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THEME 7: PLACED BASED INNOVATIONS

SHAPING-UP CLUSTER WITH TRIPLE HELIX COLLABORATION: THE CASE OF MALAYSIA

Keywords: Cluster, Triple Helix, Collaboration, Multimedia Super Corridor (MSC) Malaysia

INTRODUCTION

Industrial clusters are one of the structural concepts used in planning economic growth that have been incorporated in many national competitive strategies. Porter (1990) suggests that industry clusters promote competitiveness of nations' industries through a set of active relationships between the cluster actors, including firms, universities, research institutions and government. These actors play vital roles in determining the success of such clusters, by supporting and enhancing the competitive abilities to innovate. Baptista and Swann (1998) found that firms located in strong clusters are more likely to innovate compared to those that do not. This has led to the acceptance and adoption of industry cluster concepts as one of the strategies for economic growth. However, it has also created challenges for developing countries that have adopted this strategy. These challenges are significant and often requires the adopters to address the following questions: (1) how relevant is the cluster concept for a developing country; (2) how vital are the roles of firms, universities, research institutions and government; (3) what influences and motivates firms to locate to the cluster; (4) what are the key contributing elements for cluster formation; and above all (5) what are the challenges faced by policy makers in the design and development of clusters?

The literatures document the success of cluster formation is limited. Undoubtedly, there will be those who will argue that the existence of successful clusters such as that of: (1) Silicon Valley in the United States of America; (2) Cambridge Fen in the United Kingdom; and (3) Sophia-Antropolis in France has been well documented. It should be noted however that these clusters have grown organically. A clear gap in the literature is the discussion of cluster formation from the perspective of engineered clusters in developing nations. Engineered clusters in this study refer to the formation of a new cluster

made-up from new firms involved in similar, related and complementary business activities. They are usually created by governments as a strategy to drive innovation, generate growth and produce key knowledge workers for these cluster industries. Hence, this study is designed to investigate and explore the cluster concept in Malaysia particularly the collaborative relationship issues and what lesson can be learnt for developing countries in general.

INNOVATION AND CLUSTER

Cluster as engine of innovation

Many literatures found that the success story of Silicon Valley in California is associated with the concept of industrial clustering. Since then, many nations especially from developing country for example Malaysia, Indonesia, Thailand and China have adopted the concept to help in generating the competitiveness of the nation as well as for economic development purposes. It is crucial and important to understand the concept of cluster first as it may result in either success or failure at the end. According to Simmie and Sennett (1999) the development of cluster concept has been theoretically debated during 1990s where it was focused on the conditions related to the regional economic growth. However the original conceptualisation dates back to Alfred Marshall (1920) work on industrial district that he observed the economic activity is often clustered in the same locations and as a result there must be agglomeration economies. Marshall believed that the industrial district concept could rescue the British economy during early 19th century as cited in Belussi and Caldari (2009). Industrial district according to Marshall (1920) is where local buyer and supplier have strong linkages, long-term contracts and commitments, and low linkages with firms beyond the districts. Adding to this, Schumpeter (1939) described the concept of cluster from economic perspectives as combinations of 'new' things such as methods, product or design or process could stimulate the innovation and continuous economic development; and entrepreneur plays a disruptive role in creating products. This is supported by Enright (1995) who stresses out the point of the industry clustering in regional cluster was to foster or react to innovation of firms to be competitive. Also noted by Porter (1990) in his 'diamond model' where the model is described as promoting the clustering of a nation's competitive industries. Porter (1998) explained cluster as a geographic concentration of competing, complements or interdependent firms and institution in specific fields which are dynamic

and important to competition in national, international and regional boundaries. Oakey and Cooper (1989) stated that the agglomerated or clustered formation of high technology firms is due to input material and labour advantages as well as the peripheral locations in their studies of high technology firms in South East England, Scotland and the Bay Area of California.

Therefore, the concept of cluster is about geographic concentration of firms and related institutions in a specific and interrelated fields which have strong relationship among actors, share common knowledge and culture, unique and dynamic, competitive which promotes innovativeness and have a continuous economic development agenda either in global, national, and/or regional boundaries. This could be summarised as the reason of clustering formation either for economic or sociology purposes or both and the process itself promotes the competitive activities and innovation process.

Reason for clustering

The motivation for clustering has been clearly stated behind its definitions as it's either for economic or sociology purpose or both. Krugman (1998) claims that clustering concept or localisation has shape the new economic geography and in time changes the spatial structure and economic growth. The reason for clustering includes the labour market demand, better access of information and interaction among actors such as firms, institution and government, save transaction cost, common interest and needs, unique infrastructure, promotes and motivates competitiveness and innovativeness among actors and also economy of scale. The best example is Silicon Valley in United State which took at least 30 years to be known as successful cluster in high technology industry such as semiconductor and biotechnology industry. Its success has changed economic development in California with novel technology and produce highly skilled entrepreneur and labour. Reported by Cybercities (2008), Silicon Valley has led other region in the U.S with regards to the employment of high-technology workers in 2006, with 286 high-technology workers per 1000 private sectors workers.

