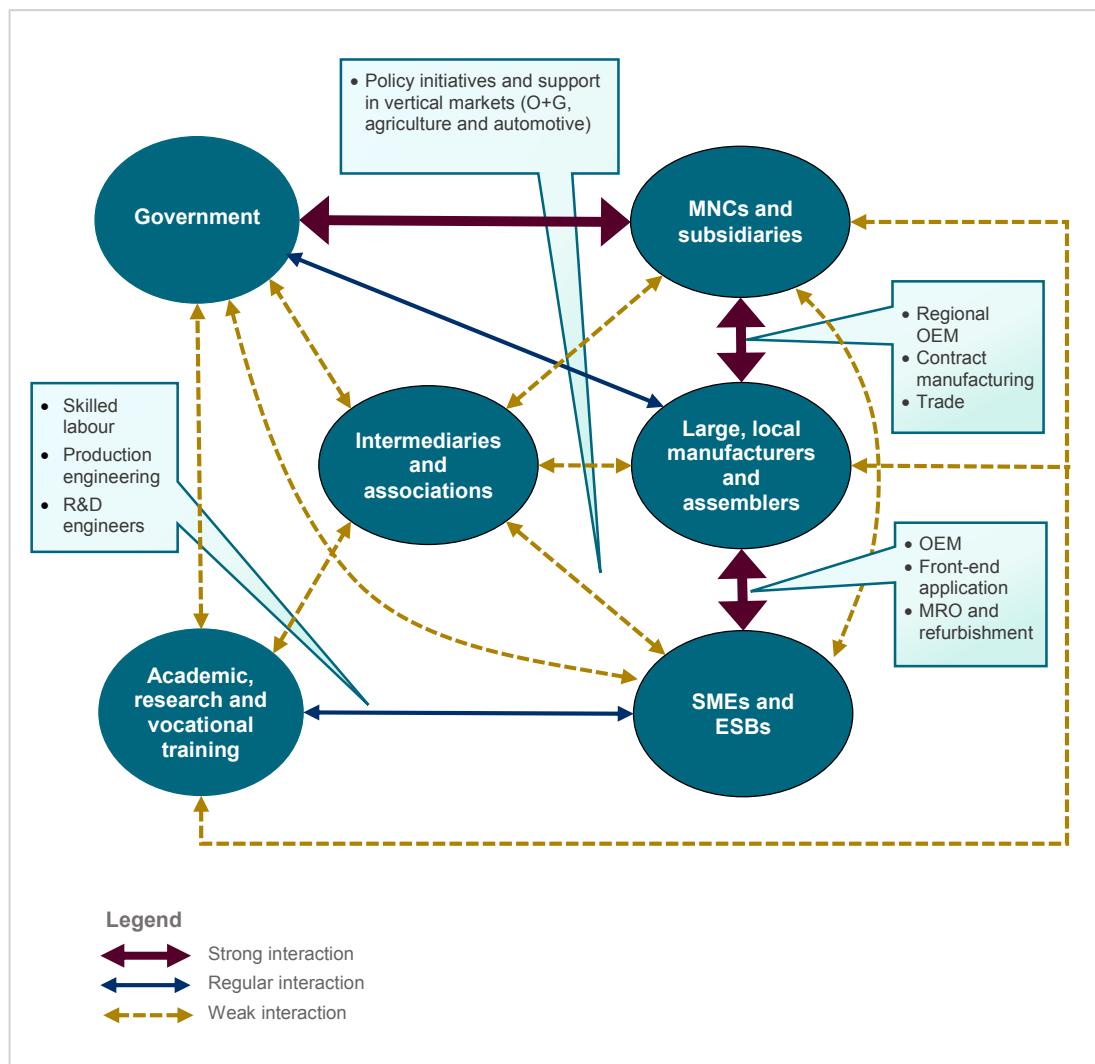


Figure 5.7 Macro Analysis

Source: Monash University Malaysia, 2016

5.7 Summary of Online Survey Findings

- Out of the 167 interviews conducted on-line, **26% (44)** of the businesses operates in the Machinery and Engineering Cluster (MEC).
- **52%** said the business environment will either **change for the worse** over the next 2-3 years. One in five (21%) think that business environment will change for the better.
- **59%** remained very **confident or somewhat confident** about their company's business prospect over the next 2-3 years.
- **74%** described their industry as "highly competitive", **48%** say **buyers have increasing buying power** while **41%** thinks that there are **too many cheap imports**.
- Heavy dependence on local market local market (**75%**), heavy reliance on labour (**50%**) and strong local market wisdom (**46%**) were identified as the top three capabilities of local firms and suppliers operating in the MEC.
- The issues identified as having the most impact on businesses in the MEC over the next 2-3 years are **business environment (68%)**, **availability of labour (39%)** followed by **availability of talent, access to export markets, state government regulations (14% each)**.
- **16%** of businesses in the MEC say the State Government has been **inhibitive/constraining** in the developing their industry. **73%** describe the state government's role as being **supportive or facilitative**.
- **77%** thought that industry associations, academic and research institutions were **supportive or facilitative** in the development of their industry while **18%** described them as somewhat **inhibitive or constraining**.
- **41%** of businesses in the MEC rated their cluster among the **top two growth** cluster over the next 5 years.
- One in two businesses (**50%**) in the MEC indicated that their sales and marketing priority for the next 2-3 years would be to **concentrate on existing products/services but seeking new markets**. **22%** would focus on servicing existing markets with existing products/services.
- **64%** say **local sales constituted 100% of their total sales over the last 12 months**. **18%** reported **export sales of more than 30%**.

5.8 Conclusion and Recommendations

What are some of the change initiatives Selangor could consider in developing a high value adding M&E cluster, taking into account the nature and structure of the sectors that forms the M&E cluster, capabilities of cluster actors and cluster governance (see Table 5.5).

5.8.1 Recommendations

Our research suggests the following initiatives could be key to success. They include:

1. Create regional, cross-industry competencies and specialisations

Key industry stakeholders in both the M&E and in Engineering Support Services, including government agencies and associations, must create a regional unified vision, convene to identify respective and collective goals, and act as a collaborator group that leads the development of a local cluster mentality. The cluster should mix-and-match the region's core competencies in identifiable segments (e.g. general/specialised industry) by specific applications (e.g. moulds and dies; frames), by industry (e.g. automotive, aerospace, E&E and agriculture (palm oil)). The aim is to create regional, cross-industry M&E competencies and specialisations.

2. Set up a State's-based R&D centre in M&E Services

Revisit and review current State's funding and support in R&D investments with a view to creating a State's-based R&D centre in Machinery and Engineering Services, with private sector participation and contributions that could contribute to cross-industry M&E competencies and specialisations. This centre could be set-up in a university, with active participation from academic researchers, and with R&D and investment project financing by private equity and support from the State government through seed grants, R&D incentives and export incentives.

3. More and better vocational hands-on training and development programs

This could be modelled on Germany's vocational training programs, and now adopted in Penang. This, in turn, will provide much needed training and development for students and key stakeholders, create R&D with the knowledge, tools and connections businesses need, to move up the value chain, and achieve commercial export success. The training could combine the benefits of classroom-based and on-the-job training over a period of two to three years, and is specifically geared to meet industry need.

4. Documenting and formalising existing and new relationships various stakeholders

Given the fractured nature of the industry, it is perhaps timely to start documenting and formalising existing and new relationships various stakeholders have with each other, and sharing them with others in the networks, and perhaps, making public some of these relationships. A formally, prescribed workgroups committee and/or emergent coalitions in M&E and ESI could then be formed to examine industry and sub-sector productivity, technology, core competencies between stakeholders and cross-industry competencies. The aim is to formulate a region-specific cluster development plan, with region-specified measures to foster the development of clusters in individual fields of technology, and ultimately, the creation of a unique region cross-industry competence.

5. Incentives for investment projects among technologically start-ups and/or among existing businesses

Especially, as they fit the needs of M&E and ESI businesses' diverse economic activities, at different stages of the production and/or investment process, without resorting to cheap imports, modular assembly and/or refurbishment exercise that do not add value. This includes identifying targeted incentives for specialised applications in specific industry such as electrical and electronic and aerospace. Of more immediate concern is the need for effective and efficient use of existing infrastructure facilities, including the replacement of obsolete training equipment, opportunities to acquire land for acquisition for expansion, without the inflated price and/or lease buy-back option.

6. Building up a workforce through further subsidies

Labour-related incentives play a significant role in reducing the operational costs incurred by new and existing businesses. The range of programs offered can include recruitment support, training support through dual education system/internships, and wage subsidies. These incentives could coincide with location-based incentives, focusing on the development of the automotive hub in Northern Selangor, Aerospace City, Subang, and major food processors in automation in the Halal Hub.

Next, pursue investments from large local and foreign MNCs in elevators, turbines, and in specialist industries through identifiable gaps in the cluster, particularly high end precision engineering, surface engineering, and mouldings, as they interface with those in agricultural (oil palm, Bio Tech), electrical and electronics (IoT) and transportation (aerospace) in the State.

7. A marketing and branding “Made in Selangor” strategy for Selangor’s M&E and ESI industries

This could be created by tapping and leveraging off the region's vast networks of SMEs, potential development of the region's cross-industry competencies and specialisations, setting up a State's-based R&D centre in M&E Services, new incentives for investment

projects and access to a quality workforce and infrastructure. Marketing and branding could be further enhanced by increasing SMEs awareness on the importance of R&D&D in developing and creating cluster support, the pressure to innovate, while gaining attention of venture capital and/or capitalists.

8. Target the right areas

Nationally and regionally, the targeted M&E subsectors could include machine tools, material handling, robotics and factory automation equipment, packaging machinery, specialised process machinery or equipment for specific industry and modules and component of the above⁸², Malaysia's Machinery & Equipment and Engineering Support Industries). In the ESI, the targeted areas could include the following (based on competency and/or competitive advantage, vertical markets and/or industries currently serving, and growth opportunities).⁸³

- **Moulds and dies** (recognised as leading ESI / capacity to manufacture most types of M&D to complement needs of manufacturing sector / opportunities for large moulds & dies > 10 MT)
- **Machining** (capacity to meet most machining needs, technological capabilities with state-of-the-art tools / diversification in automation system (especially for E&E) / specialised machining services (oil and gas, aerospace and medical))
- **Metal casting** (traditional foundry industry in tin, rubber and palm oil / spare parts, including palm oil, automotive, elevator etc. / large component casting (more than 10MT))
- **Metal stamping** (established industry / across all industries in E&E, automotive, M&E, precision measuring and testing equipment / capacity, technical capabilities and scale)
- **Surface engineering** (across all manufacturing industry in plating operations / mainly MNCs in E&E and automotive industries / opportunities in oil and gas, aerospace, medical, LED and solar/photovoltaic industries)
- **Heat treatment** (diverse range of metal products / increasingly automotive industry / expansion activities in mould and die)
- **Forging** (small and medium forged parts, mainly automotive & general manufacturing / increasingly oil and gas industry / importation of large forgings)
- **Metal fabrication** (world class and well-established / oil and gas, building, civil construction & infrastructure, turnkey projects / overseas fabrication market in building and construction)

⁸² MIDA, 2014, "Malaysia's Machinery & Equipment and Engineering Support Industries"

⁸³ Ibid.

5.8.2 Summary of Cluster Characteristics and Governances

Characteristics of Machinery & Engineering Cluster								
Cluster	Nature and Structure of Industry			Capabilities of Cluster Actors			Cluster Governance	
	Capital Intensive	Technology-driven	Structure of Cluster Ownership	Local Private Firms / Selangor	Intermediary Institutions (association, academic, research institute)	Government Agencies / Selangor		
General industries M&E and parts	High	Moderately fast changing technology	Clusters of MNCs subsidiaries and local manufacturers	High level of local wisdom and expertise providing engineering support and services	Reliance on MNCs subsidiaries and large local firms	Supportive and facilitative	Local intermediary institution coordinated	
Specialised M&E for specific industries	High	Moderately fast changing technology	Clusters of large firms and local suppliers (280+) / SMEs	High level of local wisdom and expertise in custom designed manufacturing	Reliance on large local firms and government, developing networks	Supportive and facilitating supportive	Local intermediary institution coordinated and some government coordination	
Power generating M&E	Medium	Low to Moderately fast changing technology	Clusters of large local firms catering to the local market, increasing export activities	High level of local firms with specialised manufacturing expertise	Limited resources: Reliance on large local firms	Facilitating and pragmatic	Local intermediary institution coordinated	
Metalworking M&E	Medium	Low to Moderately fast changing technology	Clusters of MNCs subsidiaries and local manufacturers	High level of local wisdom and expertise in automotive, E&E and engineering support industry	Limited resources: Reliance on large local firms	Facilitating and pragmatic	Local intermediary institution coordinated	

Table 5.5 Summary of Cluster Characteristics and Cluster Governance

Source: Monash University Malaysia, 2016

5.9 Best Practices

Case Study 1: The Machinery and Equipment Industry in Germany

Background

Machinery & Equipment (M&E) is the second largest and most innovative industry sector in Germany. It is one of the technological motors that drive Germany as a high-tech nation, and one which combines all of the key future technologies including electronics, robotics, materials, and software. Germany's highly industrialised environment is just one of the reasons for the continued success of the M&E industry.

Relevance

Germany's largest industries (chemicals, electronics, automotive, and the food & beverage sectors) are the four largest client sectors driving market growth. New market opportunities are also opening up in the thriving renewable energies & resources sector. This is not quite unlike this study focus on the electrical and electronics, transportation equipment and food clusters and identifiable, growth industries within them.

Findings

Key success factors in the development of Germany's M&E industry sector include:

1. **M&E Innovation Cluster:** The decentralised nature of the M&E industry has allowed innovation clusters to develop strong science and industry networks. The German federal government's cluster strategy encompasses the following activities:
 - Competition to promote exchange processes between universities and companies
 - Region-specified measures to foster the development of clusters
 - Measures to foster the development of clusters in individual fields of technology
 - Cross-industry competence creation
 - Cutting-edge cluster competition
2. Complete value chain coverage through numerous research institutions, close proximity to key supplier industries, strong industry base to promote innovation and R&D excellence, and service & maintenance and repair & overhaul
3. **Dynamic Labour Market:** A tradition of quality, world class education standards, dual education system (combining the benefits of classroom-based and on-the-job training over a period of two to three years – is specifically geared to meet industry need), and competitive labour costs
4. **Creating Investment Stability:** Sound and secure legal framework, open and transparent markets, reliable logistics infrastructure and internationally competitive tax conditions
5. **Financial Incentives:** Investment project financing by private equity and bank loans R&D incentives and labour-related incentives

Source: http://www.gtai.de/GTAI/Content/EN/Invest/_SharedDocs/Downloads/GTAI/Industry-overviews/industry-overview-machinery-equipment-en.pdf?v=9

Cluster Specific Insights 05

Transport and Equipment

6.0 Transport Equipment Cluster

The State's ability to leverage existing value-add contributions to regional and global transport businesses supply chain, and moving beyond a market - domestication agenda, will impact the development of its transport equipment cluster. Specific and purpose-driven infrastructure development activities could focus on advanced MRO, modular manufacturing, EEV, Aerospace City (Subang), Northern Automotive Hub, "last mile connectivity" & the transport and logistics service hub.

Key Takeaways:

- Influential regulations needed to align policy and marketing initiatives in the aerospace industry, on the back of Subang Airport, Aerospace City (Subang), KLIA 1 and KLIA 2 infrastructure's outgrowths.
- Targeted initiatives needed to pursue investments in: (a) pure play engineering, design and analysis; (b) advanced maintenance, repair and operation, engineering and research; and (c) aerospace modular manufacturing through OEM arrangement building.
- Opportunities exist to develop a critical mass of transport equipment manufacturers and assemblers in Northern Selangor, through targeted promotional efforts to encourage location and/or relocation.
- The absence of a national shipping plan has limited the State's capacity to develop the sector, as is the heavy reliance on government projects that has dampened the sector's international competitiveness, including the rail sector
- Through mergers, partnerships and joint ventures with regional auto companies, automotive manufacturers and suppliers could increase their production capacity and contributes to the regional automotive supply chain.
- The State's development of Port Klang as a maritime centre, KLIA as an air cargo hub, and road transport productivity that improved last mile connectivity, will impact the State's efforts in creating a vibrant and integrated transport and logistics hub.
- The local skilled workforce for the transportation equipment manufacturing sector remains an on-going issue, with shortage in sectors that require engineers, designers, technician, and system analysts.

6.1 Introduction

With national average export earnings of RM5.9 billion from 2011 to 2014 in the automotive industry, is there room for increased export capacity, in the presence of trade liberalisation and integration? Could the aerospace industry, averaging RM2.6 billion and accounting for 26% of national export earnings in transportation equipment⁸⁴, realign and integrate itself better in the global value chain? While the local aerospace industry generated RM19bil in revenue and RM4.2bil in investments, with 19,500 jobs created in 2014, is there room for more exponential growth, with prediction that by 2034 it is estimated that there will be 36,000 aircraft worldwide, and Asia will require 13,000 aircraft to meet demand?⁸⁵

With the State's rich and established network of transport infrastructure that includes land, air and sea, could the State capitalised on untapped opportunities in the shipbuilding and ship repair industry? With approved investment totalling RM3.1 billion⁸⁶, should Selangor rethink customer value in how they compete with their East Malaysia counterparts in manufacturing, shipbuilding and repair (SBSR)? And with a rail sector that is geared almost entirely to the local market, in the provision of public transport rail services, what are the growth potentials in local employment and export earnings, both key indicators in the development of clusters?

In the presence of an ever-increasing set of challenges, the question the State's policy makers and business executives operating in the transportation cluster ought to be asking are:

1. How should the State leverage on the existing institutional, structural and investments, while having the confidence to explore beyond a market - domestication agenda, and consider the wider range of regional and global business market opportunities, to drive export revenue and employment?
2. In the presence of established and emergent aerospace, automotive and shipping clusters in regional markets, how should policy makers initiate a more specific, purpose-driven transportation cluster agenda, within the context of the nation's aerospace and automotive blueprint, and an impending national shipping plan to be finalise, to drive-value adding in a regional and global context?

A paradigm shift is needed as the speed of globalisation in the automotive industry picks up speed, with regional and global automotive companies managing their value chain.

⁸⁴ MIDA, 2014

⁸⁵ Ling., D., 2014, "Aerospace Globalisation – The Next Wave Presentation"

⁸⁶ MIDA, 2014

One senior automotive executive in Selangor remarks,

“Despite 30 years of making cars in the country, and it being heavily politicised, the sector can best be characterised by limited opportunities for the automotive companies willing to extend their capabilities in the value chain, beyond the domestic market and making attempts to work with the global community, especially those that are keen to share and/or transfer technology.”

Similarly, parallel sentiments are echoed in the shipping industry with one executive we interviewed likening it to “oxygen (we take for granted) but will eventually seek it out once we are deprived of it.” In a recent presentation aptly named “Opportunities Lost – The need for a Shipping Master Plan”⁸⁷, Malaysia shipping industry is on the “retreat” on several fronts. They include shipping tonnage, shipping enterprises (loss making shipping companies), and an unbalanced reliance on foreign owned and registered ships impacting Malaysia shipping with impact on employment and revenue contributions.

The nation’s, in particular Selangor’s strong comparative advantage in the Aerospace’s Commercial Maintenance, Repair and Operation (MRO) sector, presents an excellent opportunity to drive and steer developmental growth in the aerospace cluster, despite strong regional competition from China, India and Singapore. This includes building on emergent strengths in aerospace engineering and design services, while capitalising on opportunities in aerospace modular manufacturing in OEM.

These developments should be reinforced by increased infrastructure spending on the “Place Marketing of Aerospace City, Subang”, through location and relocation incentives, developing further existing infrastructure, better access to a pool of engineering skills base, and also a workforce ideally proficient in English. The State should also leverage existing infrastructure offered by KLIA 1 and KLIA 2, with the objective of further enhancing Selangor’s contributory role in Airbus and Boeing regional and global value chain.