The demand of labour in specific areas resulted in labour pooling which makes the cluster unique as the local and(or) external skills needed for specialisation, efficiency and effective jobs, thus the force of labour market can be in favour of clustering. For example, the large pools of electrical and electronic, and software engineers related to ICT industry in Silicon Valley altogether has promoted

many advance technology such as iPad, iPhone and Satelite Navigation; and creates a pool of talented, skilled and innovative workers in ICT. Sourcing of labour would be much easier and reducing the recruitment cost for employers; and reduce the risk of relocation for employee. Thus, it could also attract other talented and skilled labour from outside the cluster to relocate and be part of the cluster.

Social interaction between actors in the well-established cluster provides mutual understanding of interest, needs and information. This means there are improved communications between actors within cluster and better access of specialise information (Porter, 1998). The knowledge gathered from social interaction such as business networking is more transferable and increase the trust element which is one of the main component in cluster's culture. This promotes the competitive agenda between actors in the cluster to compete and be more productive and innovative in order to survive within the cluster boundaries.

High technology based firms in cluster

The success of Silicon Valley is associated with the growth of its high technology based firm. Firms that involves in activity of cutting-edge, advanced technology, new and unique generally refer to high technology firms. However does the definition applies to firms that producing technology or intensively using technology? The definition of high technology based firm varies according to different scholars and its changes/shifts over time. High technology based firms (HTBFs) defined by Jone-Evans and Westhead (1996) in their research as companies or firms that are technologically innovative in industry such as computer services, electrical and electronic data processing equipment, aerospace equipment, medical and surgical equipment, orthopaedic appliances and telecommunications. The selected industry classified in Jone-Evans and Westhead does not include firms that engaged in the biotechnology industry, which widely recognised and contributed in innovative activity of high technology industry; and furthermore it is more concentrated on 'product-based' rather than 'process-based' activity (Jones-Evans & Westhead, 1996; Oakey et al., 1990). Moreover, Keogh and Evans (1998) defined HTBFs in their research as firms whose principal activity fall onto one of five categories: engineering, software, instrumentation/electronics, analytical services and biotechnology. However, Keogh and Evans research is limited for new HTBFs and focuses on 'process-based' rather

than ‘product-based’ activity due to small sample of 20 firms based in Aberdeen Science and Technology Park.

Referring to Organisation for Economic Co-operation and Development (OECD), HTBFs can be categorised as firms that involves in high technology activity from nine selected sectors in aerospace, computers-office machines, electronics-telecommunications (includes information and communication technology – ICT), pharmacy (includes drugs & medicines), scientific instruments, electrical machinery, chemistry, non-electrical machinery and armament (Hatzichronoglou, 1997). The OECD classification includes various aspects of technology diffusion (includes indirect intensity); uses R&D intensity as the main criterion of sector classification and applies two direct indicators, which are GDP purchasing power parities and R&D expenditure of countries participated to quantify the total R&D intensity. Using OECD classification, the biotechnology activity is categorised under the pharmaceutical and it is also classified in high technology sectors. The OECD sector classifications (from high, medium to low-technology based) uses by many economist and researcher from OECD’s member and non-members, and also European Union as a tool for international comparisons (Hatzichronoglou, 1997). The OECD classification has its limitations where the data were from manufacturing industry and not services industry as there were not enough detailed data available. However, the classification will fit to services industry once these are obtained. This research will use OECD’s high technology sector classification as a guideline to define high technology based firms. Therefore, from here, new technology based firms (NTBF) refers to new firms which are developing new technology under OECD classification of high technology sector and product classification.

Importance of NTBF in cluster

Interest in the development of NTBF has grown rapidly since 1980s (Oakey, 1991) considered the increase application of electronic technologies to production process (White J.E. et al, 1996). NTBF is the key result of many innovative clusters such as Silicon Valley, Route 128 and Cambridge, UK; and play major role in the emergence of ICT industry in America especially (Oakey et al, 1988). Based on research by Storey and Tether (1998), NTBFs show faster average growth rate of employment in Europe’s high technology sectors and expected to be an important source of future employment. However, the numbers of firms growing is not as fast as in United States, this may be due to the

negative factors of downsizing of large firms. NTBF is also important for technology transfer (Licht and Nerlinger, 1998; Fontes and Combs, 2001) within cluster and it usually associated in generating the process of collective learning (Maskell and Kebir, 2006) through social networks. This is shown in Longhi (1999) studies where the capacity of collective learning, networks and innovative milieu contributes towards the development of high technology regions in Sophia-Antipolis, France. The performance of technology transfer role also promotes as a source of new technological knowledge (Fontes and Coombs, 2001) and enhancing growth of NTBF in innovative cluster. Sophia-Antipolis for example has developed as a region with high technology focus from the beginning with large firms (IBM, Texas Instrument, Thomson and Aerospatiale) arrived in a vacant space and later influenced the formation of local firms in high technology industry and others to locate within the region. Longhi (1999) described the evolution of Sophia-Antipolis start with rapid exogenous growth since 1991 and fall in 1996. This has been taken over by the endegenous growth starting in 1996 with employment growth of +1460 in 1997 while exogenous employment growth only makes 52 jobs in the information technology industry. Today, Sophia-Antipolis is well known in Europe among its high technology activities such as in the field of computing, electronic, biotechnology and pharmacology; and also became European host of World Wide Web Consortioum (3WC).

Furthermore, Spilling and Steinsli (2004) studies on high technology small firms in two Norwegian technology cluster of Oslo and Trondheim found that 65% of innovation activity (mainly R&D activity) had developed new products or services and 70% had improved the products or services within the cluster. These activity has contributed towards the cluster evolution in Norway more dynamic and this evolutionary process derives from different ways likes independent start-up, collaboration with firms or institution, strategic alliances, merger and acquisition, and spin-out from larger firms. Thus, NTBFs plays importance role in cluster especially towards the economic growth, source of technological knowledge, process of learning and generating new ideas towards the dynamic of innovative cluster.

Key determinants of cluster formation in high technology-based industry

The evolution of Silicon Valley from agriculture to high technology industry has helped to open the eyes of other nations to replicate this form of regional clustering. However, an interesting observation is that the emergence of Silicon Valley into a highly regarded high technology area was achieved through what can be called organically grown and unplanned (Saxenian, 1985). Many articles and

books have been written about the triumph of Silicon Valley by identifying elements of its success. These elements were often studied by developing countries like Malaysia in their quest to emulate the success of Silicon Valley. Cambridge Fen in UK and Sophia-Antripolis in France are other examples of successful cluster in Information and Communication Technology (ICT) industry and biotechnology industry.

Based on these three clusters and literature reviewed, it was found that there were eleven (11) key determinants of cluster formation. These includes (1) close relationship with university, industry and government; (2) local entrepreneurs and skills; (3) technology availability especially the latest and cutting-edge equipment to be used; (4) local financial support; (5) role of financial institution and venture capitalist to support the local firm especially the new firms; (6) physical location of premises; (7) research and development (R&D) activities; (8) connection to market; (9) issues on intellectual property right and patent; (10) government and its regulations; and (11) local culture including trust issues. Theoretically, all of these determinants are interrelated to create an ideal and successful cluster supported by the role of university-industry-government relationship. The question is how to make it applicable for developing countries? Malaysia is embarking on its initiative to create and engineer its own industrial cluster based on lessons learnt from the success of clusters in other parts of the world and adapting this to the resources available in the country. This will be discussed further in the next section.

THE CHALLENGES ON ROLE OF ACTORS IN CLUSTER

Government perspective

Governments play a major role in the innovation processes of a country. The national system of innovation (NIS) is the responsibility of government, to plan and stimulate innovation process and learning at national level. The concept of NSI involves the interaction between people bounded with the national culture and norms. Lundvall (1992) suggests an ideal role performed by governments and private sector based upon public policy and NIS could enhance technology capabilities of nation. However global intervention causes challenge for NIS and possible chance to public policy.

University perspective

Universities were traditionally associated with teaching and learning. However the role of university in innovation has shifted from its traditional function. Today university acts as an entrepreneurial centre producing talents, innovators, policy advisers and business consultant apart from also developing its own start-up enterprises. This new role exists as a result from collaborative interaction between entrepreneurial university, government agencies, public and private industrial firms, intermediaries and other institutions. Entrepreneurial university is a concept portrayed in Triple-Helix models where university involves in regional economic development through its entrepreneurial activities as common characteristic of enterprise in industry along with its common traditional role (Etzkowitz and Leydesdorff, 1997). However, the concept has been reviewed and found to be more relevant to developed countries and challenges to developing countries. According to Saad, Zawdie and Malairaja (2008) the main challenges for developing countries is the development of culture partnership and collaboration and also reducing strict interaction boundaries between organisation and institutional sphere that could hinder the 'academic entrepreneurship' phenomena.

Industry perspective

Firms manage its innovation through many ways but one of it is learning through alliances or collaboration. This notion starts with networks linkages and interaction among others in similar or related economic activities. This concept of innovation network appears to benefits firm's development internally and externally. But also offer challenges in communication and mutual understanding issues such as trust between collaborators (Tidd, Bessant and Pavitt; 2001).

CLUSTER IN THE MALAYSIAN CONTEXT

The Malaysian government has recognised the cluster-based development approach as one of the strategic development tools for the growth of its economy. There are selected geographical areas identified as Free Trade Zone (no duty tax on products and services) which aims to boost the growth of local industry cluster especially in tourism industry in areas such as Labuan Island, Langkawi Island

and Tioman Island. Furthermore, there are five new growth corridors identified during the Ninth Malaysia Plan (for year 2006 – 2010) with the objectives of balancing the regional economic development and focusing growth in the selected industry cluster and geographical areas. According to the Tenth Malaysia Plan (for year 2011 – 2015), Malaysian government has identified the potential economic cluster in selected areas or also known as National Key Economic Areas (NKEAs) of each of these five corridors have the economic and geographic advantage. They are briefly explained below.

Northern Corridor Economic Region (NCER) - This corridor covers the northern part of Malaysia ranging from states of Kedah, Pulau Pinang, Perlis and four northern districts in Perak (launched in 2007). Traditionally these states in particular Pulau Pinang contributes to majority of manufacturing and services industry (i.e. electric & electronics) in Malaysia. Based on Tenth Malaysia Plan, there are four NKEAs identified which were agriculture, manufacturing and services, tourism and logistics. Along with these targeted industry, strengthening local talents, enabling technologies and local infrastructure development as the key outcomes target to support the industries.