⁸⁷ Yusof, 2015, “Opportunities Lost - The Need for a Shipping Master Plan” - In Malaysia Shipping Master Plan: Revitalizing Shipping Industry”

6.2 Scope

The transportation equipment cluster consists of private sector companies that participate in the automotive, aviation, shipping and rail sub-sectors. They are involved primarily in manufacturing, building and constructing (ships), design and development, maintenance, repair and overhaul, provision of engineering services, with differentiated pattern of innovation and technological change in each of these sectors. Indirect support includes businesses that provide workforce development and training, and a loose network of related support services and auxiliary services in inter-related network of transport functions.

While this definition do not include emerging and developing industries such as pure play engineering and industrial engineering services, we have included them in this study due to their increasingly important contributions in the regional and global supply chain vis-à-vis partnership arrangements with Airbus, Boeing, and Tier 1 suppliers. These industries also impacts on the very important local areas like workforce development and training in engineering.

6.3 Cluster Map

Numerous and various types of firms, associations, government bodies, suppliers, service providers and supporting works and affiliations constitute the transport equipment cluster (see Figure 6.1). They include private companies that participate in four key sectors, namely automotive, aviation, shipping and rail. With each sector tailoring their highly dependent and homogenous resources to specific customer requirements, often with a silo-like domestic market focus, it is no coincidence these sectors have different business priorities.

Against the backdrop of the nation's most visible transportation blueprints, namely the National Automotive Policy (2015) and National Aviation Policy (2015), sentiments on growth and investment opportunities in terms of employment and export earnings, of course, varies from state to state. With its strong transportation infrastructure networks, strong local tenants that include subsidiaries of multinationals, a comparative advantage in cost of doing business with better cost structure and a densely populated metropolis, Selangor is ideally placed to capitalise on current and future local and foreign investments.

Particularly in the automotive and aerospace sub-sectors, the State is witnessing greater interest and dynamism in investment opportunities. This ought to lead to greater export earnings and employment opportunities, and importantly, a reduced reliance on domestic markets-led growth for their survival. These two industries have existed for a long time in Selangor. But with challenges thrown up by changes in the local, regional and global automotive and aerospace competitive landscape (See Figure 6.2), a rethink of the State's fiscal and financial incentives is needed to stimulate deliberate, targeted and focussed growth, especially with emerging, new cross-sectors transportation ecosystems.

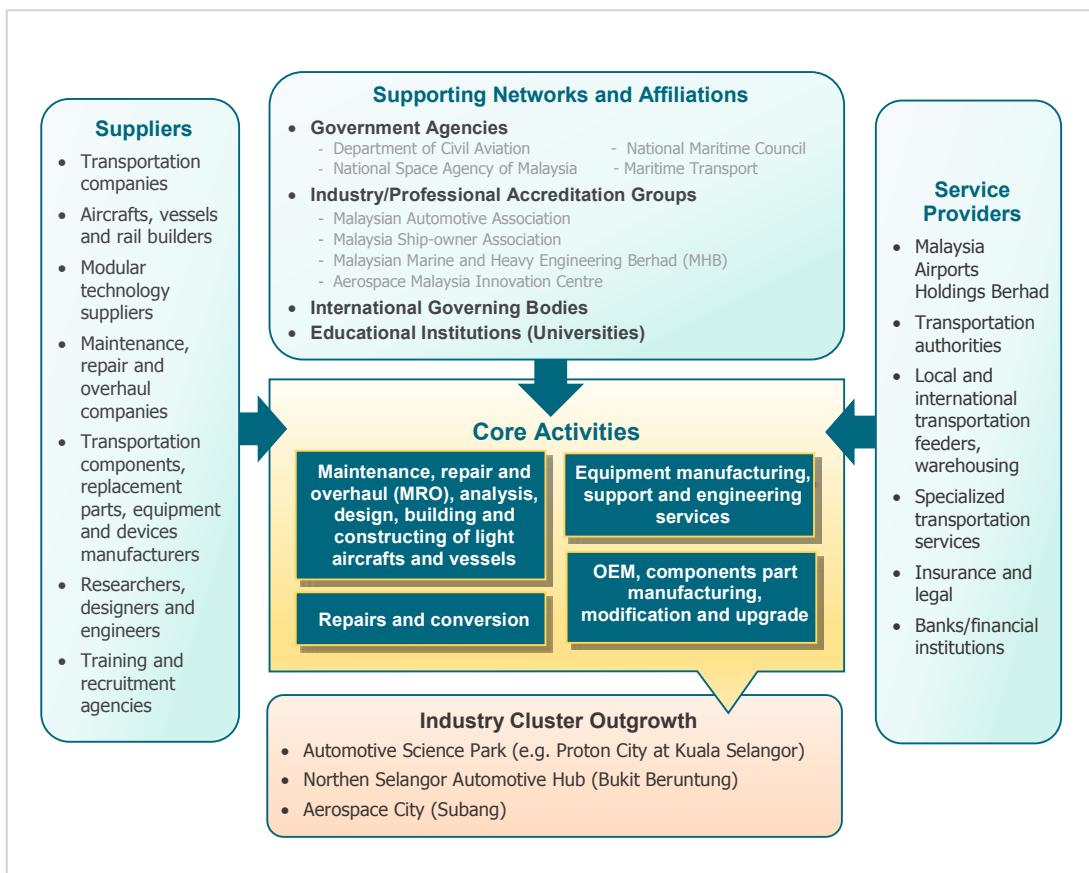


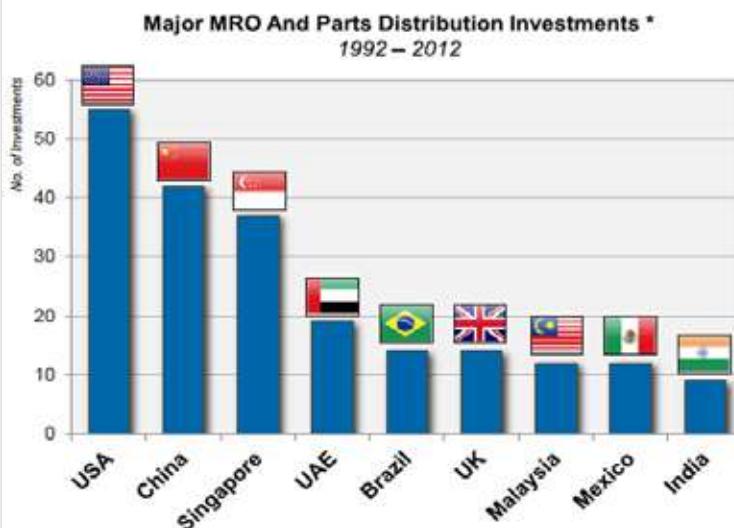
Figure 6.1 Cluster Map

Source: Monash University Malaysia, 2016

For example, Selangor has attracted numerous investments, especially in maintenance, repair and operations (See Figure 6.2). Major MRO players in the State include MAS Aerospace Engineering, SR Technics, Airod Aerospace Technology. Recent, important developments include Airbus's expansion of a joint venture with Malaysia's Sepang Aircraft Engineering (SAE), and the establishment of a new customer services centre adjacent to SAE's Kuala Lumpur facilities. These developments also marked the latest expression of Selangor's strength in MRO recognition. The new agreement will see the construction of a new 13,000-sq-m hangar capable of accommodating three A320s for major maintenance checks. SAE's existing hangar already can hold six single-aisle airplanes at a time.⁸⁸

⁸⁸ Polek, G., "For Boeing and Airbus, Partnerships Proliferate in Asia", AIN Online, February 10, 2014, (<http://www.ainonline.com/aviation-news/aerospace/2014-02-10/boeing-and-airbus-partnerships-proliferate-asia>)

The U.S.A., China and Singapore saw the most MRO and distribution investments



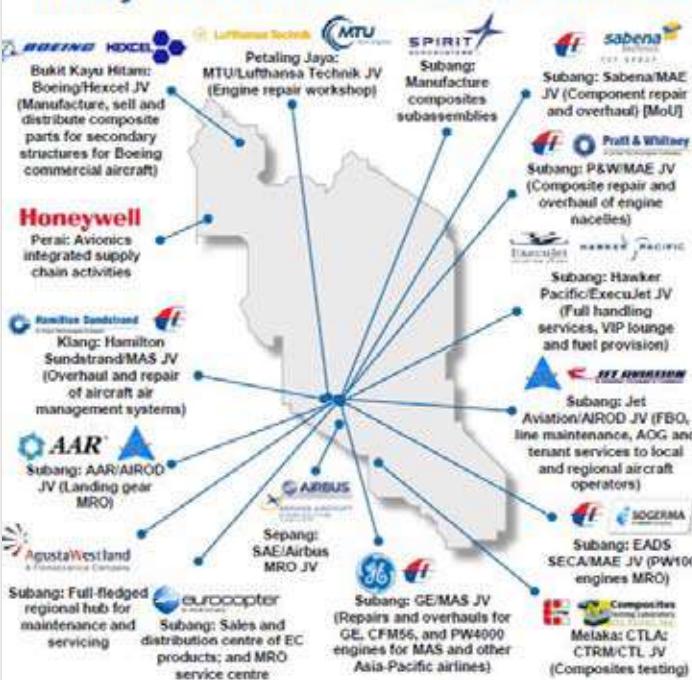
- USA volume led by business jet OEMs establishing their support networks in the 1990s/2000s boom
- OEMs invest in China for market access, labor intensive MRO activities, and to get behind the “tariff wall” and customs, which is inconsistent
- Singapore is favored for capital intensive MRO activities, service parts distribution, and MRO-related R&D

Source: ICF SH&E * Includes joint ventures and organic investments for over 180 OEMs and service providers; excludes acquisitions

Figure 6.2 Aerospace Globalisation: The Next Wave

Source: Ling, 2014, "Aerospace Globalisation – The Next Wave Presentation"

Malaysia has also attracted numerous investments



- Subang is currently the hub for MRO activities in Malaysia; MAE's main facility is at Subang – so co-location makes sense; Development of KLIA as an MRO hub has implications for Subang
- Subang is also a key hub for business aviation & rotary wing
- Penang is a major electronics manufacturing hub in the region; Kedah and Melaka has seen some success in composites manufacturing
- Malaysia has comparative advantages in availability of land, good infrastructure and lower labour costs

Figure 6.3 Aerospace Globalisation: The Next Wave

Source: Ling, 2014, "Aerospace Globalisation – The Next Wave Presentation"

Business growth prospects in the aerospace industry now extends beyond Selangor's strength in MRO to include conversion design, built and construction, engineering support and development services (ESI). A major local player is Strand Aerospace Malaysia (SAM) that was programmed to reach a critical mass of 350 engineers by 2013, with an established track record of delivering high value design and analysis engineering services, to aerospace original equipment manufacturers (OEMs) in Europe and America. The company also act as reference for other global OEM's and potential investors to initiate private investment in developing Pure Play Engineering Services solutions in Malaysia, and capitalising on the readily available Malaysian talent pool and growing reputation of the Malaysian Engineering Services Industry, to drive foreign direct investment.⁸⁹

For Selangor, the Aerospace City Subang nexus located in the Malaysia International Aerospace Centre provides the ideal "Place" with its current and future mix of good anchor tenants. This place could potentially offer collaborative partners opportunities to apply and harness their respective capabilities, alter their resource and activities mix, depending on their business needs. Among many of the challenges in this Aerospace City, is an acknowledgement that Subang is currently the hub for MRO activities in Malaysia. MAE's (principal MRO player and a subsidiary of Malaysia Airline) main facility is at Subang, and as such so co-location makes sense, although development of KLIA as an MRO hub has implications for Subang.⁹⁰

In the automotive sector, companies such as Ford Malaysia, Tan Chong Motor, UMW Toyota, Proton and Perodua, with their supporting networks of First, Second and Third-Tier parts and components manufacturers and suppliers, continue to be major employers in the state. A wide range of car and components manufacturing activities are either currently embedded in existing cluster outgrowths, housed within a certain location, or could, in future, be designated a cluster outgrowth by the State.

For example, Shah Alam is an extraordinary automotive manufacturing hub, dominated by the presence of global car manufacturers. Less visible but an equally important new automotive outgrowth is taking place North of Selangor. The area, encompasses communities in Bukit Beruntung, Rawang, Batang Kali, Serendah and Batang Berjuntai, with strong economic growth potential and increasing local and foreign workforce participation – factors that support high wages and improved quality of life (See Figure 6.4).

⁸⁹ PEMANDU, 2011, (http://etp.pemandu.gov.my/8_September_2011-@Strand_Aerospace_Malaysia_Sdn_Bhd_%28SAM%29.aspx)

⁹⁰ Ling, 2014

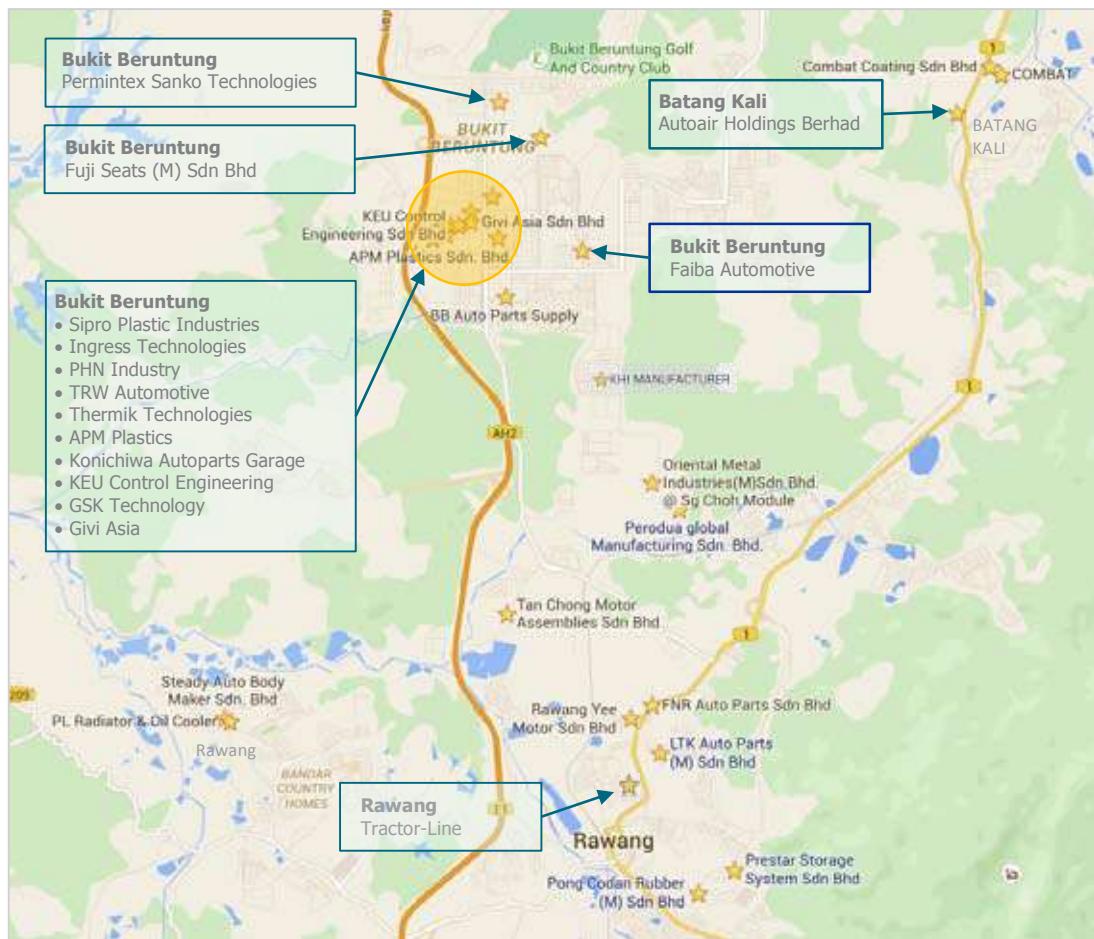


Figure 6.4 Spatial Mapping of Known Stakeholders in the Automotive Sector – Northern Selangor

Source: Monash University Malaysia, 2016

In the rail sector, SCOMI, ABB and Sutera are among some of the key, local players in the manufacturing, assembling and MRO space, while Boustead Shipping and Muhibbah Engineering are major players in the shipping industry, especially in modifications and upgrade of vessels. In shipping, the absence of a national shipping plan has limited the State's capacity to develop the sector, as is the heavy reliance on government projects that has dampedened the sector's international competitiveness. Key activities, resource mix and major stakeholders in the shipping sector are captured in Figure 6.5.

Cause & Effect of National Shipping?

➤ Direct and Indirect Effect:

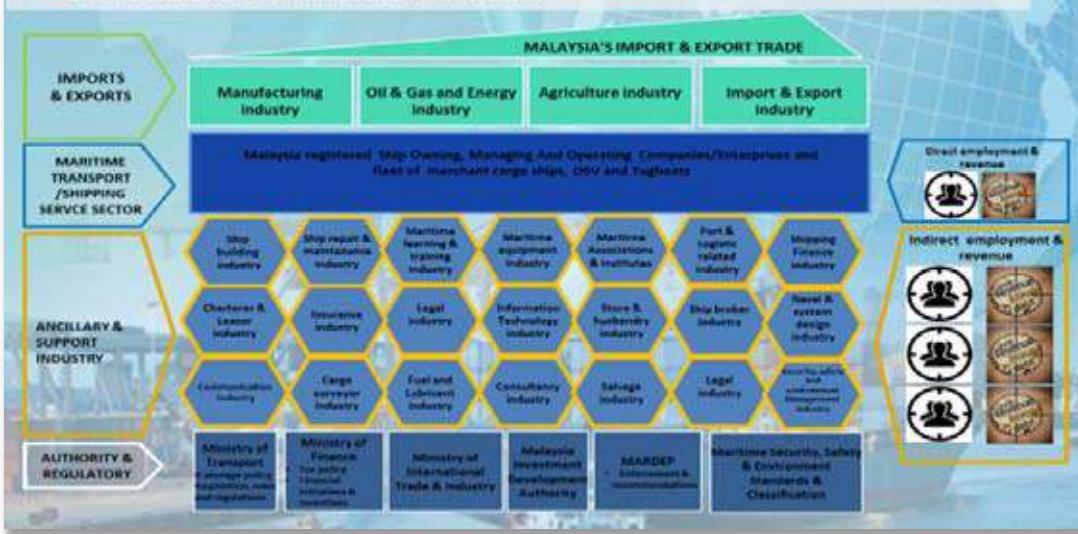


Figure 6.5 Cause and Effect of National Shipping

Source: Yusof, 2015, "Opportunities Lost - The need for a shipping master plan", In *Malaysia Shipping Master Plan: Revitalizing Shipping Industry*"

In the rail sector, future and local demand for public transport, especially in Klang Valley, Greater Klang Valley and Kuala Lumpur, could result in more investments in LRT (Light Rail Transit) and MRT (Mass Rapid Transit). Major resource activities mix, the key players in the rail sector, and their varying business needs, are captured in Figure 6.6 and 6.7.



Figure 6.6 Selected Resource Activities Mix and Key Players in the Rail Sector

Source: Malaysian Industry Government Group for High Technology (MIGHT)

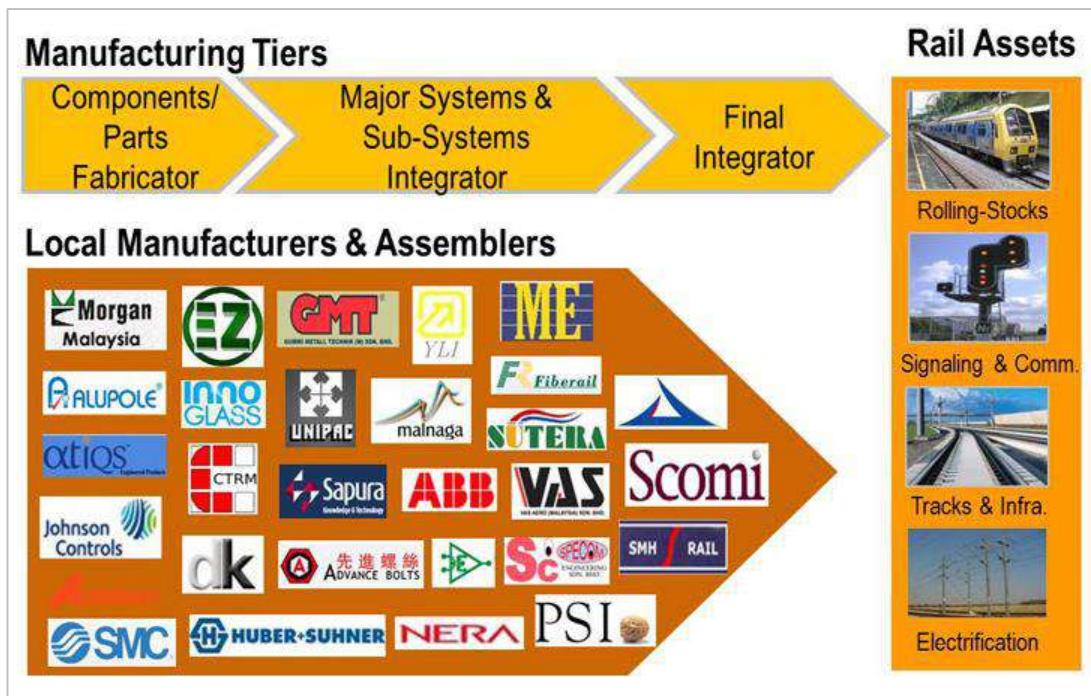


Figure 6.7 Selected Resource Activities Mix and Key Players in the Rail Sector II

Source: Malaysian Industry Government Group for High Technology (MIGHT)

From this cluster, key outgrowths such as the Automotive Science Park/Proton City, Aerospace City, Subang and PKFT Zone have evolved naturally, due to the collective and collaborative activities of stakeholders in the cluster. Many are constituted through federal and state participatory and facilitative regulations that include the setting aside of industrial land to drive economic initiatives.

These actions result in a concentration of higher than expected population that are working there, compared with other industry, and with infrastructure demands that reflects cluster's requirements. Cluster outgrowth could, therefore, be seen as institutionally spearheaded developments that capitalises on historical or existing social and economic evolutions of various firms and organisations operating in this cluster. This is an important distinction because it impacts on State's cluster policies and spending on existing and future infrastructure.

For example, the State's role (levers) in the value chain may be limited to merely facilitative and supportive, especially in projects that are in the advanced stage of execution (for example Transport Master Plan in the North and Aerospace City, Subang in the South). The value-add Selangor provide may, therefore, be limited to reinforcing and upgrade existing infrastructure, through better land and transport management, and better access to the skills of local and foreign assemblers and design engineers. This, however, do not limit the State's initiatives in aggressively targeting selective investments from overseas partners, incentivise high-end value adding engineering services and technology process manufacturing that cuts across sectors, through selective fiscal and financial incentives.

These incentives would, however, have to be benchmarked against major regional players such as Singapore in the aerospace and shipping industry, Thailand and, possibly, Indonesia in the automotive industry. The aim is to establish Selangor value contribution in the regional and global market and/or supply chain, by offering better comparative advantages, while delivering incremental but significant opportunities in new markets. Key areas in which the State could capitalise on includes emerging manufacturing technologies, pure play engineering skills, MRO and MRO-related R&D, and high value-adding modular engineering and design opportunities in the State's transportation equipment cluster.

From our cluster analysis, the State's ability to capitalise on the export markets should also extend to include the aftermarkets automotive components and parts, engagement in joint international collaborative efforts in rail, and OEMs forging strategic partnerships with OES (Original Equipment Supplier) in aerospace. The objective is to ultimately reduce stakeholders (i.e. manufacturers, suppliers, service providers etc.) reliance on the domestic transport market and infrastructural needs for their survival and growth.

Anecdotal evidence from face-to-face interviews also suggest that despite the general reluctance to liberalise the nation's automotive market, entrepreneurial flair among Tier 2 and 3 companies seeking international market expansion have not dampened. New emerging players in the aerospace industry, especially those that deliver value-adding MRO and ESI activities, design and/or built, continue to thrive.

Together with businesses that have expertise in equipment manufacturing (vehicles, vessels and trains) which includes modular technology engineering, together they represents the State's hope for a vibrant transport cluster. Especially when they operate in industries that are capital and technology intensive, requiring substantive investment outlay, and carries substantial risk.

For Selangor, the question pose is "how much influence and/or support should the State government and/or institutions influence cluster outgrowths, without stifling those that have grown naturally and/or grown through effective matching of resources with demands of the clusters at a national level? While Selangor has access to an educated population, a strong economy, well-established network of infrastructure (seaports, airports, roads, and rail), business executives we interviewed says the State could capitalise further on on-going value adding activities to include Advanced MRO, Support and Engineering Services (ESI), large, pure play engineering services, new infrastructure and/or maintenance, modular technology engineering and capacity building (See Figure 6.8):

1. Capacity building through engagement with suppliers seeking international accreditations and certification. For example, STRAND Aerospace Malaysia holds AS EN SJAC (Cert No. 2009/32562) and ISO 9001:2008(Cert No. 2009/32561) certification with a wide scope covering the design and analysis of composite and metal structures components. The company also holds Airbus Approval (Metallic & Composites Cert No. 300135 since 2006)

and is a registered member of the Airbus Supply Chain and has been audited approved by various Airbus Tier 1 and E2S companies.⁹¹

2. Engineering support services, R&D and innovation in design, building and construction of front end application in electrical and electronics. This is seen in the increasing integration of electrical and electronics with automotive technology, that employs advanced testing and design equipment and tools in the development of applications and final products.

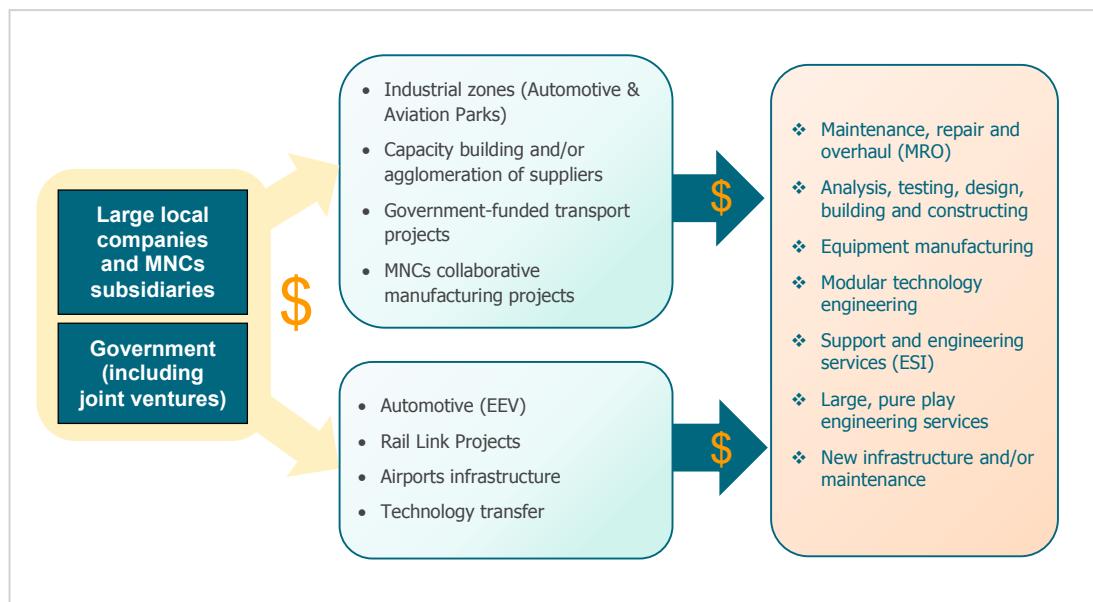


Figure 6.8 Inter-industry Chain Analysis

Source: Monash University Malaysia, 2016

6.4 Diamond of Advantage

The four sub-sectors in the transport equipment cluster placed heavy demands on technology, skilled workforce and capital, as input requirements. Over time, the State has built its competitive advantage by integrating these demands to drive export earnings, while creating a model of private and public transport ownership and usage based on value.

Other key input conditions that continues to drive the State's development of its transportation sectors include continuous upkeep and expansion of airports and seaports, capital expenditure spending, reduced cost of doing business to attract new investments, and the availability of skill sets, to capitalise on the State's strategic role especially in the regional and global aerospace and automotive value chain (See Figure 6.9).

⁹¹ Engineers that the World Can Rely On – STRAND Aerospace Malaysia, (<http://www.matrade.gov.my/en/malaysian-exporters/going-global/exporters-success-stories/strand-aerospace-malaysia-sdn-bhd>)

Specifically, the automotive sub-cluster has, and will, continue to be a source of the nation's pride in its leap towards developed status. This helps explain the nation's vested interest in the development of Proton and Perodua.

At a national level, this provides and explains the context of automotive firms' strategy and rivalry. While hopes are running high with reforms, on the ground, reality does not necessarily match the rhetoric. As one seasoned automotive executive notes,

"It (Players in the industry) underpins concerns over the lack of liberalisation and deregulation to promote and attract foreign firms into the supporting industries, when there is no economy of scale due to protectionist policy."

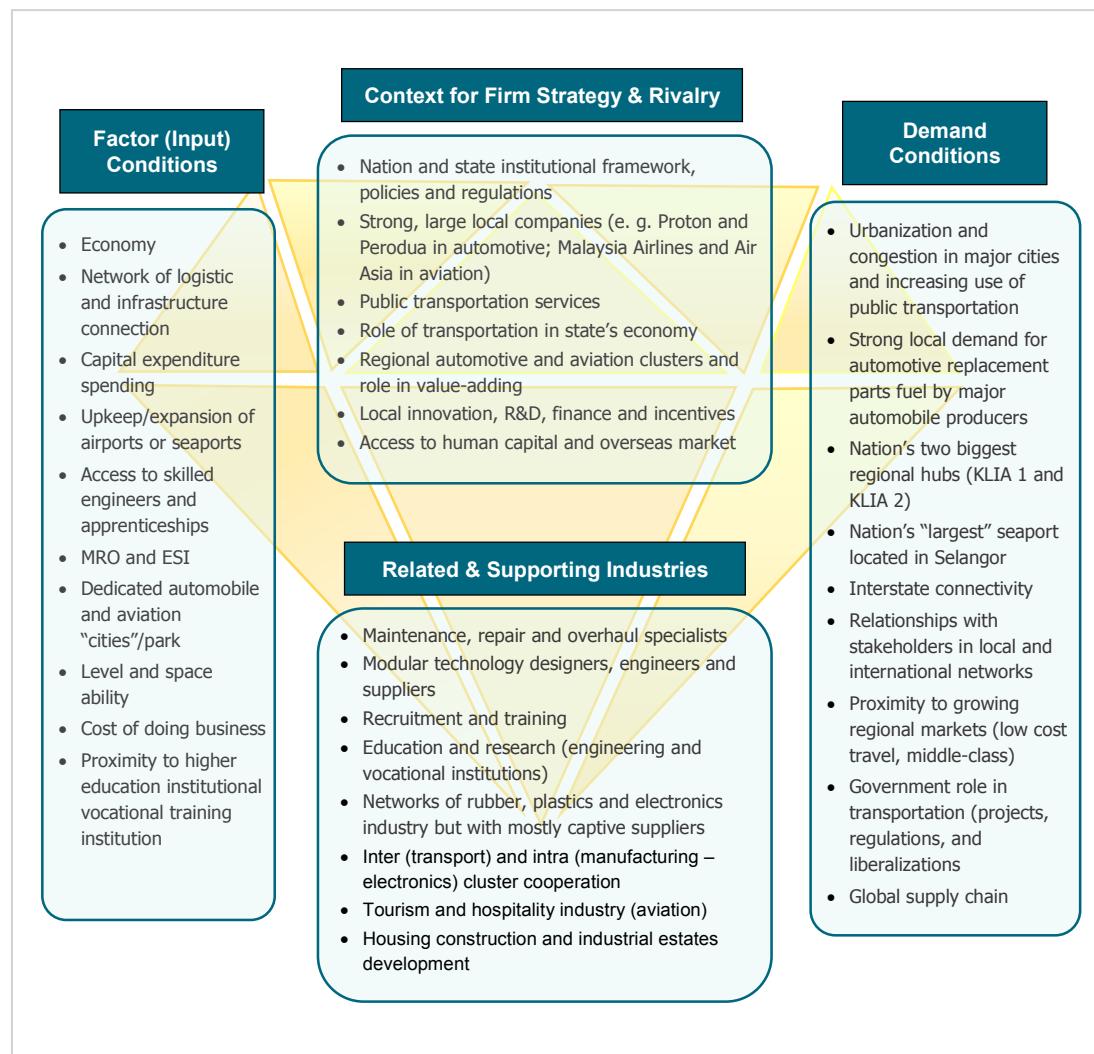


Figure 6.9 Diamond of Advantage

Source: Monash University Malaysia, 2016

This is a recurrent well-known theme in the industry and underpins the context for firm's strategy and rivalry. Internationally, the dominance of Thailand and the emergence of Indonesia as regional automotive hubs, are also cause for concerns.

In the aerospace sector, the State's historical low cost base, reinforced by cost effective man-hours quantum, offers significant competitive advantage in MRO and pure play engineering. The nation's proximity to regional markets, with strong demand for aircrafts such as China, provides significant and sustaining opportunities for aerospace companies in Selangor to play a much more strategic and integrative role in Airbus and Boeing global value chain.

Local rail companies based in Selangor such as Scomi are seeking export revenues through collaboration with international partners, while capitalising on existing and planned local transport infrastructure spending. In shipping, the "industry will, and can be globally competitive, and contribute substantially to the nation's economy if right policy and strategy is formulated and implemented, with all stakeholders working together and unite behind a bold vision".⁹²

In related and supporting industries, Tier 1 suppliers such as DRB Hicom and Pilkington Glass continues to play significant roles in the supply of local innovation infrastructure with strong local automotive assemblers. Other Tier 2 and Tier 3 suppliers (Stamping, plastics, rubber, machining, casting, forging etc.) draws on strong relationship building and innovation capabilities, to work with each other and Tier 1 supplier (engines, drivetrains, steering, suspension, interiors etc.) in the value chain.

Similar supporting industries are found in the rail sector with companies engaging in 1st, 2nd and 3rd level maintenance in the MRO segments, manufacturers and assemblers in components/parts fabricator, and systems integrators for both sub-systems and final products. The ability of these suppliers to diversify in a focussed way and focused on key export markets, to engage in contract manufacturing and turnkey project management, presents significant opportunities to leverage beyond the region, and expand into international rail cluster.

In the automotive sector, PHN Industry Sdn Bhd which is jointly owned by DRB-HICOM Berhad and PROTON Holdings Sdn Bhd, is the leading manufacturer of automotive components in Malaysia. The company is a Tier-1 supplier for body structure modules for major Original Equipment Manufacturers (OEMs) namely Proton, Perodua and Honda. PHN specialises in metal stamping, components assembly, roll forming and dies manufacturing. The company is capable of offering customers a full range of mechanical press and welding services including fine blanking, tailored welded blank (TWB) stamping and assembly for high tensile and advanced high tensile material. The company's roll forming facilities is the first automotive high tensile roll forming production line in South East Asia. The company's dies manufacturing solution also offer full range of services, from design to assembly, and also producing dies for selected models for major OEMs, namely Proton and Nissan.⁹³

⁹² Anuar Mohd Noor, 2012, "Malaysia's Shipping Industry: Shifting Towards Sustainability (my FORESIGHT)

⁹³ PHN Industry Sdn Bhd, 2015, (<http://www.phn.com.my/>)

6.5 SWOT Analysis

An organisation's environment is properly seen as a network of other organisations in the cluster environment. Within this cluster environment, four sectors make up the collective, transportation equipment cluster. These sectors and the industries within the cluster changed over time, shaped by external threats and opportunities, while capitalising on their respective strengths and managing their weaknesses. Given the capital and technological intensity of these sectors, the role of the government in spurring growth (from interventionist [automotive], facilitative [aerospace] to supportive [shipping and rail], is important.

From a national conception perspective, and how this will impact on for Selangor at a regional level, Figure 6.10 offers a SWOT framework that could assist the State in the formulation of its transportation equipment cluster Action Plan.

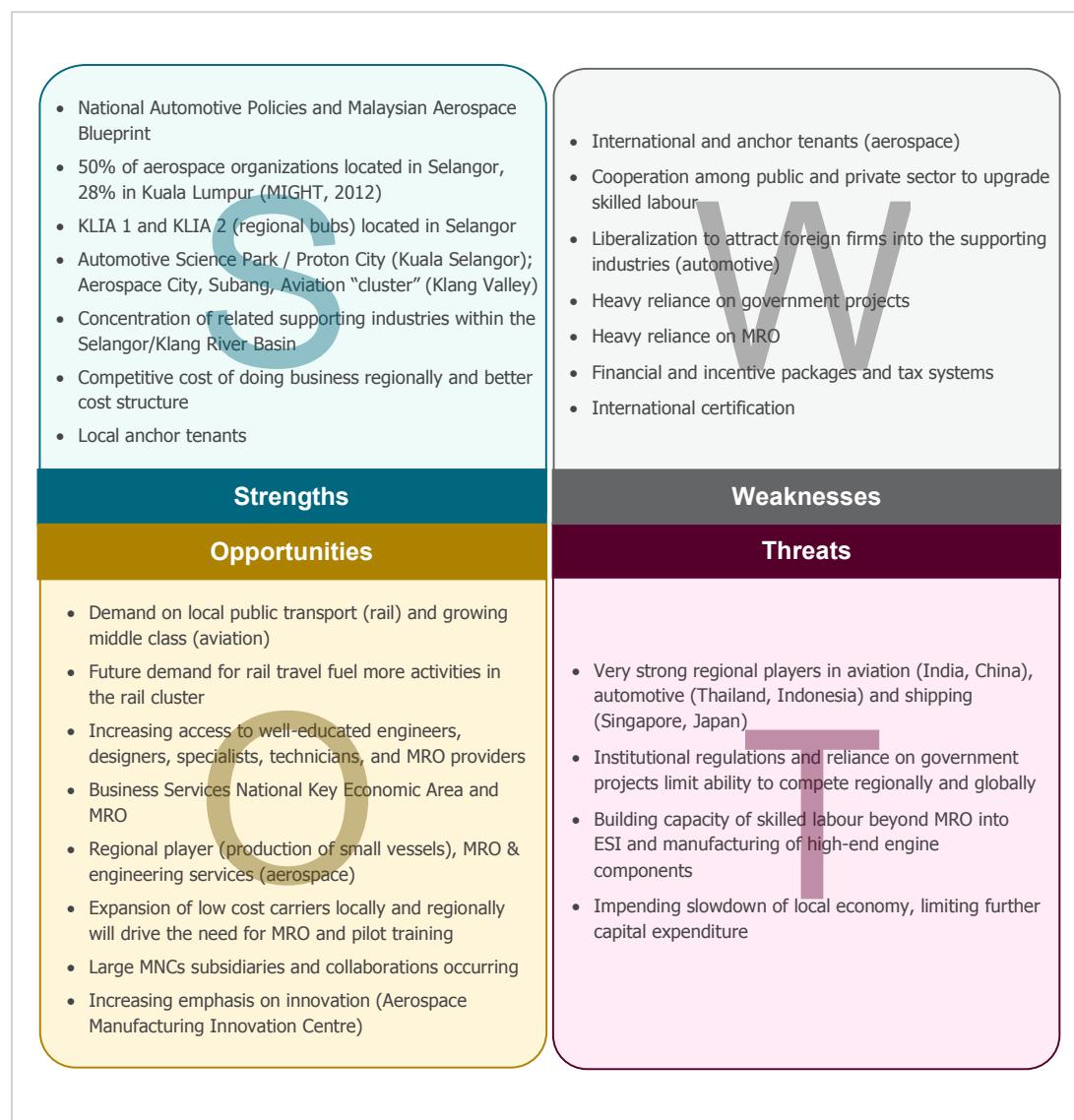


Figure 6.10 SWOT Analysis

Source: Monash University Malaysia, 2016

6.5.1 Strengths

Some of the State's key strengths include:

- **Anchor infrastructure**

Historical, natural “anchor” infrastructure that includes Port Klang, KLIA 1 & KLIA 2, Subang airport, and the automotive “hubs” in Shah Alam and Northern Selangor (Bukit Beruntung, Rawang, Batang Kali, Serendah and neighbouring districts). Their central locations provides excellent market accessibility to all regional markets, especially with related supporting industries located nearby, and/or within Selangor / Klang Valley basin / Greater Klang Valley.