Iskandar Malaysia – This corridor covers the southern part of Malaysia which is state of Johor and formally known as Iskandar Development Region (IDR) was established in July 2006. This states traditionally contributes the country's economic growth in manufacturing, utilities, tourism, properties and logistic. The strategic location of the states which is sharing the Malacca Straits and South China Sea with neighbouring country of Singapore makes Johor as one of busiest port of Malaysia. The state has been responsible to further its investment in five NKEAs identified by the Malaysian government in the Tenth Malaysia Plan. The industries were of education, healthcare, finance, creative industry, logistic and tourism.

East Coast Economic Region (ECER) – This corridor covers the east part of Malaysia which stretching from states of Kelantan, Terengganu, Pahang until the district of Mersing in Johor (launched on June 2008). The economic activity of east coast of Malaysia is less active than other regions in peninsular Malaysia. Traditionally the region mostly depends on agriculture and tourism

industry. There are four NKEAs identified that main objectives is to accelerate the sustainable economic growth and improve the income and poverty level of the region. The industry identified were related to tourism; oil, gas and petrochemical manufacturing; agriculture; and education.

Sarawak Corridor Renewable Energy (SCORE) – This corridor covers the state of Sarawak which geographically located in the north of the island of Borneo. The initiatives to develop the Central Region and transform Sarawak into developed state by year 2020 along with other regions in Malaysia (launched in January 2008). The primary focus of this corridor is to economically and environmentally make use of its energy resources of hydropower and natural gas located in Central Region of Sarawak as its main source of income. Other than that, there are ten priority industries related within the NKEAs identified by the government to be further promoted and develop for this region. The industries were involve in heavy industry such as aluminium, glass, steel and timber industries; agriculture industry such as palm oil and related products, livestock, fishing and aquaculture related industry; marine engineering industry and tourism industry.

Sabah Development Corridor (SDC) – This corridor covers the entire state of Sabah and northern part of the island of Borneo. The SDC was launched in January 2008 to further develop the region and prioritising the industry that could enhance the quality life of Sabahan. There are five NKEAs identified which were tourism, manufacturing (palm oil and related products; and oil and gas industry), agriculture and logistic industry. There are twelve major development programmes under SDC such as Kinabalu Gold Coast Enclave (focusing on activities related to areas of marine sports, resorts and holiday homes, and speciality natural products) and Oil & Gas Cluster (focusing on activities related to areas of petrochemical complex, oil and gas support services, oil refineries and tank farms, and power plants). However, there are still major physical infrastructure developments needed to materialise the contribution of SDC towards Malaysia's resilience economics of growth.

Other than these five corridors or regions of identified clusters, focus is also given to the area called Greater Kuala Lumpur (Greater KL) cluster announced in Economic Transformation Programme in 2010 where this geographic areas contributes 8 times the Gross Domestic Product (GDP) of any other city in Malaysia (EPU, 2010) and covers Kuala Lumpur (capital city of Malaysia) and its

neighbouring cities, also known as Klang Valley. Within Greater KL, an engineered cluster of Multimedia Super Corridor (MSC) was created in 1996 to spur the economic growth and introduce information and communication technology (ICT) industry as an industry that can move Malaysia forward towards high technology industry with talented skills and attract foreign investment. Engineered clusters in this study refer to the formation of a new cluster (in the case of Malaysia is ICT and biotechnology industry) made-up from new firms involved in similar, related and complementary business activities. These type of cluster usually formulated, created and develop by governments as a strategy to drive innovation, generate growth and produce key knowledge workers for these cluster industries. The city of Cyberjaya has been created from the green-field of rubber and palm oil plantation to brown-field of commercial building of firms in ICT industries and other related industries along with research institutions and higher education institutions. Further section briefly explained the MSC project.

Multimedia Super Corridor (MSC) Malaysia project

Inspired by the success of Silicon Valley in California, coupled with the intention to be a developed nation under its Vision 2020 initiatives, the policymakers in Malaysia established the Multimedia Super Corridor (MSC) also known as MSC Malaysia in 1996 with a mission to transform Malaysia into a high-technology zone and knowledge-economy. In line with this project, the Malaysian government established the Multimedia Development Corporation (MDec) to develop, facilitate and oversee the MSC Malaysia project. The MSC covers an area of 50 x 15 km^2 zone, stretching from the Petronas Twin Towers in Kuala Lumpur which also referred to as the Kuala Lumpur City Centre (KLCC) to the Kuala Lumpur International Airport (KLIA). This zone includes Putrajaya (the official seat for federal government), Cyberjaya (national hub for information and communication technology (ICT); and research centre), Multimedia University, MSC Central Incubator (focusing on IT and multimedia) and Technology Park Malaysia (focusing on ICT and biotechnology). The development of the MSC is spread out over three phases of covering a period of 25 years (1996 – 2020) as shown in Table 1. The concept of MSC also being establish to promote healthy linkages among actors in Porter's Cluster concept and the Triple Helix's innovation concept that could drive the innovation, contributes to competitive advantage of nations and sustainable economic growth. However there are challenges

for Malaysia to pursue this project and it is interest of this research to explore the high technology firms located within the MSC cluster.