- **Strong presence in aerospace industry**

In the aerospace industry, there is a strong presence of established MNCs subsidiaries, joint ventures between MNCs and local companies, and emerging, local players, operating in niche market sectors and contributing to the regional and global supply chain. This includes maintenance, repair and operations, aviation design and analysis, pure play engineering and modular manufacturing.

- **Low cost and ample land**

Historically, the State has a low operating cost base, ample land, access to talent and growing pool of engineers, with numerous training and tertiary education institutes located in Selangor / Klang Valley basin. These are reinforced by cost effective, man-hours quantum in Aerospace, strong institutional support and policies across all transportation sectors (with the possible exception of shipping), further cementing the State as the nation’s transportation hub.

- **Logistics industry growing in strength**

With major trade and goods moving through centrally located seaports and airports in the State, and strong infrastructure in interstate transportation connectivity, the State’s logistics industry is growing in strength. This industry, and associated service industry, will further stimulate trade, facilitate business efficiency, and spur economic growth. It also enhances connectivity to the rest of the world and the nation’s competitiveness. Selangor is very well placed to act as a regional logistics gateway to the region.

6.5.2 Weaknesses

However, with these strengths, there are also numerous natural and structural internal constraints and/or weaknesses. They include:

- **Heavy reliance on government projects**

Heavy reliance on government projects to drive growth and fund investments in the shipping and rail sector has dampened international competitiveness. This is evident in the nation's standing in the global market. A 2010 Review of Maritime Transport ranked Malaysia 22nd in terms of the number of vessels of 1000 GWT built totalling 480, and accounting for 1.07% of world total market share. This compares with Singapore (ranked 10, 985 vessels, and global market share of 2.8%). Regionally, Japan (2, 3751, 15.73%), China (3, 3633, 8.96%) and Republic of Korea (5, 1200, 3.85%) dominates the market.

A 2015 Maritime Review Report found that that Malaysia's ship building competitiveness has declined further, with more than 91% of GT delivered in 2014 being built in just three countries: China (35.9 %); the Republic of Korea (34.4%); and Japan (21%). China builds mostly dry bulk carriers, followed by container ships and tankers; the Republic of Korea builds mostly container ships and oil tankers; and Japan specialises in bulk carriers.

- **Reliance on domestic market**

The reliance on domestic market is prominent. This limits the nation's international comparative advantage (with spill-over effect for the State) when compared with neighbouring countries, particularly those with huge export potential and/or significant contributory role in the regionals and/or global value chain.

- **Reluctance to think outside traditional revenue source**

A reluctance to think outside of traditional mainstream engineering and manufacturing business model and engage in new value-adding activities to generate sales and profits, vis-à-vis, their roles in the regional and global value chain – through joint venture and/or partnerships – will further limit established businesses operating in the transport equipment industry.

- **Shortage of skilled workforce**

The local skilled workforce for the transportation equipment manufacturing sector, like many other sectors, remains an on-going issue. The shortage of skilled workers is acute in sectors that require engineers, designers, technician, and system analysts. As it is for all industries too, a heavy reliance on foreign workers to compensate for a decline and/or lack of interests among locals to work in transport equipment manufacturing sectors is expected to continue. Existing demographic trends and the propensity of younger workers to pursue careers outside of manufacturing further compounds the shortage of local skilled workforce. Close cooperation between public and private sectors to upgrade skilled labour is also somewhat limited.

6.5.3 Opportunities

We have identified several opportunities, including:

- **Growing, regional MRO market**

The growing, regional MRO market offers the State tremendous opportunities to move up the value chain, and differentiate its contribution to the global and/or regional value chain. The new paradigm is to manage value chain processes across dispersed geographies. The emergence of global service firms and emerging economies becoming major Airbus and Boeing's customers is driving this paradigm (See Figure 6.11).⁹⁴

Opportunities exist for the State to identify:

- a. The value chain where investment potential are most likely and;
- b. What the State could do to position itself to receive the most investments

The creation of Aerospace City in Subang, bringing together established partners and start-up firms that focuses on the development Aero-related cluster activities, will create more opportunities to develop the State's aviation cluster.



Figure 6.11 Customer Support & MRO – Established and Emergent Clusters

Source: Ling, 2014, "Aerospace Globalisation – The Next Wave Presentation"

⁹⁴ Ling, D., 2014, "Aerospace Globalisation – The Next Wave Presentation"

- **Integration with other clusters**

Increasing integration of electrical and electronic with automotive technology that offers better safety design and driving features and provide in-car access to communication networks, is expected to increase in the near future. Integration will lead to deployment of more advanced testing and design equipment, tools and computers and wireless communication networks, to develop more applications and/or end product that range from LED lighting, components and parts, vehicle tracking and navigation systems to mobile television and email access. Importantly, the growing interest in better designed and safety features and internet-enabled automotive features could provide opportunities for parts and accessory manufacturers, electrical and electronic engineers and designers.

- **Demand for replacement parts**

In 2015, total industry sales volume for passenger and commercial vehicles was approximately 666,674.⁹⁵ Data specific to the sales of used car is not available, despite their significant presence in the market. The used car market is, however, expected to increase in the future as concerns grow over the state of the nation's economy and as motorists either want to spend less on a vehicle and/or will have difficulty securing new car financing, and hence will keep their cars for longer periods. Sales of after markets replacements and parts are therefore expected to increase further, offering opportunities for businesses operating in this market to grow their business. Discussion with one of the largest local market replacements and parts manufacturer also reveal efforts to develop the export markets, including Latin American country.

- **Cooperation in the region**

While the automotive market is supported by a network of first and Second-Tier manufacturers and modular assemblers with a strong focus on the domestic market, opportunities exist for them to grow their business by contributing to the regional automotive supply chain. Through mergers, partnerships, and joint ventures with regional auto companies, including automotive companies with a strong established presence in the State, manufacturers and suppliers could increase their production capacity and achieve better economy of scale. To further keep or add onto their existing businesses, smaller tier suppliers could then leverage off these opportunities through mutual exchange of product and production ideas.

- **Demand for transport travel**

Future local and international demand for all forms of transportation in Selangor, Klang and Greater Klang Valley, and connections between rural and urban populace, will see demand for all forms of transport travel, especially public transport. In recent years, investments in numerous phases of LRT (Light Rail Transit) and MRT (Mass Rapid Transit) have seen local locomotive and railcar companies engaging in joint ventures and/or partnerships with foreign companies. Opportunities now exist for these companies to access key parts such as airbrakes, wheelbases, and couplers through international joint ventures. Bringing local

⁹⁵ Malaysia Motor Vehicles Association, 2016

component manufactures into the company can also help to control costs and shorten the supply chain.

6.5.4 Threats

The issue of how external threats influence the behaviour of firms in the transportation equipment cluster is especially important, in the case of protected industries and new, growth industries. Of particular concern is the growing dominance of Thailand's automotive hub and local manufacturers' reliance on government projects in shipping and rail. These limit local firms' capabilities to compete in regional and global markets, and access to talents. Furthermore, whereas production - driven company act in the context of a market structure that is perhaps, more low-cost, labour-driven, it by no means follows that in a High End, High Value engineering, design and support services, labour rather than talent will provide the foundation for business growth. Following are some of the major threats:

- **Very strong regional players**

Neighbouring countries, particularly those with huge export potential and/or significant contributory role in the regionals and/or global value chain, pose a major threat to the nation's effort to develop the transport equipment cluster. For examples, Thailand has a very strong regional and increasingly global presence in the automotive sector, Singapore in aviation, and China and Republic of Korea in shipping. Constraints and/or inability to penetrate new export markets, particularly in developing and emerging economies with growing infrastructure needs, further limits the nation's competitiveness in the manufacture of cars and railcars.

- **Protectionist policies impact**

Protectionist policies have, thus far, act as disincentive in attracting foreign firms into the supporting industries, in particular the automotive sector. This, in turn, limits Second and Third Tier manufacturers and suppliers the opportunity to collaborate with foreign firms, resulting in the sector's spending less on R&D, making improvements in quality control standards, and investing in new product development and production technology.

- **Last mile connectivity**

Bottleneck and last mile connectivity together with road transport productivity could, potentially, impact the State's efforts in creating an integrated transportation model that centres on the development of KLIA as an air cargo hub, development of Port Klang as a maritime centre, and the development of the cargo village.⁹⁶

⁹⁶ Logistic and Trade Facilitation Master Plan, 2015-2020

6.6 Relational Network Impact Analysis

In the transportation equipment industry, the government has, and continues, to play a dominant influencing role in shaping relations between stakeholders, through various government instruments, quasi-monopoly institutions and policies. With so much funds invested in the automotive industry, in particular, it is not surprising to find that government, foreign MNCs and their subsidiaries, have strong relational ties when it involves technology transfers, joint venture partnerships and alliances arrangements (See Figure 6.12 and 6.13).

Efforts to create, say technology assimilation across sub-sectors, review of tariff/tax structures, provision of vocational training and the creation of more effective private sector-led cluster institutions, would require close collaborative ties between them.

Against the backdrop of the nation's vested interest in the transportation equipment industry, foreign MNCs and their subsidiaries continues to play an influential role in directing investment in model development and technology, in a capital intensive, technology-driven industry. For example, foreign MNCs that are involved, say, in their regional disaggregation of supply chain, will determine the direction and governance of sub-sectors within the transportation equipment cluster. These may include the development of new industries, policy initiatives with substantive local multiplier effects, resource, talent and employment requirements and export earnings potential. Examples include Daihatsu tie-up with Perodua, Mitsubishi and Honda with Proton in the automotive sector, Airbus Industries with Strand Aerospace Malaysia (SAM), and Rolls Royce with UMW M&E and UMW Aerospace in the aerospace sector.

Not surprisingly, Tier 1 companies typically have strong relational ties with government and/or government agencies, foreign MNCs and Mid-Tier local firms, in outsourcing of contract, OEM manufacturing and technological and skill upgrading. Strong, relational ties also exist between government and/or government agencies with local associations and between academic institutions and local agencies. For example, the Malaysian Automotive Association (MAA) and the Malaysia Automotive Components Parts Manufacturers are the two key local associations active in the automotive and auto-parts cluster. Major national car and auto parts companies are members of these associations.

While these agencies and associations typically maintain a close cooperation with large leading manufacturers and service providers, it should come as no surprise to know that members would like to see a much more active representation, with one senior executive saying,

"A public relation body (the association) where members get together socially and occasionally, but avoid dealing with the sector's protectionist policies."

In the shipbuilding industry, it is a case of “several Government agencies established to look into maritime - related matters, (but) none of these agencies are concerned with their well-being. A division within Ministry of International Trade (MITI) which is tasked to formulate policies and strategies for the development of Transport and Equipment sector is the closest one can get”.⁹⁷

The executives we spoke to, however, also repeatedly emphasised the opportunities various NKEAs have thrown up, and are redoubling of their efforts to pursue new business opportunities, especially in MRO, pure play engineering services, Greenfield operations and cross sectors cooperative engagements.

The Selangor State Government could work in tandem with local leading manufacturers and organisations to assist in making strategic and risk decisions, in assessing within and between sectors emerging business opportunities, such as aerospace and automotive with electrical and electronics and internet of things, examine new business models, and identify new skill sets requirements.

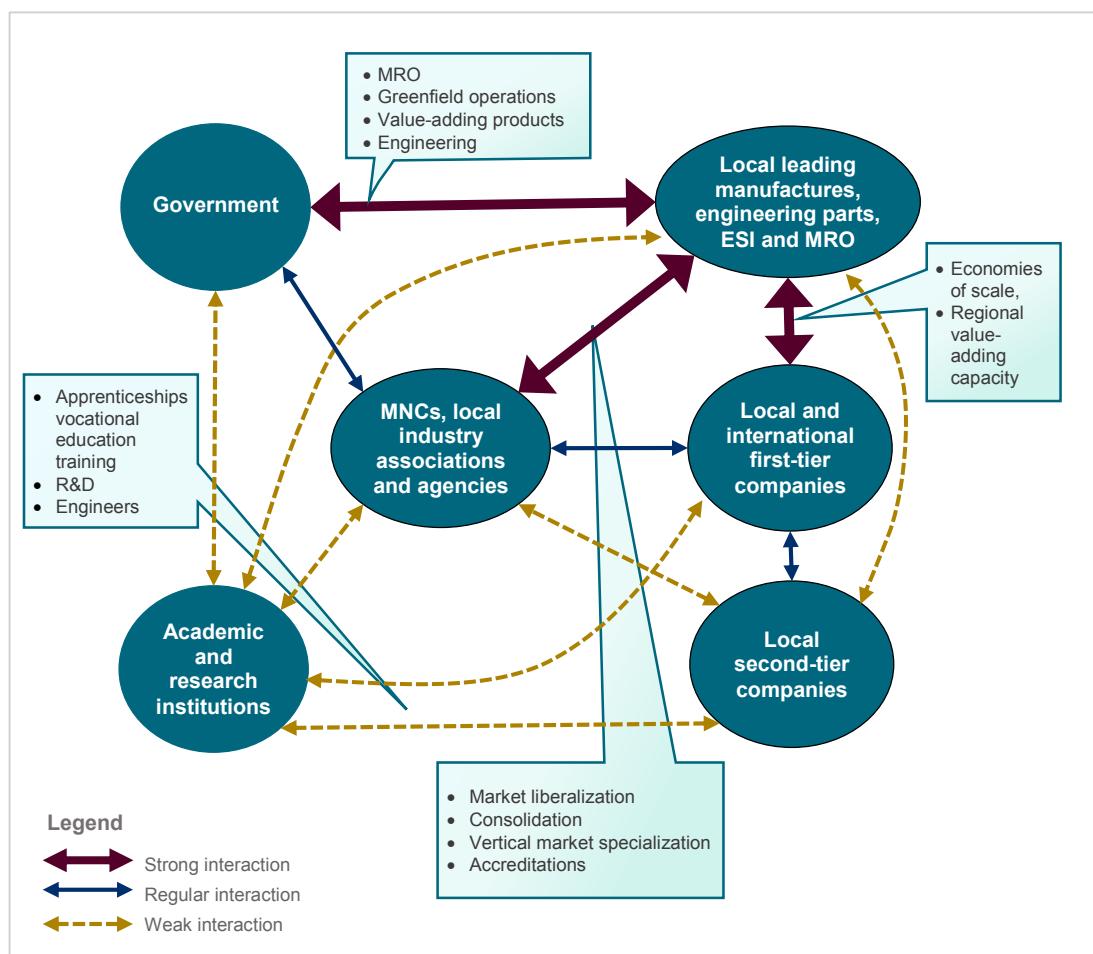


Figure 6.12 Macro Analysis

Source: Monash University Malaysia, 2016

⁹⁷ Anuar Mohd Noor, 2012, “Malaysia’s Shipping Industry: Shifting Towards Sustainability (my FORESIGHT)”

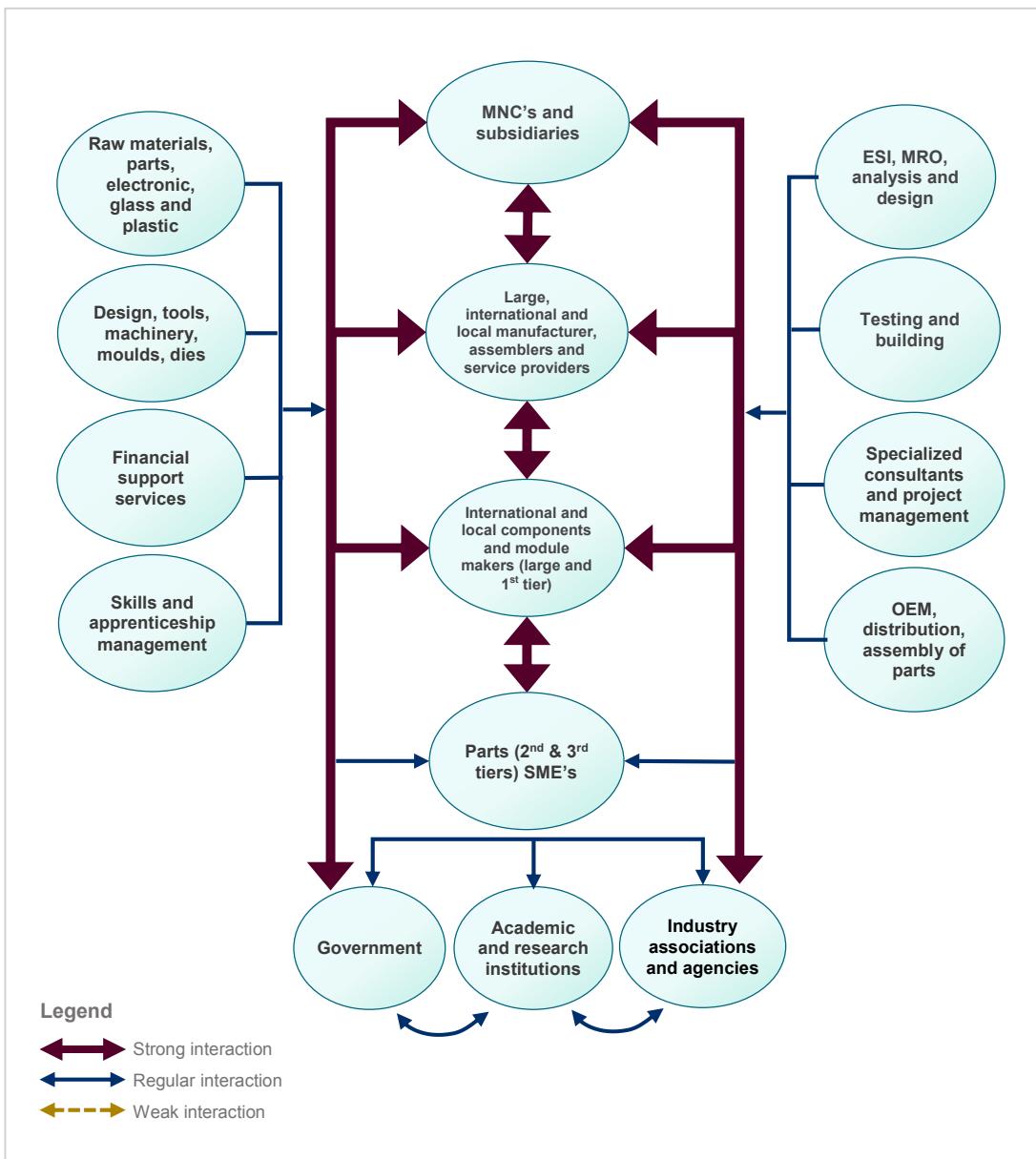


Figure 6.13 Meso Analysis

Source: Monash University, Malaysia, 2016

6.7 Summary of Online Survey Findings

- **24** businesses identify their company's business as primarily operating in the transport equipment cluster from 167 interviews conducted on-line.
- Nearly **one in three businesses** in the cluster thinks that the business environment will **change for the better** over the next 2-3 years. **38 %** (9 businesses) **thinks it will change for the worse**.
- **71%** of businesses (17) were however **very confident or somewhat confident** about their company's business prospect over the next 2-3 years.
- **92%** of businesses describe their industry as "**highly competitive**", **42%** believe their labour intensive and buyers have **increasing bargaining power**. More than **one in three businesses (38%)** also thinks that their business is **capital intensive**.
- Heavy dependence on local markets (**75%**), strong local market wisdom (**63%**) and heavy reliance on local labour (**50%**) were identified as the top three capabilities of local firms and suppliers operating in the transport equipment cluster.
- The issues with the most impact on businesses in the transport equipment cluster over the next 2-3 years are **business environment (63%)**, **availability of labour (50%)** followed by **access to export markets (38%)** and state's government regulations (**29%**).
- **71%** of businesses describe the state government's role as being **supportive or facilitative** in the development of their industries while **17%** felt that it was inhibitive or **constraining**.
- **71%** (17 businesses) also describe the role of industry associations, academic and research institutions in the development of their industries as **supportive or facilitative**, with **21%** (5 businesses) describing the role as **inhibitive or constraining**.
- Businesses operating in the food cluster are **optimistic** about their growth potential in Selangor with **two in three businesses (67%)** ranking the cluster among the top two growth cluster.
- **50%** of businesses in the transport equipment cluster indicate that their sales and marketing priority will be to **concentrate on existing products/services but seeking new markets**. More than **one in three businesses (38%)** will, however, focus on existing markets, with either existing or new products/services.
- While more than **one in two businesses (55%)** indicated **local sales constitute 100%** of their total sales over the last 12 months, **one in three businesses have more than 30% in export sales**.