	Phase I **(1996 – 2004)** **Create Multimedia Super Corridor**	**Phase II** **(2004 – 2010)** **Link MSC to other cyber cities in and outside of Malaysia**	**Phase III** **(2010 – 2020)** **Transform Malaysia into Knowledge-society**
Target Milestone	• 1 corridor. • 50 world-class local companies. • Launch 7 flagship applications. • World leading framework of Cyber laws. • Cyberjaya as world-leading intelligent city.	• Web of corridors. • 250 world-class companies. • Enhance current flagship applications and introduce new one. • Harmonisation of global framework of Cyberlaws. • Enhance local ICT industry. • Link 5 intelligent cities to other global intelligent cities.	• 500 world-class companies. • Global test-bed for multimedia application. • International Cyber court of Justice in MSC. • 12 intelligent cities linked to one another.
Achievements to-date	• Build a corridor ranging from KLCC to KLIA. • 742 companies (10 strong performers and 50 foreign and local MNC's were awarded MSC Status). • 7 flagship applications were launch before end of Phase I. • Comprehensive set of cyberlaws were enacted but Personal Data Protection Act are still pending • More focused on development of physical infrastructure in Cyberjaya while social infrastructure was not at the same pace	• 7 Cybercities and 8 Cybercentres have been created while southern and eastern corridors are still undergoing development • As of October 2008, 2173 companies in total have been awarded MSC Malaysia status while 9% from this number were inactive. • Flagship applications that were launched are still in enhancement process of its potential (Electronic Government, MyKad, Smart School and Telehealth) and there have been no new flagship launched. • ICT related laws especially IP-protection right have yet be adequately enforced	• In the hope by end of Phase III Malaysia will be transformed into Knowledge society

Table 1: Development plan and current achievement of MSC Malaysia for period of 1996 – 2020. (Source: Official website of MSC Malaysia (www.mscmalaysia.my) and the National IT Council (www.nitc.org.my)

Previous Research on MSC Malaysia

There are not many research papers published on MSC Malaysia at the moment compared to other more established clusters such as the Silicon Valley. Notwithstanding the role of government, it can be said that there are four major important elements that support Silicon Valley success. These elements are: (1) culture; (2) the university-industry relationship; (3) technology and infrastructure; and (4) availability and access to venture capitals.

One of the few researches on the MSC is that by Tidd and Brocklehurst (1999) which identified two major weaknesses in Malaysia's innovations policy: (1) lack of strategic intent to exploit alliances; and

(2) lack of indigenous expertise (knowledge and skills). However, government role in creating MSC Malaysia project has shown some effort for technological learning. Ramasamy, Chakrabarty and Cheah (2003) report on the progress of the MSC found that the lack of intangible factors such as entrepreneurial spirit that could threaten the success of the project. The researchers also criticise the culture of risk aversion of Malaysian which they deemed important enough to warrant government intervention. The study by Ramasamy, Chakrabarty and Cheah (2003) also found that there exist skills gap among Malaysian which must be addressed in order to achieve the objectives of the MSC.

Malairaja and Zawdie (2004) found that the MSC project has increase joint-venture activities in Malaysia especially in information and communication technologies (ICTs) industry. However, there is limited international joint-venture and technology transfer. The study by Malairaja and Zawdie (2004) identified two main factors behind the ineffectiveness or lack of innovation and technology transfer in Malaysia: (1) learning gap (knowledge and skills readiness); and (2) institutional gap (organisational and cultural framework). There is weak link between technology transfer practices and decision to innovate. The research also suggests that government need to enhance local technological development in its innovation policy while strengthening the links between institutions, research institute and private firms (triple helix culture). Adequate venture capital's investment and infrastructure support is also required in order to stimulate the development of technology.

It can be summarised from previous research that there are: (1) gaps in knowledge and skills among locals; (2) low level of institutional link even though progress has been made; (3) ineffective policy on innovation; and (4) influence of local culture are among the factors slowing down the progress of the MSC project. At the same time, there is limited information available on the components of firm formation and cluster analysis of MSC project. Currently, there is little research done on the role of university, industry and government relationship or interaction for firm formation within MSC cluster.

RESEARCH METHODOLOGY

This paper applies the Triple Helix and cluster model to conceptualise and organise research framework as well as analysing the research problem. A triangulation survey approach has been used by integrating the quantitative and qualitative data to gather and validate information, deepen and broaden understanding on cluster phenomenon in engineered cluster of MSC Malaysia including the

role of actors and collaboration issues in Triple Helix environment. An on-line survey questionnaire was conducted and sent to firm located within the areas of MSC cluster to understand the current state of technology firms. The survey consisted of 88 technology firms involves in information and communication technology (ICT) and biotechnology (Biotech) industry which has experiences in collaborative work. Further semi-structured fieldwork interview was performed in Malaysia with 21 interview respondents consists of actors in Triple Helix environment including local universities, industry (i.e. technology firms, financial institutions and intermediaries) and government agencies. The interview samples were carefully selected to represent the Triple Helix stakeholders in MSC cluster.

RESULT AND DISCUSSION: CLUSTER AND COLLABORATION IN MSC MALAYSIA

The state of technology firms in MSC Malaysia

The data obtained from the survey shows the current condition on the development of firms' formation, the impact of determinants and value of partners in cluster. The finding indicates the Malaysian high technology firms show nearly similar pattern with other high technology firms in different countries. However the role of government is significantly influence the development of firms in the cluster.