6.8 Conclusion and Recommendations

Our analysis and assessment of the transport equipment sectors that makes up the cluster's characteristics and governances are shown in Table 6.1. For example, and not surprisingly, it identifies cluster governance for all sectors, with the exception of shipping, as State-controlled. This is mostly likely due to the absence of an inter-ministerial committee at a national platform level that discusses matters concerning the shipbuilding industry. There are, however, non-government agencies (NGOs) that represent the interest of shipbuilders. They are the Association of Marine Industry of Malaysia (AMIM) and Miri Shipyard Association and Sibu Shipyard Association.

6.8.1 Recommendations

From the results gathered from our face-to-face interviews, on-line survey, and extensive secondary data content analysis, there is merit for the State to consider taking a decisive role in aerospace and automotive. This means:

1. Key stakeholders that constitute the overall transport equipment cluster need to create a unified vision, convene to identify their respective and collective goals, and act as a collaborator group that leads the development of a regional transport equipment cluster mentality. This vision, however, needs to dovetail with the State's role in the regional value chain in terms of its:
 - a. Specialisation in selected core competencies that will differentiate the State from regional competitors
 - b. Increase export earnings and employment opportunities, and engaging in high value-adding manufacturing, design and service operations, and
 - c. Ability to contribute to, and leverage existing national and regional logistic industries and facilities, further enhancing service sector contributions to the State's GDP.
2. In the automotive sector, this vision must be driven by at least one of the two large established local car manufacturer and/or a MNCs in an established joint venture relationship. The focus is on the manufacturing and production of motor vehicles, not pick-up vehicles that are targeted for local and foreign markets. The National Automotive Policy (NAP) 2014 that aims to make Malaysia a regional hub for energy-efficient vehicles (EEV) provides an ideal opportunity to address key institutional, structural and market challenges that have so far limited the sector's growth and export earnings potential. Strategies include supply chain development, human capital development and safety, security and environment.

3. In the aerospace sector, the State needs to go beyond participative to, perhaps, influential regulations, with a view to better align policy initiatives that are supported by infrastructure outgrowths. These outgrowths include Subang Airport, Subang Aerospace, KLIA 1 and KLIA 2. Marketing and promotional resources need to be allocated to promote these outgrowths, placing priority on a branding strategy on marketing Aerospace City, Subang. The positioning theme could be one that positions these Subang Aerospace as “Malaysia’s MRO hub,” and/or “Malaysia’s Aerospace Hub.

Companies in these hubs, their interests and their inputs then need to be protected by the State government. Their “Place” activities should largely be driven by the businesses located within the cluster. The “Place” commercial perspectives and incentives must be at the heart of the cluster’s activities, with a strong focus on greater integration of value-chain stakeholders and the growth of new interface business areas within, and beyond this “Place.” Buy-in from participating companies to promote this hub needs to take place in conjunction with existing infrastructural developments of the Aerospace City, Subang.

4. For Selangor to compete effectively in the growing regional MRO market, move up the value chain, and differentiate its contribution to the global and/or regional value chain, greater emphasis could be placed on key success drivers in the MRO. A report by Capgemini⁹⁸, identifies the need for: (a) efficient operations and maintenance; and (b) enhancement of customer experience. However, to better manage the product life cycle of the aircrafts, data analytics skill and talent is invaluable in MRO.

To master these three drivers, companies may have to collaborate with one another. For example, existing MRO companies and aerospace OEMs can forge strategic partnerships with OES (Original Equipment Suppliers) or MRO companies to develop and service new products and share the risk.⁹⁹ The OEMs can also partner with vendors of cutting-edge technology and designers to cut costs in overall product lifecycle management. Through these strategic partnerships, Malaysian aerospace MROs could position their businesses as aftermarket value chain integrators. These collaborative operating models, in turn, can be scaled to meet the needs of different customers.

⁹⁸ Capgemini, 2015, “Maintenance, Repair and Overhaul”, (<http://www.capgemini.com/aerospace-defense/maintenance-repair-overhaul>)

⁹⁹ Ibid., 2015

5. The shipping sector decade of missed opportunities does not mean that the State could not pursue carefully targeted growth, to make up for missed opportunities. It include maximising all opportunities from the domestic demands for small to medium-sized vessels that is less than 120m to capture more international markets (Noor, 2012), especially given the State's limited capacity to build large ships that is dominated by China, Japan and the Republic of Korea.

Importantly, the State's development of Port Klang as a maritime centre, KLIA as an air cargo hub and road transport productivity that improved last mile connectivity, will impact the State's efforts in creating a vibrant and integrated transport hub. This connectivity also impacts the nation's and state's trade, physical distribution and the logistics service sector. According to the Logistics and Trade Facilitation Master Plan, 2015-2020, "consolidated cargo volume, through a well-defined hub system will provide better connectivity to entry points, optimise usage of existing infrastructure and promote modal shift from road to rail via consolidating cargo volume. This has been identified as one of five "Strategic Shift" to improve overall productivity and to better connect industries with their markets, both locally and internationally.¹⁰⁰

6. While the current automotive market is supported by a close network of first and second tier manufacturers and modular assemblers that focuses on the domestic market, the State needs to create an environment for new suppliers (Level 3, 4 and 5) as set out in the NAP policy. Level 3 covers statistically stable process, Level 4 covers process design capability and level 5, product design. Specific linkages in the manufacturing of motor vehicles include power train, transmission and related control systems, die set and mould base, aluminium and other non-duress casting, design engineering and prototyping, vehicle sub-system and complement testing, automotive grade steel and engineering plastic.¹⁰¹
7. There must be clear identification of stakeholders' competency in the aviation sector and how they fit into the regional and global value chain of Airbus and Boeing. Targeted initiatives to pursue investments from large local businesses and foreign MNCs are needed to support the development of ideas, products and services. Three key areas are identified in this study. They include: (a) Pure play engineering, design and analysis; (b) Advanced maintenance, repair and operation, engineering and research; and (c) Aerospace modular manufacturing through OEM arrangement building.

¹⁰⁰ EPU: Logistics and Trade Facilitation Master Plan, 2015

¹⁰¹ Sahari, M.M., 2015, "Malaysia Automotive Industry – Towards Sustainability"

8. While Sungai Buloh and Sime Darby Vision currently represents mixed development as priority sectors and economic clusters across Greater KL and Klang Valley, there is an existing mix of transport equipment manufacturers and assemblers in Northern Selangor. They include Tan Chong Motor and Perodua in neighbouring Tanjong Malim in the automotive sector, integrated monorail system providers Scomi Engineering Rail Bhd., and UMW Aerospace Sdn Bhd recent proposed collaboration with Rolls-Royce to manufacture and assemble their fan cases for the upper-range aero engines. This area could, potentially, provide the transportation hub to develop a machining and engineering sector build around productions and supply of machineries, parts and components (heavy engineering) and finished products (cars and rail).

Existing management of land leases and land-associated initiatives in this area could be reinforced with State's leverage to manage existing land leases and provides land-relocation incentives for existing manufacturers located in the Shah Alam Auto Hub. This has three major effects:

- i. It frees up valuable prime land that would in, future, be used for higher-value added design and service operations that are associated with the Transport Equipment industry;
- ii. Incentives given to new operators in Shah Alam should relate to very high-value added specialisation manufacturing operation and/or advanced MRO that feeds into neighbouring Subang Aerospace City;
- iii. Create a Northern Corridor in transportation engineering and manufacturing that is distinct from a Southern/Central Corridor with an Aerospace focus. Working with MIDA, Invest Selangor should target its promotional efforts (local and FDI) to gradually encourage location and/or relocation in the North.

The State's Transport Plan or the Kajian Pelan Induk Pengangkutan Awam Negeri Selangor will form an important platform as it impacts on economic development in the North, and reduce bottleneck in Greater KL and Klang Valley. The plan provides much needed infrastructural and public transport development support to develop community in the North and attract skills and talent through better transport mobility.

6.8.2 Summary of Cluster Characteristics and Govrances

Characteristics of Transport Cluster								
Cluster	Nature and Structure of Industry			Capabilities of Cluster Actors			Cluster Governance	
	Capital Intensive	Technology-driven	Structure of Cluster Ownership	Local Private Firms / Selangor	Intermediary Institutions (association, academic, research institute)	Government Agencies / Selangor		
Aerospace	High	Very fast changing technology	Clusters of large national firms, subsidiaries of MNCs and local suppliers	Local firms are weak in advanced technological capabilities, strong in MRO and engineering services	Strong reliance on global players, large local firms and federal government	Influential and supportive	State-controlled	
Automotive	High	Fast changing technology	Clusters of large national firms and local suppliers	Local firms are engaging in advanced technological capabilities (E&E) with high level of local wisdom, captive to component suppliers	Strong leadership (MAA) but strong reliance on large local firms and government	Very influential through National Automotive Policy	State-controlled	
Railways	High	Moderately fast changing technology	Clusters of few large national firms	Local firms are weak in advanced technology	Weak with limited resources, reliance on federal government	Supportive and facilitating	State-controlled	
Shipping	High	Moderately Fast changing technology	Clusters of family run businesses (E. Msia), one dominant large local firm	Strong level of local expertise, limited experience outside of government contracts	Weak in terms of limited resources, reliance on federal government and poor coordination	Supportive and facilitating	Local intermediary institution coordinated	

Table 6.1 Summary of Cluster Characteristics and Cluster Govrances

Source: Monash University Malaysia, 2016

6.9 Best Practices

Case Study 1: Seletar Aerospace Park (S1) and Singapore's Seletar Aerospace Park is booming (S2)

Background

Seletar is currently home to about 30 aerospace companies in Singapore such as ST Aerospace, Jet Aviation, Fokker Services Asia, Hawker Pacific Asia and Execujet. This historic landmark is being transformed into a leading-edge, world-class aerospace facility designed to meet Singapore and the region's burgeoning aerospace needs, including:

- i. Aerospace Maintenance, Repair & Overhaul (MRO);
- ii. Design and manufacture of aircraft systems, components, and potentially light aircraft;
- iii. Business & general aviation activities, and
- iv. Business aerospace campus, which will house educational and training institutes and research facilities.

Relevance

In the MRO space, Pratt & Whitney is establishing an MRO campus at Seletar. Homegrown ST Aerospace, which is the largest, third-party MRO company in the world today, has opened new hangars for airframe maintenance and modifications, including passenger-to-freighter conversions. Rolls-Royce, a major supplier of aircraft engines, is setting up a futuristic plant to manufacture engines for large aircraft, among others including EADS, Eurocopter and Bell Helicopter.

Findings

First mover advantage from Selatar makes it increasingly difficult for Selangor to compete. Singapore's advantages include a well-developed infrastructure, a strong engineering skills base and a workforce that is proficient in English. Singapore also offers foreign industrial investors some tax breaks. Seletar is located approximately 30 minutes from the city and 20 minutes from Changi International Airport, making it very accessible.

Source: <https://www.edb.gov.sg/content/edb/en/why-singapore/ready-to-invest/setting-up/business-location/seletar-aerospace-park.html> (S1) & <http://www.ainonline.com/aviation-news/aerospace/2012-02-14/singapores-seletar-aerospace-park-booming> (S2)

Case Study 2: Thailand Automotive Cluster

Background

Thailand is the automotive hub of Asean with 2.45 million cars produced in 2013.. About 50% of the manufactured vehicles are exported. About 50% of the manufactured vehicles are pick-up trucks. OEMs are from Japan and the USA supported by virtually ally MNCs and a Thai Automotive cluster of component suppliers. And 85% of the market share is controlled by Japanese, about 15% by U.S. OEMs.

Relevance

Differences in Comparative Advantages between Thailand and Malaysia's Automotive Sector

Findings

The table below shows how Thailand compares to its neighbours.

Country	Policy Environment	Brands	Status of Clusters
Malaysia	Government directly involved in production Attempting to reduce reliance on foreigner	Tried to create national brand (Proton)	Ten times fewer exports than Thailand
Thailand	Initially interventionists	Bluechip MNCs, e.g. Toyota, Honda, GM, Ford	Highly competitive with world markets especially pickup trucks
	Switched from import substitution to facilitating exports		
Indonesia	Intense government intervention	Initiated national care brand "Timor" (Tecknologi Industri Mobil Rakyat")	Now known in Indonesia as "bayi yang sudah tua" (an old baby)
	Rent seeking activity		Never reached economies of scale

Source: <http://www.slideshare.net/uликайзер/thai-autobook-2015-thailand-automotive-cluster-edition> (Thailand AutoBook 2015: Thailand Automotive Cluster Edition) and Global Insight, BOT, Thailand Ministry of Finance, Thai Automotive Research

Online Survey Findings

7.0 Online Survey Findings

7.1 Executive Summary

What do businesses operating in the clusters have to say about the issues affecting them?

Few CEOs, senior managers and key stakeholder in the business community believe the business environment will change for the better over the next 2-3 years. Many, however, are also cautiously optimistic about their company's business prospect. Businesses operating in the Food cluster offer the most growth potential follow closely by Life Sciences and Transport Equipment.

Many businesses operate in industries that are highly competitive, with buyers increasingly exerting bargaining power. This, perhaps, is not unexpected especially when businesses rely on the local market, local wisdom, local talent and local labour to survive and/or grow their businesses. Other infrastructure-related issues businesses are worried about, besides talent and labour, include availability of water and electricity, availability of land and management of industrial parks. The response for many has been to start focusing on seeking growth in new markets, by concentrating mainly on existing products and services. In a business environment that is not immune to fundamental changes in regional and global markets, many are looking for people capabilities. They are also looking to develop their export markets and build product innovation.

Crucially, there is a growing realisation and acceptance that cooperative engagements with government, industry associations, academic and research institutions will strengthen the ecosystem of partnerships that businesses need to effectively manage and leverage their capabilities. We believe the current strong supportive and facilitative role of these stakeholders is one of several factors that will redefine business success in these clusters.

7.2 Overall Findings



Only 1 in 4 businesses believed the business environment will **change for the better** over the next 2-3 years.



80% of the businesses expressed a **positive** opinion on the **State Government role** in the development of their industries.



67% of all businesses were **confident** about their company's business prospect expressed confidence with the business environment.



Four in five businesses believed the role of industry associations, academic and research institutions have been **influential, facilitative or supportive** in the development of their industries.



79% of businesses described their industries as **highly competitive**, followed by **increasing bargaining power of buyers (54%)**.



Businesses operating in industries in the **Food cluster** offered the most growth potential over the next 5 years (**28%** nominating this cluster), followed by **Life Sciences cluster (25%)** and **Transport Equipment cluster (18%)**.



64% identified **heavy dependence on local market** as their number one capability. **Strong local market wisdom (56%)** and **heavy reliance on local labour (41%)** rounded out the top three capabilities.



70% of all businesses sales priority over the 2-3 years would be to **concentrate on existing product and services**, with nearly **three in four businesses (74%)** seeking growth in new markets.



64% of businesses said **business environment** would have the most impact on industry over the next 2-3 years, with more than one in three businesses identifying the **availability of talent and labour as having the most impact**.



More than **one in two businesses (52%)** said that the **local, domestic markets accounted for 100% of their total sales** with **0% export sales**.

7.3 Themes and Findings

We develop the online survey around 10 themes that enable us to have an all-rounded insights on the environment of the cluster and executives' opinions.

7.3.1 Business Environment

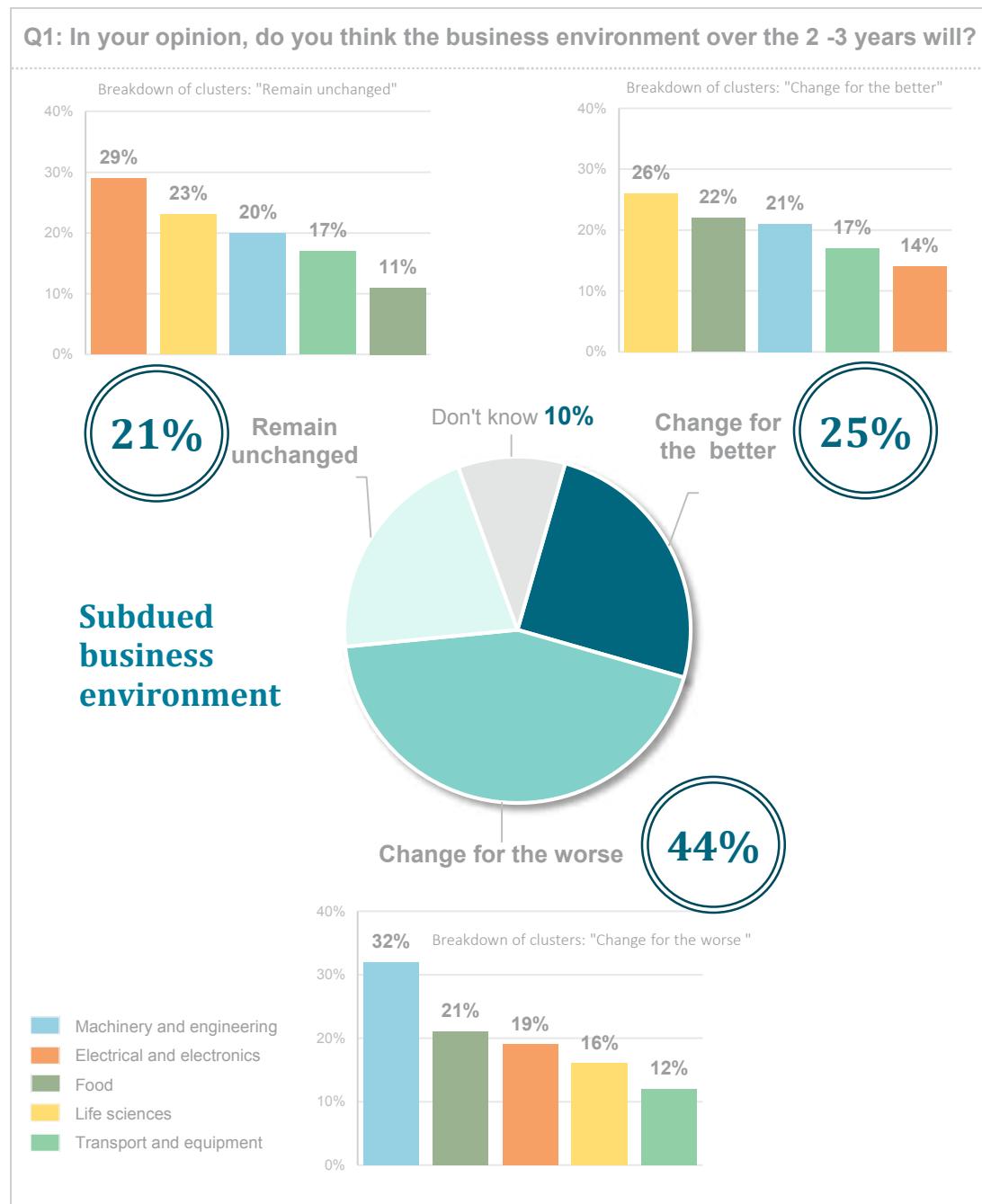


Figure 7.1 Business Environment over the Next 12 months

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

Subdued business environment

One in four businesses believed the external business environment would change for the better over the next 2-3 years. However, nearly half of businesses (44%) also pointed out that the business environment would change for the worse. 21% believed that the business environment would remain unchanged while one in ten businesses don't know what the business environment would look like over the next 2-3 years. Concerns over the business environment in light of continued local uncertainty and uncertainty in several major regional economies are not surprising.