The development of cluster starts with the development of firms in the cluster itself. It is important to know where the origin of idea to form new firm comes from. Through this, the start-ups may be recognised as spin-outs from research institution, existing organisation or collaboration with different organisations or institutions. In cluster evolution perspective, the role of institutions such as university and research institutions regarded as the important mechanism in promoting high technology spin-off firms (Keeble, & Wilkinson, 2000; Menzies, T., 2004;). Based on the research finding, the link of these institutions is week where majority of respondents (64.8%) developed the idea independently to form a new venture compared to other sources (see Figure 1). The ideas were generated while the owner was working in other firms and in some instances working within other institution such as university and research organisation. Collaboration has also given ideas for the formation of new firms and the result suggests that collaboration with other firms is in favour other than collaboration with other institution. However such collaboration has week influences for spin-offs and this further

questioned on the important role of the relationship between firms and university or research institutions in MSC Malaysia. Little evidence also found that 3.4% of the ideas came from other sources such as initiative by the government, political influences, innovation led and also foreign firms.

Government role in giving support such as tax benefits, research grant and award incentives can be considered important in the development of firms particularly for new start-up. Respondents were asked to identify any status recognition received for their organisation. There are two types of recognition outlined which are MSC Status Companies for ICT industry and Bio-Nexus Status Companies for biotechnology industry given by the government for support the development of the firms. The survey results found that 56.8% of respondents are currently enjoying incentives based on the status recognition that they obtained. Respondents later were asked on the impact of having such status recognition on their organisation and this is reflected in Figure 2. Overall, the respondents agreed that by having status recognition it could possibly give a positive impact and benefits to firms. This result suggests that high technology firms are most likely depending on government incentives and government plays as dominant role in development of cluster. According to Triple Helix concept, this behaviour is referring as *statist* type of Triple Helix culture, where government maintains the dominant role in the cluster. Thus supporting the argument by Razak, A. & Saad, M. (2007) on positioning the Malaysian university in *statist* type of Triple Helix culture of innovation, however their research suggest university should be given more autonomy to positioning Malaysia move forward the next level of helix i.e. *lassiez- faire* type of Triple Helix.

Technology based firm generally perceived research and development (R&D) as an important business strategy to their firm. According to Oakey (2007), the clustering advantage of sharing technological ideas or information among other competing technology based firms clearly based on informal networking rather than formally based. This reflect to the important of collaborative relationship among actors in cluster in particular related to managing their R&D. Respondents in this survey were asked to rank the significant impact of research and development activities to their firm from scale of no impact to high impact. The results indicates that majority of respondents (84.1%) agreed that R&D give a significant impact to their firms by being actively involves in R&D activities.

An overall, the finding indicate that engineered cluster of MSC possess similar pattern on how the firm was formatted as in Silicon Valley and Cambridge. The major differences are the MSC is highly

depends on government for support in commercialisation, financial and social linkages with low involvement of university in supporting the industry.