So, what differences, if any, exist between the five clusters on confidence over the business environment? High level of confidence over the business environment changing for the better holds true among businesses operating in the LSC (26%), FC (22%), and MEC (21% each). In contrast, 17% and 14% of businesses operating in the TEC and the EEC respectively shared similar sentiments.

The concerns over the business environment were particularly evident among businesses operating in the MEC with 32% thinking that it would change for the worse. This compares with 21% in the FC, 19% in EEC, 16% in LSC, and 12% in TEC. Businesses operating in the EEC and LSC are also more likely to think that business environment would remain unchanged over the next 12 months.

While 67% of businesses either expect business environment to change for the worse or remain unchanged, businesses in the LSC and TEC are more upbeat compared with businesses the MEC and EEC, and to some extent, businesses in the FC. So are businesses confident about their company's business prospect given their perceptions over a business environment that could best be described as a "subdued"?

7.3.2 Level of Confidence

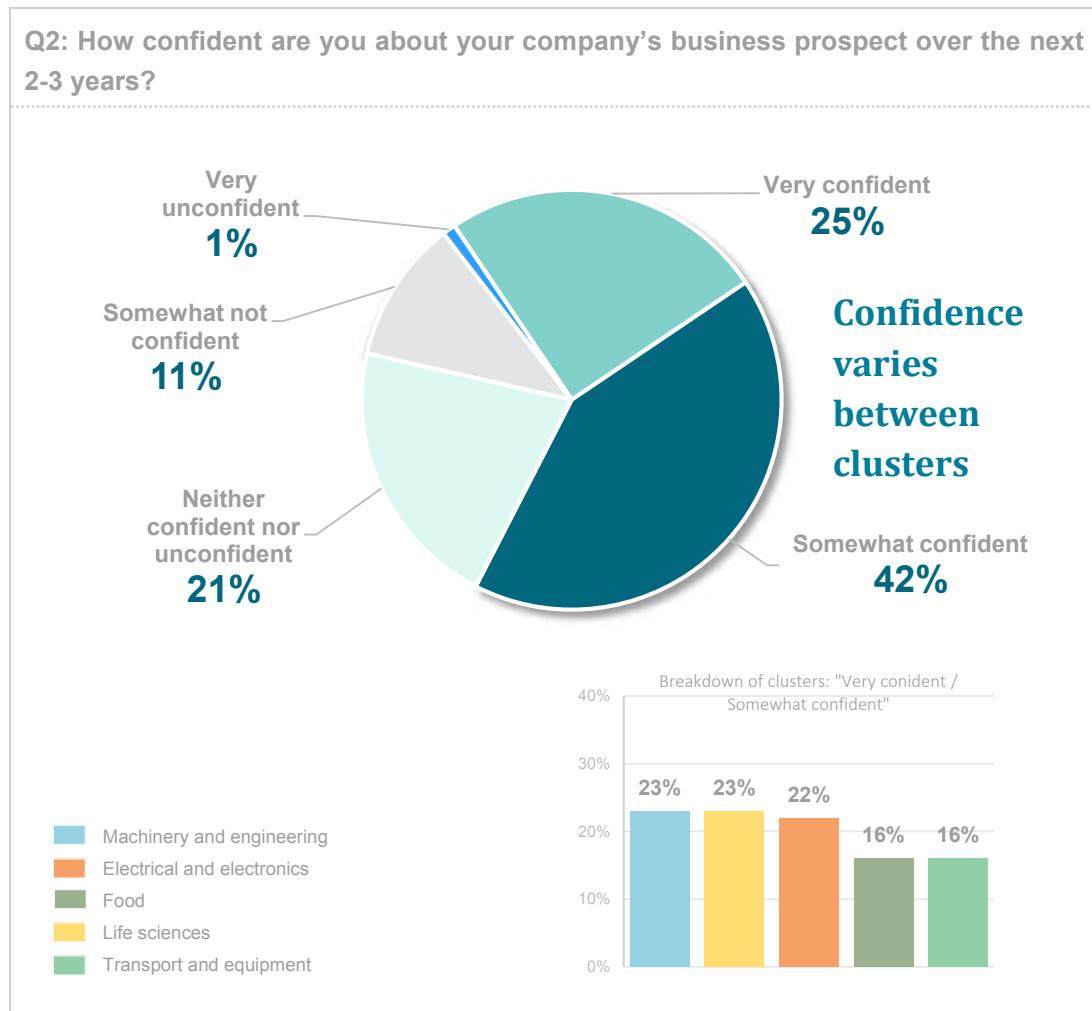


Figure 7.2 Confidence About Company's Prospect over the Next 2 – 3 years

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

Confidence varies between clusters

While businesses were generally subdued about the business environment, fortunately, this did not translate into a lack of confidence about their company's business prospect. In fact, one in four businesses interviewed were very confident about their business prospect over the next 2-3 years.

42% were somewhat confident while one in five businesses (21%) was not prepared to take a bet on their company's business prospect. Low confidence sentiment is only shared among 12% of businesses. Strong local and foreign direct investments (FDIs), numerous developments under the Economic Transformation Programme (ETP) and Entry Point Projects (EPPs) are likely to have given much needed boost for these businesses.

Sentiment, of course, varies between clusters. 23% of businesses in both the LSC and MEC were either very confident or somewhat confident about their company's business prospect over the next 2-3 years. This compares with 16% for businesses operating the TEC and FC. 32% of all businesses operating in the MEC also were either ambivalent (neither confident nor unconfident) or somewhat not confident about their company's business prospect over the next 2-3 years. This compares with 13% and 14% of businesses in the TEC and EEC respectively.

In the current economic climate, contracting consumption in household goods and limited government spending on new infrastructure underpins businesses lack of confidence about their business prospect over the next 2-3 years, especially those with strong domestic-market sales like the FC, MEC and TEC.

7.3.3 Nature of Industry

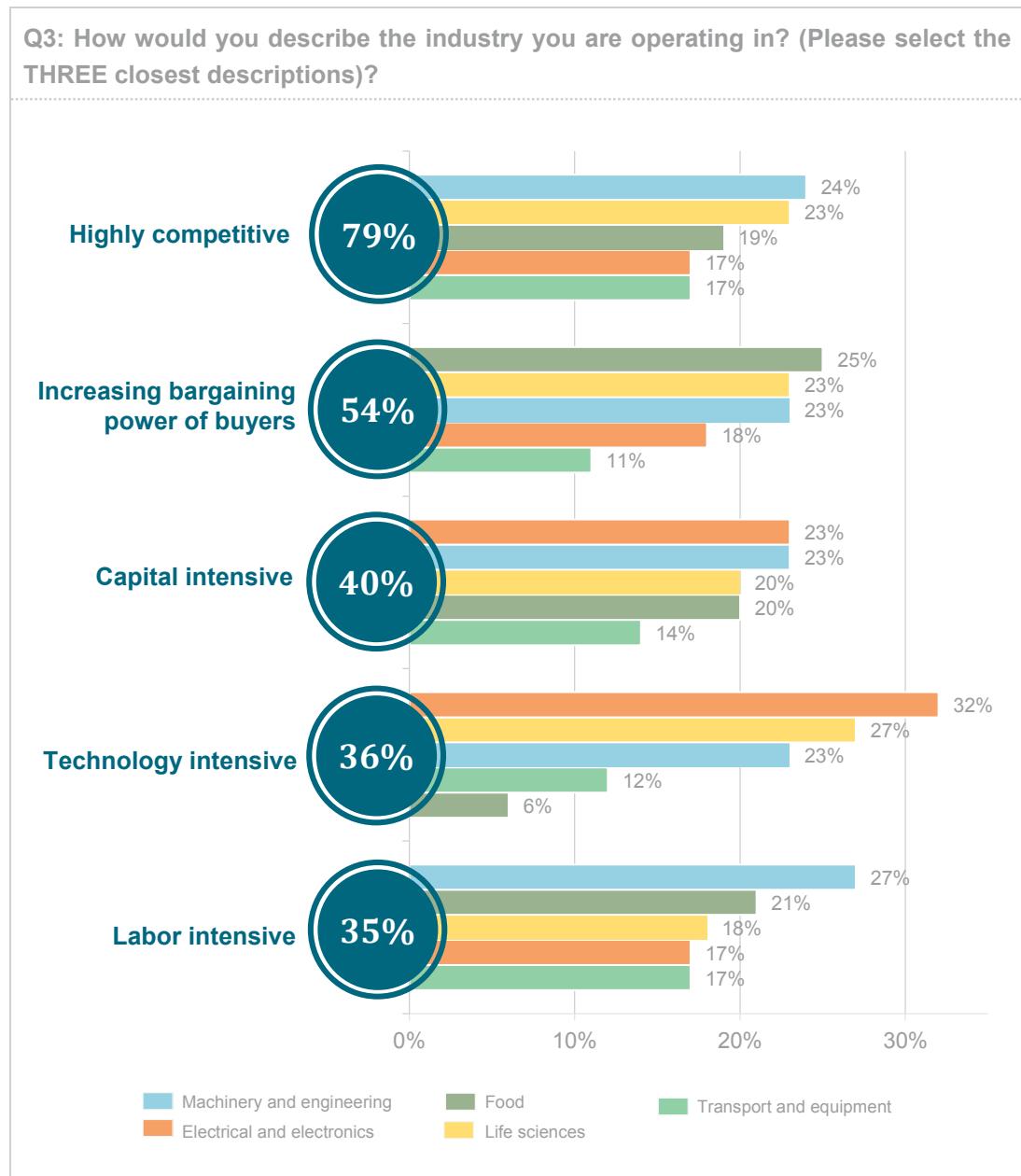


Figure 7.3 Description of Industry

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

Highly competitive, powerful buyers and capital investment intensive industries

Now more so than ever, no clusters, industries and businesses are not exposed to competition. Take the global semiconductor, electrical, automotive, shipping, processed food, medical equipment and pharmaceutical industry. Global and regional players are making their presence felt in global and regional supply chain.

While there is an underlying sense of cautious optimism among businesses of their company's business prospect over the next 2-3 years, institutional, market and technology factors may moderate business optimism. Accordingly, we asked businesses to nominate the three closest descriptors that characterised their industry.

Four in five businesses (79%) we polled nominated intense rivalry between competitors. More than one in two businesses think that the increasing bargaining power of buyers (54%) characterised their industry. 40% of businesses view their industry as capital intensive, while 36% think that their industries are both technology and labour intensive. One in five businesses say that their industry has far too many cheap imports (23%) and the suppliers they deal with have increasing bargaining power (20%).

So what do all these means? Increasing competition and bargaining power of buyers would impact on business sales and profit margins. These are extraordinary times, requiring a change in attitude towards investment in new technology and production processes. To survive, grow profitably, and to capitalise on the nation's ETPs, businesses need to rethink, re-engineer and re-boot existing business models. To move up the value chain, collaborative engagements, investing in talent, innovations, new product developments, and export initiatives will drive their value chain agenda.

Businesses that rely on access to readily available pool of labour are also less empowered to compete with cheap import, as they tend to operate in industries with low value-add (examples consumer electrical, food processing). The ability to continue to source for low value adding labour, source for cheap imports to compliment existing product range, staying on top of local labour law and third party agencies are among some of ecosystems that will determine the ability and viability of businesses operating in these industries.

7.3.4 Capabilities of Local Firms and Suppliers

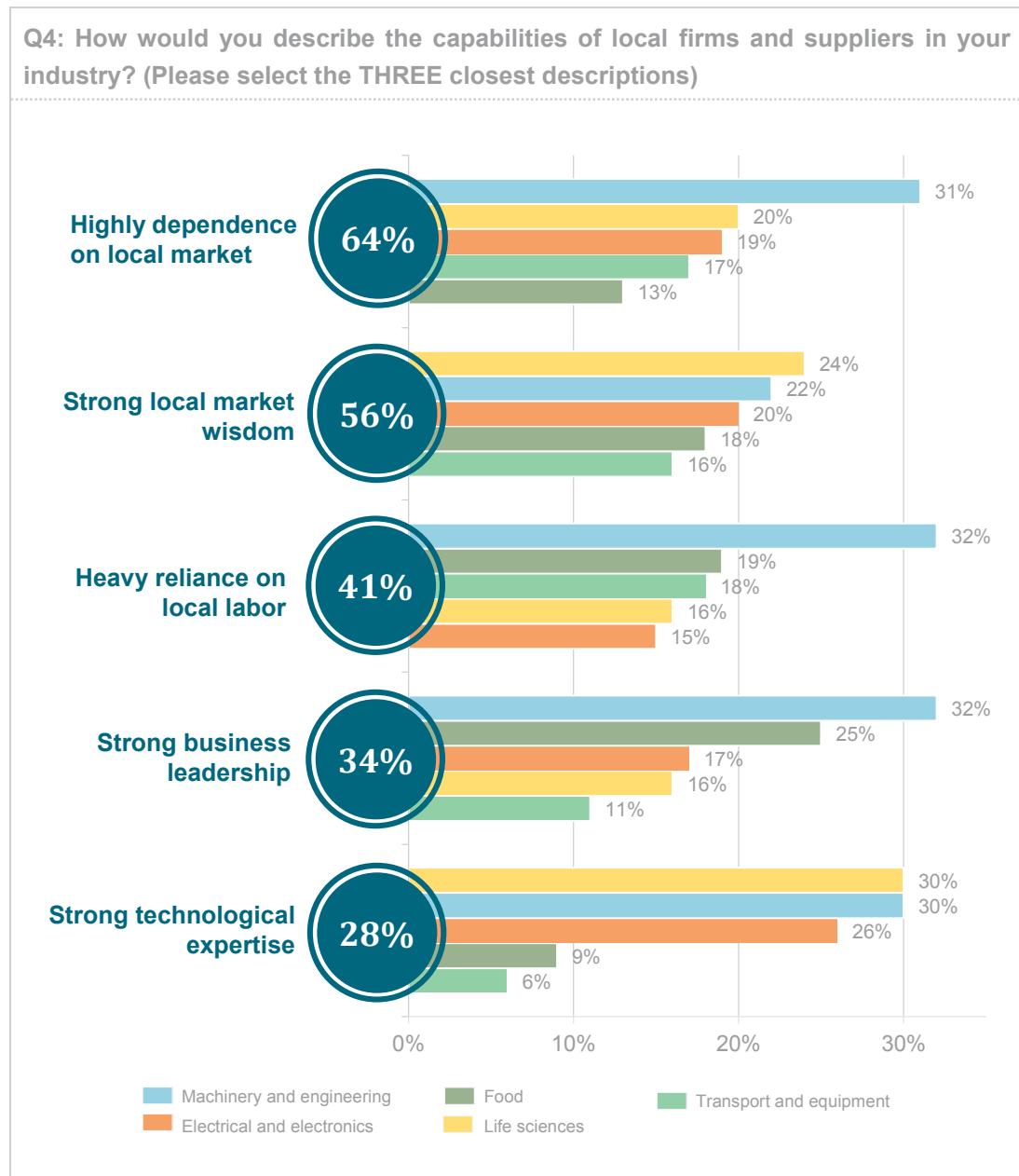


Figure 7.4 Capabilities of Local Firms and Suppliers

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

Local market, local wisdom and local labour capabilities

We next asked businesses to describe the capabilities of local firms and suppliers operating in their industry. A heavy dependency on the local markets (64%) and strong local market wisdom (56%) were the top two capabilities of local firms and supplier. The nurturing of a domesticated market, a general reluctance to undertake risk, limited supply of local talent and a general desire to operate within traditionally defined markets, geographies and industries with limited range of products are

coming back to haunt these industries. While a slowdown in the local economy may result in businesses rethinking their sales and marketing priority over the next 2-3 years, it is apparent that the local markets remain firstly in their sights when it comes to business survival and growth. The focus on the local market is “matched” only by 14% of businesses describing strong export market wisdom as one of their capabilities.

41% of businesses next listed heavy reliance on labour followed by strong business leadership (35%) and strong technological expertise (28%), among their capabilities. One in five (19%) businesses and 13% of businesses cited strong production capacity and strong investment in R&D respectively as capabilities. This tells us that heavy reliance on labour is not necessarily matched by strong investment in R&D. This posed two potential challenges. Firstly, among traditional industries with many SMEs, the opportunity to move up the value chain could be severely compromised. Secondly, a service-led economy with lesser reliance on labour but requiring greater investment in R&D and innovations especially in the LSC and the EEC could be a tall order for Selangor, in the foreseeable future.

This will become evident in the analysis of capabilities between clusters below:

- Businesses operating in the MEC reported the strongest dependence on the local market (31%) as one of their capabilities compared with a surprisingly low 13% for FC.
- Close to one in five businesses operating in LSC (24%), MEC (22%), EEC (20%) view strong local market wisdom as one of their capabilities while 18% and 16% operating in the FC and TEC respectively think likewise
- 32% of businesses in the MEC think that their businesses have a strong dependency on labour compared with a low of 16% and 15% operating in the LSC and EEC respectively.
- Understandably perhaps, reliance on government support was highest among businesses operating in the LSC (36%) and EEC (26%) – the former an emergent cluster, the latter an export-led cluster.
- Strong business leadership is more likely to be found in businesses operating in the MEC (32%) and FC (25%) than in TEC (11%).
- A low of 6% of businesses operating in the TEC also listed strong technological expertise as a capability compared with a high of 30% for businesses in the LSC and MEC, with 26% for businesses in the EEC.

Businesses operating in clusters with a heavy dependence on the local markets and strong local market wisdom, however, will face more challenges in an increasingly, liberalised global economy with greater open market access, and pressures on R&D, innovation and patent, and the need to move beyond a local market domestication agenda. These are some of the structural issues businesses operating in these clusters will have to address. They could seek to reinvent their roles in the local supply chain through (re)investment in value adding activities, invest in enhanced production process, rethink and recreate their roles in the local, regional and global value chain, and leveraged off and identify new connections and new networks.

7.3.5 Factors Impacting Industry

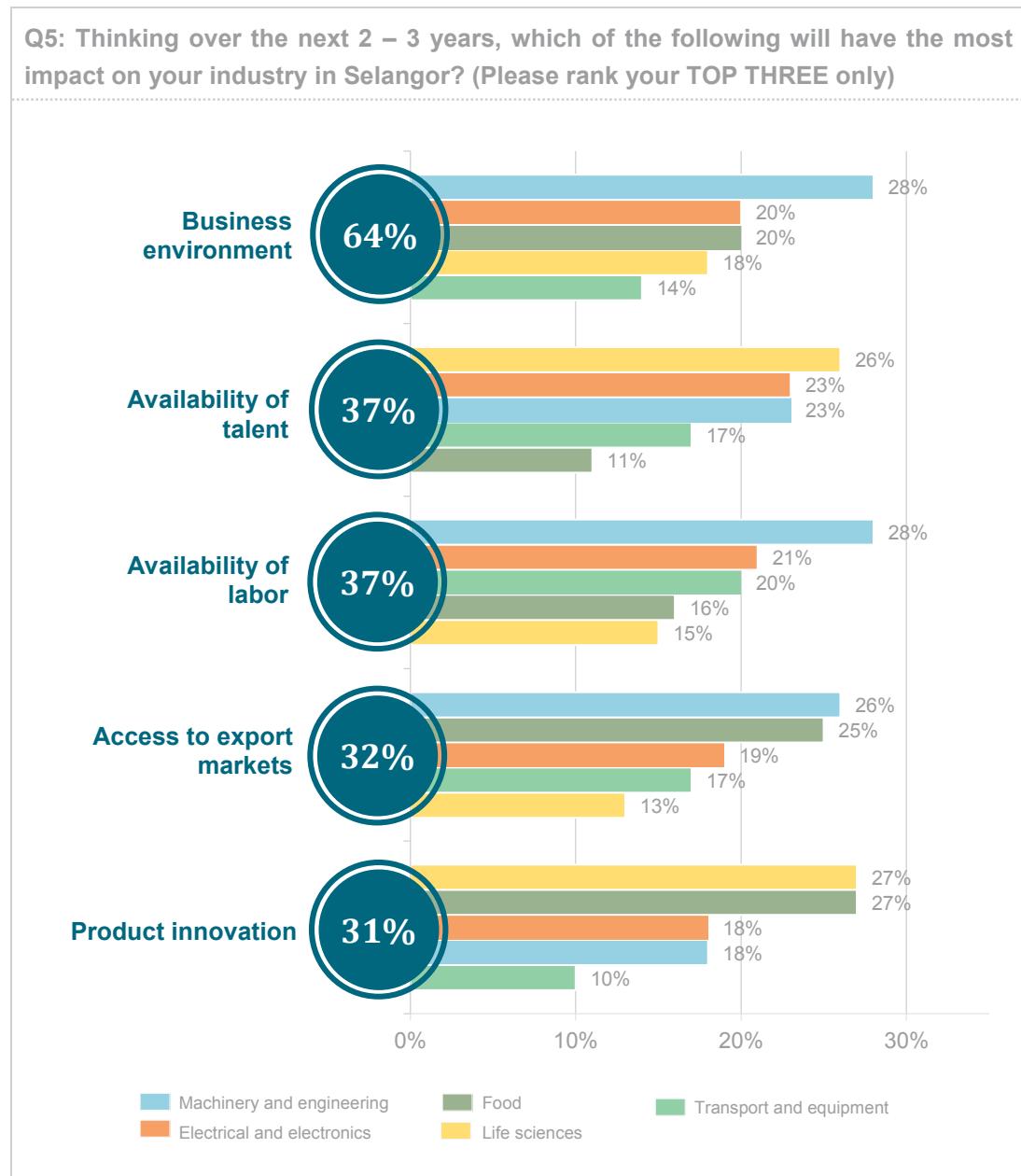


Figure 7.5 Factors Impacting Industry over the Next 2 -3 years

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

Business environment, talent and labour

64% of businesses in our survey identified business environment as having the most impact on their industry over the next 2-3 years. Fear over the business environment was particularly evident among businesses operating in the MEC (28%), while only (14%) in the TEC shared similar sentiment. The concerns over the business environment are surfacing due to a host of local and international economic (market and financial), political, technological and social factors.

What is more, 37% of businesses viewed the availability of labour and the availability of talent as among the top three issues having the most impact on their industry. While remedial measures to address the availability of labour are offset by foreign workers, the ability to recruit and retain talent has been problematic. This is true in among businesses in electrical and electronics, aerospace and medical equipment industry as they embrace research and development, innovation and pure play engineering to promote growth opportunities. Access to talent through collaborative partnerships with education institutions and vocational training institutes are high on their value adding agenda for boards and senior management.

Despite earlier acknowledging their limited export market wisdom, access to export market is cited by 32% as having the impact on their industry over the next 2-3 years. This concern will no doubt include ways to engage in product innovation (31%) and work with the state government on regulatory matters (21%). Access to export markets is more likely seen as a challenge among businesses operating in the MEC (26%) and FC (25%) compared with only 13% in the LSC. This could be due to the large number of foreign MNCs and large local companies in the LSC that are viewed as legitimate formal players in export markets especially in the sales and distribution of pharmaceutical products and medical devices.

Subtle but important differences also existed between businesses on their evaluations of availability of talent and labour, and how these might impact on their businesses. Businesses in the LSC, EEC and TEC are more likely to nominate talent (one in four) as having the most impact on their industry compared with a low of 11% and 17% among businesses in the TEC and FC respectively.

While 23% of businesses in the MEC also nominated talent as an issue, 28% also raised the prospect of availability of labour as among the top three issues that will impact on their industry. Interestingly, executives in the FC ranked talent (11%) and labour (16%) behind product innovation (27%) and access to export markets (25%) with the most impact on their businesses. We think a highly competitive domestic market and an increase in bargaining power of buyers are causing businesses in the FC to invest in product innovation and to seek new growth opportunities through export markets. To make this happen, and if past experience has taught us anything, it is that government agencies and businesses, especially SMEs, need to understand each other's perspectives on funding support in product innovation, production automation and exporting.

Almost one in four businesses (23%) also identified state government regulation as potentially having the most impact on their industry. 20% next cited increased funding and subsidies, 17% indicated better State Government investment initiatives, while 11% and 10% nominated ease of dealing with State Government and better inter federal – state ministerial coordination respectively as issues that will impact on their industry. On the surface, this perhaps reflect businesses ability to better deal with regulations, greater self-regulations among existing businesses and/or a generally business-friendly environment that allows businesses to focus on managing business affairs.

Other infrastructure-related issues some businesses are worried about include the availability of land (5%) and management of industrial park (3%). Somewhat surprisingly, only 8% of businesses interviewed identified availability of water and electricity, suggesting perhaps that the State Government has been effective in addressing what has been a major infrastructure issue.

7.3.6 Role of Selangor State Government

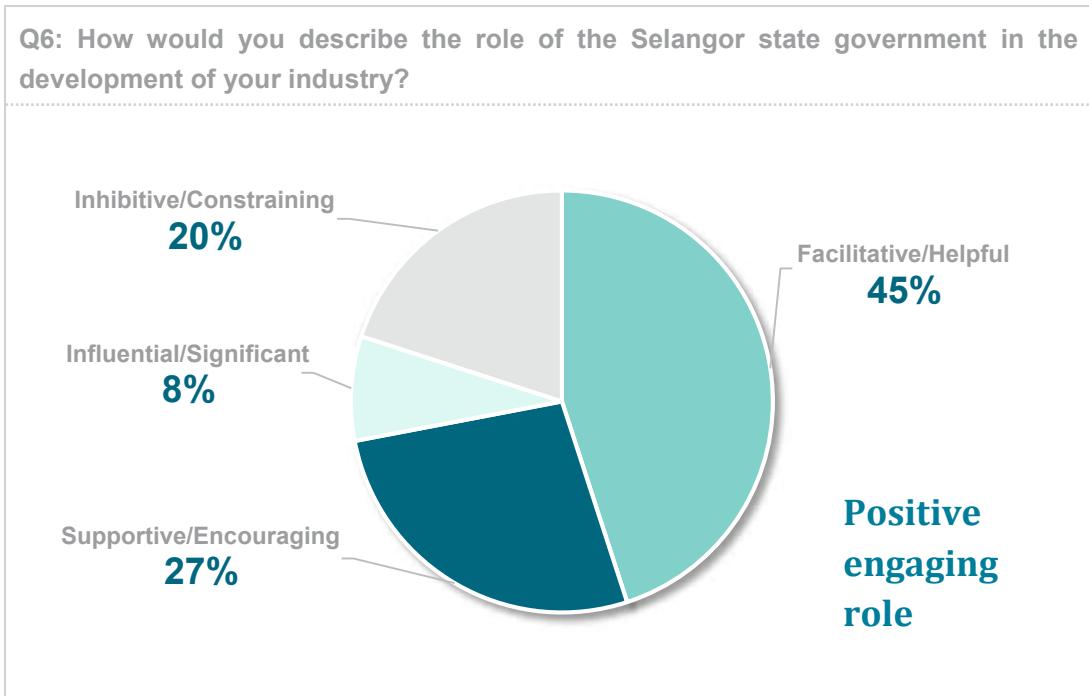


Figure 7.6 Role of Selangor State Government

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

State government positive engaging role

We next proceed to raising the question on how businesses describe the role of the Selangor state government in the development of the industry. Besides being a key regulating and controlling stakeholder in the economy, the State government is also a major consumer for businesses. They are also a significant investor in emerging, often riskier industries, requiring substantive research and development outlays but with potential major implications on the nation's economy. With limited availability of commercial land and intense inter-state competition for a share of the nation's FDIs, the State government also play a crucial role in promoting cluster development as a means of knowledge transfer and business development.

Four descriptors were used to ascertain the State government in the survey. They range from significant and influential (through direct, close relational intervention), supportive and facilitative (direct and indirect, at times distant role), to one where the State government was seen as inhibiting and constraining.

Results from the survey showed that one in five respondents (20%) thought the Selangor state government has been inhibitive (constraining) in the development of the industry. However, 80% of the businesses interviewed expressed a positive opinion on the State Government role in the development of their industries.

This is despite earlier findings of businesses rating increased funding and subsidies, investment initiatives and ease of dealing with State government as somewhat “insignificant” when compared with business environment, availability of labour, product innovation, and access to export market.

Indeed, more than one in four businesses (27%) believed the Selangor state government was supportive/encouraging, with nearly one in two businesses (45%) believing that they play a facilitative/supportive role. The facilitative/helpful role of the State government is more evident among businesses in LSC (28%) and MEC (25%) compared with 16% of businesses in both the EEC and TEC, and 11% of businesses in FC. One in three businesses operating in the FC (35%) also viewed State government support as inhibitive/constraining.

Seemingly perhaps, there is a growing realisation and acceptance that cooperative engagements with government can only strengthen the ecosystem of partnerships that businesses need to effectively manage and leverage their capabilities. Working together as business partners, a supportive and facilitative relational atmosphere will result in greater trust and commitment as a result of continual and open dialogue with the State’s policymakers. Adaptive measures to deal with challenges in the business environment, moving beyond existing silos mentality, could only happen in ecosystems where partnerships and not adversaries are built.

7.3.7 Partnerships with Associations and Institutions

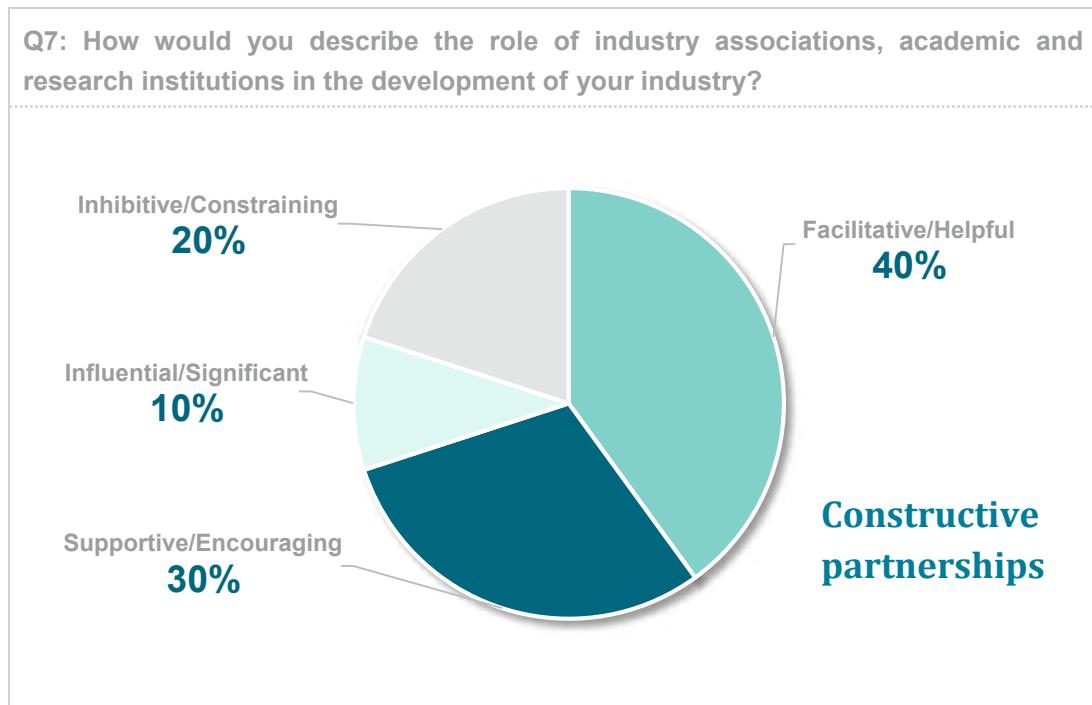


Figure 7.7 Partnerships with Associations and Institutions

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

Constructive partnerships with associations and institutions

Universities and research institutions hold multiple roles in their interactions with businesses. A recent Monash University's study of Business Sentiment (2014/2015) listed the top 5 roles as enhancing graduate employability, aligning R&D needs with the needs of business, developing training programs for business, linking with industry R&D labs and developing global R&D network.

Industry associations such as those represented earlier in various cluster maps, in general represent members' interests through the development of their opinions and standpoints on a consensus basis. Associations also typically maintain a close cooperation with the various nation's and state's authority and cooperate with other professional organisations in the development and pursuit of the industry's goals and visions. In some special cases, associations play a coordinating role in the implementation of projects, develops and coordinates a public relations project to promote an objective view of the operation of the industries they represent.

Using the same role descriptors (i.e. influential, supportive, facilitative and inhibitive), results from the survey showed that 40% of businesses thought that industry associations, academic and research institutions play a facilitative/helpful role. 30% believed they play a supportive/encouraging role, while 10% of businesses described their respective associations and institutions role as influential/significant. One in five (20%) felt the associations and institutions role as inhibitive/constraining.

7.3.8 Growth Potential

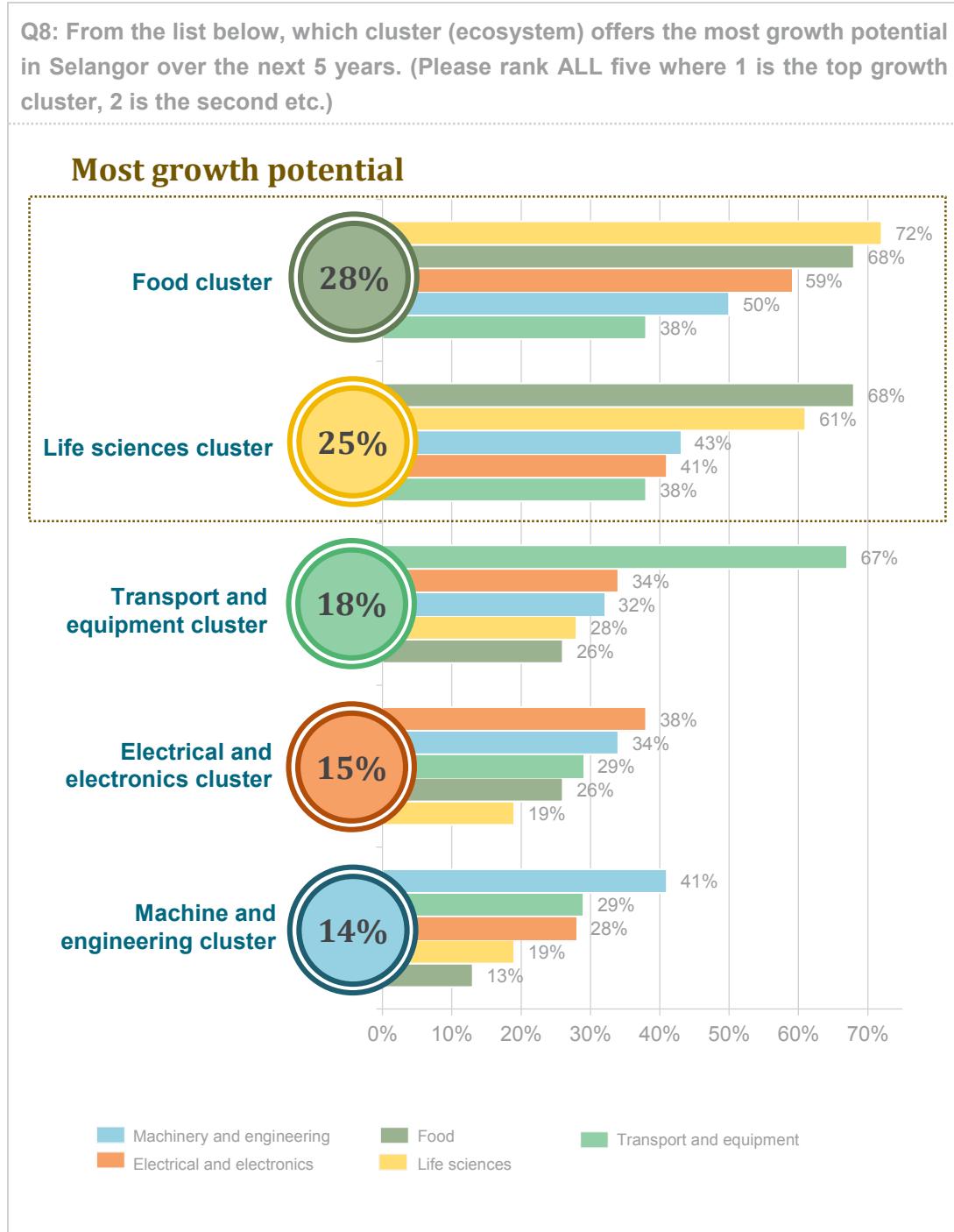


Figure 7.8 Cluster growth potential over the next 5 years

Base: N = 334 respondents (only top 2 growth clusters)

Source: Monash University Malaysia, 2016

Food cluster and life sciences cluster offer most growth potential

With the nation's industry and transformation initiatives gathering pace against the backdrop of key NKEAs and the 11th MP, a current environment of shifting and disrupting trends, regional and global economies capitalising and competing for a dominating role in the value chain, the survey also sought businesses views on cluster growth prospects.

In this survey of 167 businesses, 28% ranked the FC as the top and second top growth cluster in Selangor over the 5 years, with 25% nominated the LSC. 18% of businesses think that the TEC (34%) offers the most growth potential with 15% and 14% in the EEC and MEC think likewise, respectively. While having a diverse range of clusters is important, allowing the State opportunities to mix and match its cluster priority with the national economic agenda, a large and increasingly reasonably well-organised network of players in the FC and the LSC is convinced that these service-dominant offers the most growth potential in the State over the next 5 years.

There were also variations in the analysis of cluster growth opportunities among businesses in different clusters. These findings are important to establish how businesses in other clusters viewed growth potential in clusters other than the ones they are operating in. Our findings revealed:

- 61% of businesses in the LSC cluster nominated this cluster among the top and second top growth cluster in Selangor over the next 5 years. However, businesses in the FC are more optimistic with LSC's growth potential with 68% expressing this sentiment.
- This confidence is reciprocated in kind with 72% of businesses in the LSC expressing confidence in the growth potential of the FC compared with 68% of businesses in the FC who think it likely that their cluster offers the most growth potential in Selangor over the next 5 years.
- Only one in three (38%) businesses in the EEC cluster identified this cluster as offering the most growth potential. Almost similar level of confidence was expressed by businesses in the MEC (34%) and TEC (29%). This perhaps suggest that businesses operating in these three clusters are moving into each other industries or have plans to do so.
- While nearly one in two businesses in the MEC (41%) is upbeat about their cluster's growth potential, one in three businesses (34%) also expressed pessimism. Institutional and structural reforms, constant changes in business ownerships, limited opportunities in replacement markets, downturn in O&G sector and stiff competition from China and Vietnam are among some of the factors contributing to this mixed sentiment. Businesses in the TEC (29%) and EEC (28%) were relatively more upbeat with the growth potential of the MEC compared with LSC (19%) and FC (13%).
- Two in three businesses (67%) in the TEC identified their cluster with the most growth potential over the next 5 years. 34% in the EEC and 32% in the MEC also rated the TEC cluster as the top two growth cluster.