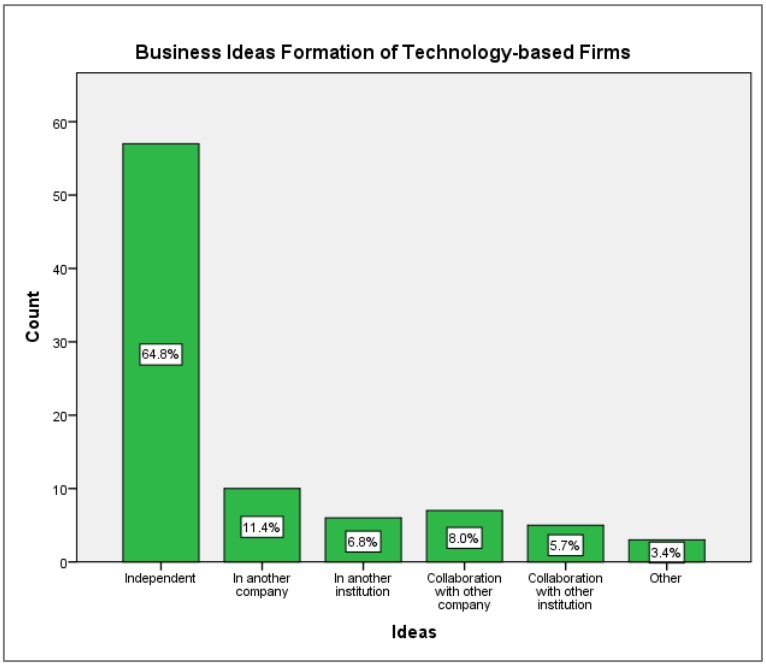

Figure 1: Business idea formation of technology-based firms

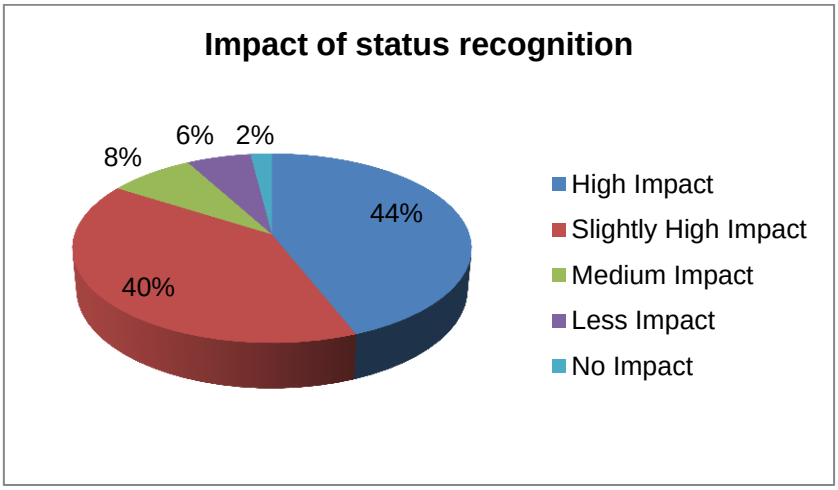

Figure 2: Impact of status recognition

Impact of determinants in cluster

Respondents were asked to identify the impact of listed determinants in the questionnaire using a five-point Likert scale ranging from high impact to no impact. The result revealed five key determinants were most important based on the highest score of mean shows in Table 2. Majority of respondents (93.1%) indicates the role of government in its policy and support as the most important factor to support firms in cluster comparing with other factors. This means firms are much depends on government support than their own capability to survive in the high technology industry. Other most important factors identified including the capability of firms in connecting to their current market, availability of current technology including its facilities and equipment, healthy relationship with industry and also with government agencies.

The respondents consider the concept of geographic concentration as the physical location of premises gives little significant evidence on its importance to firms. This finding is in contrast with Porter (1990) cluster concept; however, it is important to have a broader perspective on this. The concept is too focused on geographical factors neglecting to consider other factors that might be of importance to success of clusters such as governmental support and commercialisation issues to name a few. Also the concept is vague towards the engineered cluster in developing country of like MSC Malaysia. This is one of the key finding of this study, where it was found that geographical factors is not that important in determining the success of clusters (see Table 2). Interestingly, the elements of social issue which is having relationship with local higher education (i.e. university) is considered as least important to respondents and it also has the lowest mean score of 3.08. This result also shows respondents are not interested to have social interaction with university as they perceived such relationship will not give any benefits or significant impact to their firms

Factors contributing to support firm formation	Mean	Standard	Cumulative Percentage

		Deviation	(Important and above)
Government policy, support & regulations	4.34	0.64	93.1
Connection to market	4.22	0.90	71.8
Availability of technology	4.15	0.82	79.5
Close relationship with industry	4.02	0.83	76.2
Close relationship with government's agencies	4.00	0.84	78.4
Involvement and allocation of R&D	3.85	1.02	65.9
Availability of financial support	3.80	0.95	74.8
Issues on IP	3.73	1.01	62.5
Availability and quality of local entrepreneurs and skills	3.67	0.88	60.2
Culture issues including trust	3.65	0.91	65.9
Physical location of premises	3.43	0.87	48.9
Close relationship with university	3.08	1.23	37.5

Table 1: Mean score distribution for factor contributing to support firm formation in cluster

ROLE OF ACTORS IN MSC CLUSTER

The success story of high technology cluster includes Silicon Valley and Cambridge is associated not only by strong linkages amongst its system actors, active involvement of venture capitalist for financing and advantages of geographical concentration through its economic activities; but also role played by its own complex system actors. A healthy relationship and role played by local firms (industry), university and government make-up the clusters to continuously grow and performs in its own way (culture). In the development of MSC cluster, the interviewees confirmed that the role played by government and industry are both significantly contributed. In total, there are 9 interviewees agreed that government and industry are both important. However the contributions from the university alone rather look disappointing with little contributions involves for the development of MSC as displayed in Table 2. Role of actors in cluster were another issues emerged from the interview data. Each stakeholder has different views from others and found out that the role of university has less contribution into the development of the cluster. The interview data also discovered that role of government sees as dominant contributor in the development of cluster as also found in the quantitative data survey in Table 3. As an overall, the role of university seems moving from learning, teaching and researching to be source of funding, spin-off and source of talent. These various roles of university have placed university in difficult situation to interact and evolve towards triple helix culture and innovative technology cluster.

Contributors in MSC cluster development	Count
Government	8
Government & Industry	9
Government & Intermediaries	1
Industry	2
University, Industry & Government	1
University & Industry	0
University	0
Total	**21**

Table 2: Relative major contributors in MSC cluster development viewed from interview respondents

Collaborator's Partner	Mean Score	Std. Deviation	Cumulative Percent (Slightly High Value and above)
Customers	4.25	0.81	86.4
Government Agencies	3.94	0.90	63.9
Suppliers	3.92	0.82	76.5
Foreign firms	3.91	0.81	69.3
Financial institution	3.72	0.97	61.5
Local firms	3.66	0.90	61.4
Intermediaries	3.52	1.00	42.3
Research Institution	3.05	1.09	35.3
University	2.90	1.12	31.8

Table 3: Mean score and impact distribution for value of collaborator's partner in cluster from survey respondents

Role of university	Role of government	Role of intermediaries	Role of industry
• Learning and teaching centre • Source of talent • Research and development centre • Collaborators for research and business • Spin-off and entrepreneur producer • Source of funding • Knowledge sharing provider • Problem solvers • Agent to government	• Source of funding • Policy planner and regulators • Connectors to market • Intermediaries • Provides support to industry and university • Provides economics environment	• Access of funding • Facilitator • Project manager • Agent for government • Problem solver • Marketing and commercialising • Training providers and educators • Business intelligent • Resources agent • Knowledge and technology transfer centre	• Sharing knowledge and resources • Corporate social responsibility • Adviser to government and academic council for university • Seeking and hiring skills and talent • Provides knowledge and technology transfer • Motivator for competition • Provides training for local skills • Engine of growth