7.3.9 Sales and Marketing Priority

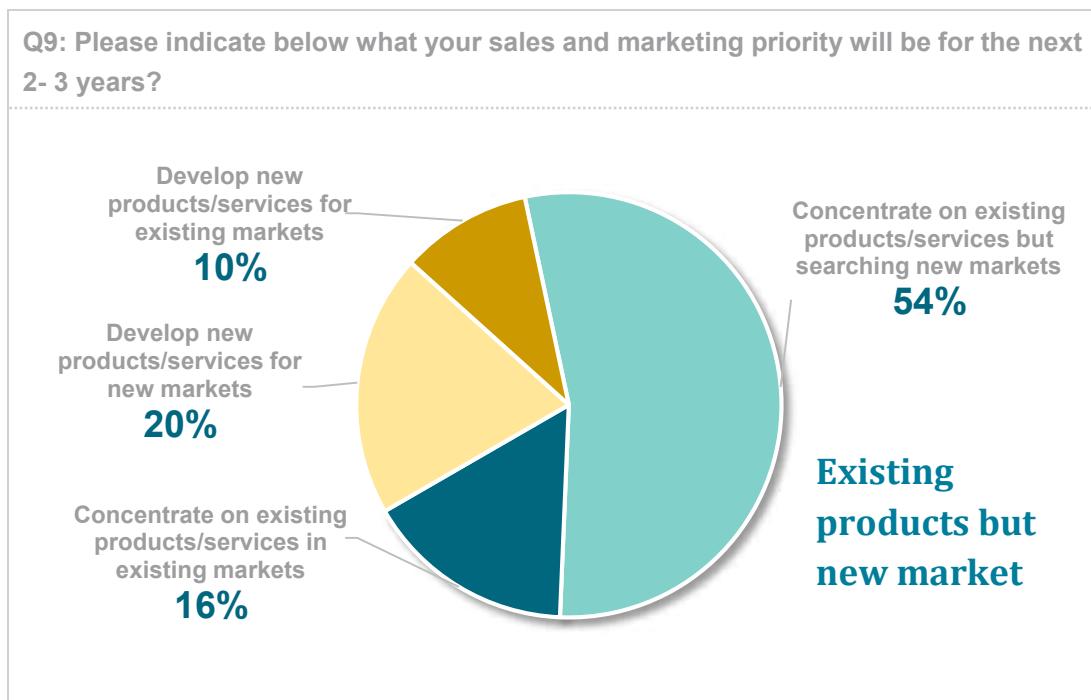


Figure 7.9 Sales and Marketing Priority for the Next 2 – 3 years

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

Existing products/services but new markets

While 70% of all businesses sales priority over the 2-3 years is to concentrate mainly on existing products/services, 74% of these businesses would also be seeking new markets and 26% servicing existing markets. One in five businesses seeks to develop new products/services for new markets.

Analysis between clusters showed some differences in sales and marketing priority. Seeking new markets with existing products/services was a priority among businesses in the LSC and MEC (25% each) compared with 13% for businesses in the TEC.

Businesses in the TEC are also least likely to develop new products/services for new markets (9%) compared with businesses operating in the EEC, LSC and MEC. Businesses in the MEC (26%) and TEC (23%) are also more likely to take the lower risk option by concentrating on existing products/services for existing markets.

7.3.10 Sales Direction

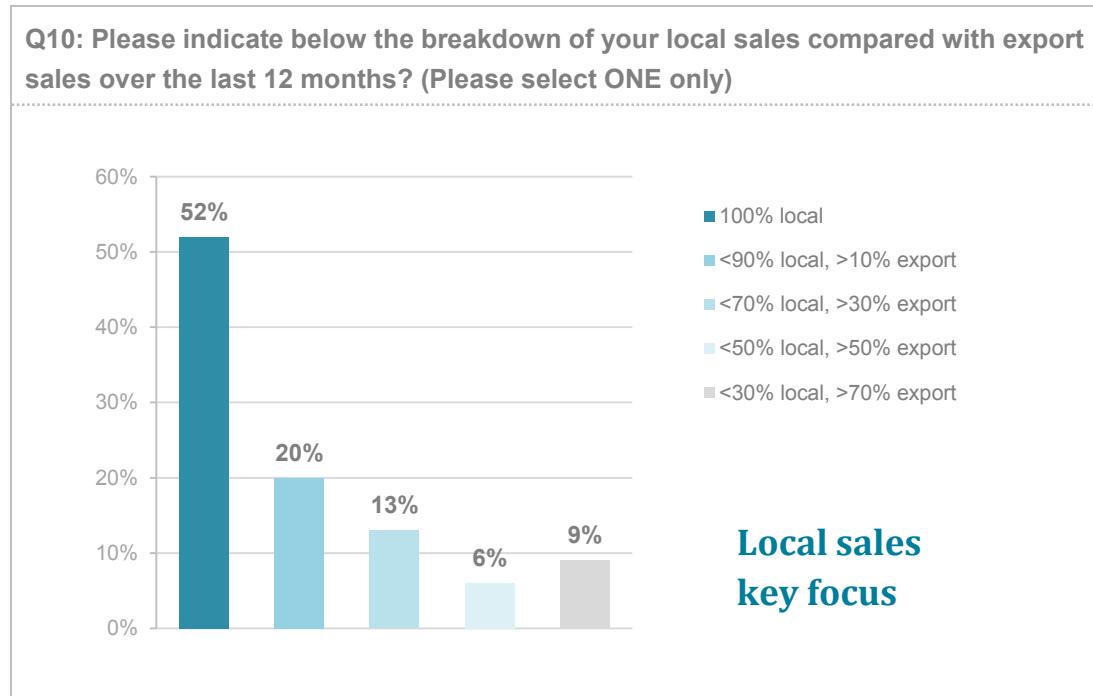


Figure 7.10 Breakdown of Sales over the Last 12 months

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

Local sales key focus

Dependency on the local markets has historically provided a sense of security without the risks associated with overseas markets. Globalisation, business digitalisation, changing demographic and consumption patterns now offers a mix of challenges and opportunities that extends beyond the local markets. While tough questions surrounds benefits of TPPA to the nation, building on and leveraging off businesses capabilities beyond local market becomes a priority.

To be certain, which clusters and which industries to promote, and how these could be leveraged in the development of a State's action plan that is set in a national context but with a clear regional and global direction is crucial in targeted decisions on resource deployment. Focussing on the local market alone undermines growth prospect in terms of export earnings, economic prosperity, stifles innovation, and research and development, especially when there is minimal engagement through competition in the global market place. Yet opportunities abound for industries operating in these clusters, whether historically and institutionally supported, and emerging, nascent clusters.

It is no surprise that 52% of businesses in the survey indicated that 100% of their sales are for the local, domestic market, with 0% export sales. The evidence is even more alarming when a staggering 85% of all businesses reported a 30/70 import/export sales ratio. Only 9% and 6% of businesses reported an import/export sales mix of less than 30% local sales/more than 70% export sales, and less than 50% local sales and more than 50% export sales, respectively.

Across all businesses in all the five clusters reporting zero percent export sales, 33% were businesses operating in the MEC, followed by businesses in the LSC (28%). While 14% of businesses in EEC reported 100% local sales, one in two businesses also reported export sales of more than 70% with less than 30% local sales. Among businesses in the FC, the mix of local versus export sales is less well defined. This is because while 10% of businesses reported 100% local sales, nearly one in three businesses (30%) reported export sales of more than 30% with less than 70% local sales.

What do all this mean in terms of export revenue, economic prosperity and international competitiveness of the industries? While a change in mind-set to focus on an export-driven economy is not going to happen anytime soon, businesses needs to start find the right balance between local and export markets and to better articulate their export strategies. This takes on added urgency given concerns over perceived increased unilateral policy decisions pre-empting the TPPA reforms. Businesses need to make sure its voice is heard and well understood, and perhaps rethink beyond the local market mentality by examining their role in the value chain.

For example, to ensure survival in the local market businesses in the MEC need to tap into overseas manufacturers' expertise through private-private and/or public initiatives and through the development of an innovation portfolio on industrial machinery and engineering that interface with the nation's expertise in agricultural, oil and gas sector; and recruiting and keeping talent.

Among businesses in the TEC, there is dire and urgent need to leveraging off breakthrough development in IoT, embedded technology including solar by setting in motion the creation of a technopreneur environment. Gaps in our value chain analysis highlight the need for more international joint collaborative initiatives that include innovation, research and development, marketing and distribution, and networking and cluster development initiatives. These actions, in turn, would expose businesses in this cluster to much needed overseas market with a view to export revenues, higher value-adding jobs.

7.4 Respondent's Profile

A total of 167 interviews were conducted online following strict data gathering guidelines. Referring to Figure 7.11, the interviews were spread across a range of industries and comprise of 19% businesses operating in manufacturing (including transport equipment), 13% in wholesale and retail, 12% in food & beverages and tobacco, 11% in health care, 6% each in utilities and energy and construction (building and civil engineering) and 5% each in distribution, logistics and transportation, and professional services (for business and consumers).

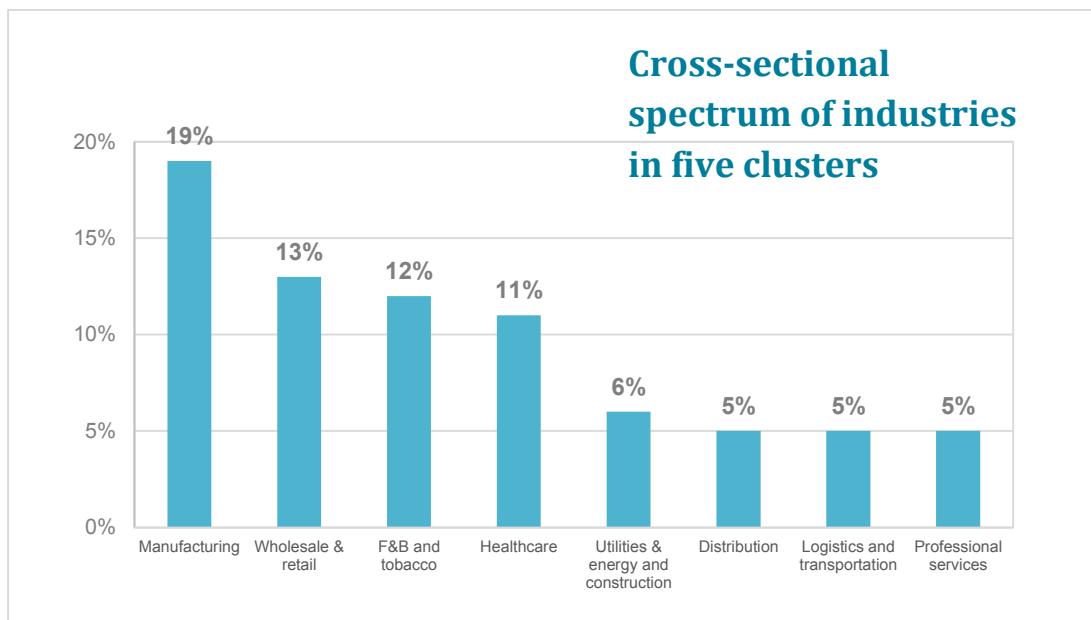


Figure 7.11 Distribution of Industries (Selected)

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

Of these, 50% of the companies reported an estimated gross revenues of less than MYR20 million. 13% reported an estimated revenue of between MYR20 million to MYR50 million. While 25% gave no indications of their expected gross revenue for the next 12 months, 5% indicated a revenue of between MYR250 million to MYR500 million, with 2% reporting a revenue of more than MYR 500 million. 3% of businesses estimated gross revenue of between MYR75million to MYR250 million. The results are illustrated in Figure 7.12.

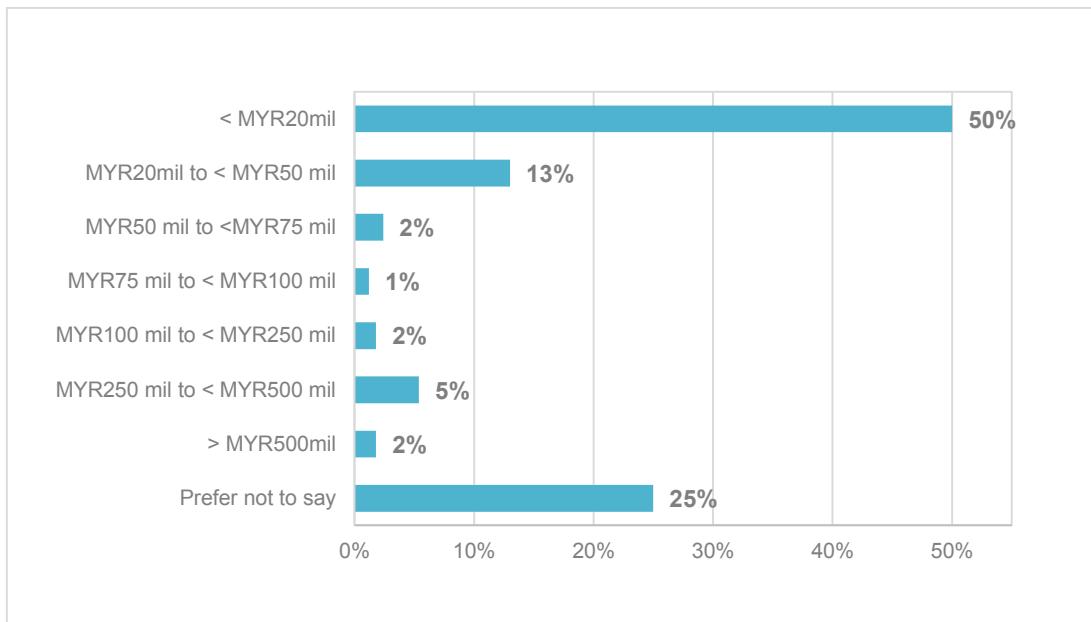


Figure 7.12 Estimated Gross Revenue for the Next 12 months

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

Referring to Figure 7.13, MNCs and subsidiaries of MNCs accounted for 15% and 16% respectively in terms of ownership of dominant firms in the respondent's industry. Large national firms and local suppliers accounted for 32% while 54% is reported as mainly SMEs. A further 35% of businesses are reported as mainly family owned firms and suppliers.

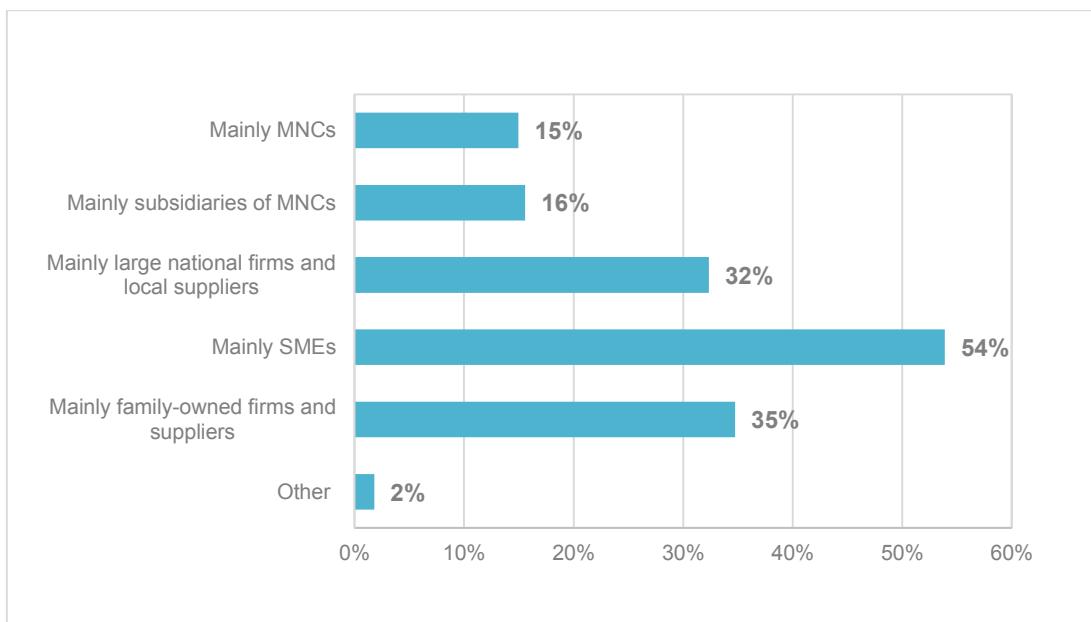


Figure 7.13 Ownership of Dominant Firms

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

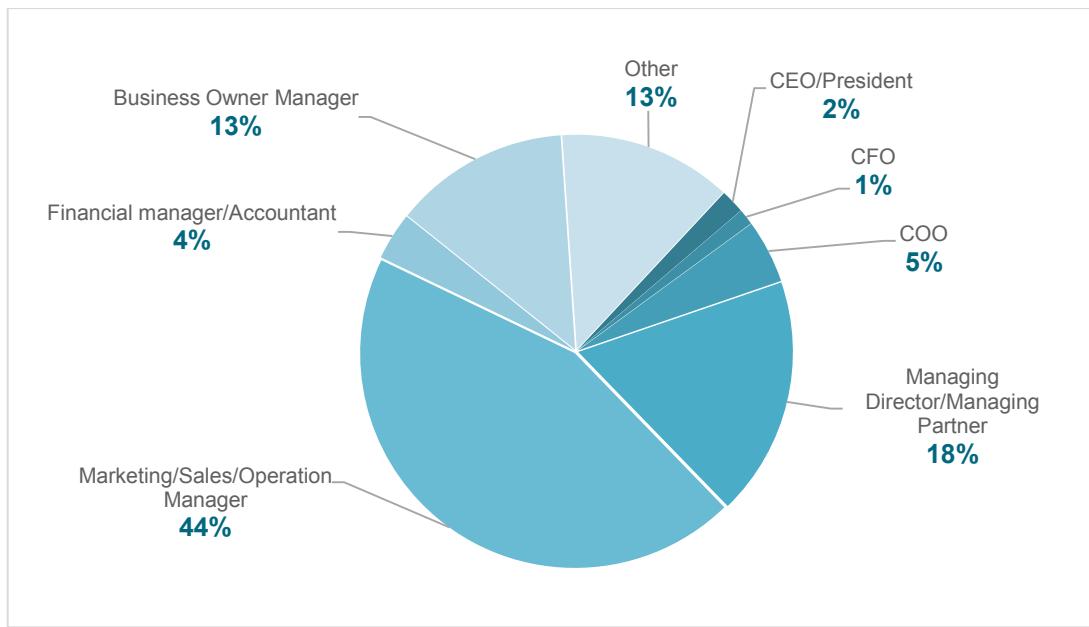


Figure 7.14 Role/Function within the company

Base: N = 167 respondents

Source: Monash University Malaysia, 2016

The profile of respondents was CEOs, senior managers, business owners and/or operators with knowledge of their industries and the clusters. One in four respondents (26%) were managing director/partner, CEO/President, Chief Financial Officer or Chief Operating Officer. 44% of respondents were Marketing/Sales or Operation Managers and 13% were Business Owner Managers.

~ End of report ~

Notes

Notes

Monash University Malaysia is jointly owned by the Jeffrey Cheah Foundation and Monash University

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