Table 4: Summary views on role of actors in MSC cluster

COLLABORATION IN MSC CLUSTER

The majority of the respondents agreed that the primary reason of collaboration is related to the benefits of their firms in the industry, particularly economic reasons rather than social reasons (see Table 4). Also, respondents viewed collaboration as a strategic management tool in strengthening business operation capacities, enhanced innovative capacities and strategic planning. By having collaboration, respondents agreed that it would increases business opportunity, competitiveness and profit maximisation of firms in the market. There is some evidence of knowledge seeking activities have been done via collaboration. This motive is more towards improving knowledge capability and sharing technical knowledge with their collaborative partner. Through this, cost could be save and inspire more valuable ideas into the business. Other explanation where majority of respondents agreed upon the motives of collaboration was that collaboration was able to give opportunity for firms to benefit from government's incentives and support in the form of tax credit and allowance. For this reason, 77.2% of respondents rated this motive as 'Slightly High Impact' to their firms. Furthermore, collaboration is associated with social motives such as increasing networking contact and self-recognition.

The process of collaboration has been recognised as the major barrier of its ineffectiveness such as bureaucracy and process of financing. Limitation of local skills was found as another major barrier of collaboration which included low number of quantity and quality of local skills, lacking of commercialisation skills and also availability of local technology. Other collaborative problems gave less impact to majority of respondents. They included the influence of large and foreign firms, knowledge sharing, personal objective, local culture and physical location of premises. Respondents also agreed that unclear policy and guideline of patents is one of barrier for collaboration; however it gives less impact to the firm and not a major problem that need to be resolved. This indicates the current policy and guidelines are in favour for collaboration. Also respondent's practices in gift-giving or reward practices has little concern over personal reasons to assure them it would be a barrier in collaboration.

The most prominent collaboration enabling factors that could contribute to the success of a collaborative relationship was the importance of skill. This could be enhanced by focusing on the quality and performance of local education system along with availability of local technology. Without

a doubt, the role of government is seen as equal important in this situation by providing balanced business eco-system including the info-structure and infrastructure support. The social element includes actively involved in social networking activities and trust's capability among partners also see as important and encouraging for firm to collaborate. However, it depends on the clear defined and effective expectations between partners.

In summarising, the capability of collaborations of MSC Malaysia is dependent on its motives and barriers of collaboration which also associate with the determinants of cluster formation. This was illustrated in the summary of survey and interview data findings in Appendix 1 and Appendix 2 respectively.

Objective of collaboration	Mean Score	Std. Deviation (sd)	Cumulative Percent (Slightly High Impact and above)
To increase business opportunity (e.g. connection to market)	4.38	.763	89.70
Strengthen the position of your organisation in a competitive cluster of your business industry	4.27	.840	82.90
Improves and gain technical skills & know-how of selected technologies	4.26	.686	88.60
To develop new ideas (e.g. technology, design of product or process)	4.18	.687	88.40
To achieve profit maximisation	4.15	.851	77.30
Enjoy the tax benefit/credit from government (e.g. government support program to encourage collaboration)	3.99	.977	77.20
Increase social networking contact and reputation	3.87	.770	70.50
To increase social commitment and trust benefit with your collaborators	3.80	.805	69.30
To upgrade and increase the quality of R&D	3.77	.968	78.20
To achieve self-recognition and be known by others	3.74	.953	68.20
To increase the possibility of formatting new business venture (e.g. open your own company / start-up)	3.63	1.021	61.30
Government influence and policy that you have to collaborate with others (e.g. sometimes government has sign the memorandum of understanding (MoU) with other international firm to improve political relationship)	3.60	1.088	64.80
Ability to use collaborators patent e.g. licensing of patent	3.32	1.140	50.00

Ability to use sophisticated and expensive technologies or equipment that your organisation do not have	3.30	1.074	44.30
To increase numbers of research papers publication	2.67	1.275	29.6

Table 4: Mean score and impact distribution of collaboration's objective.

CONCLUSION AND IMPLICATIONS TO POLICY MAKING

This paper has explored the main strategic characteristic of the Malaysian ICT and biotechnology industry and identified how these companies used collaboration as strategic management tools in their own industry cluster. There is evidence of collaboration as contributing factor in developing new business ideas for technology firms in Malaysia but the linkages among firms and university rather disappointment result. In contrast the high technology firm in MSC sees collaboration as important for the social networking purposes with other firms rather than with local university or research institution. However, the role of government along with its positive and encouraging policy to support these firms considered important toward firm's development. In a different perspective, the role of university sees less important to the firms as little contribution is appreciated from collaboration activities. This phenomenon explained the role of government is dominant in the cluster and effort in collaborative relationship should be strengthen between the triple helix's actor i.e. university, industry and government. Reducing the bureaucracy and improving the business eco-system seen as enabling factor to encourage collaboration and bridging the gap for successful engineered cluster's development. It is suggest that the role of intermediaries such as government agencies (in this case such as MDec, SME Corp. and Biotech Corp.) and trade associations also seen important for high technology firm in acting as an agent or broker in facilitating, supporting and mentoring the university as well as industry for enjoying the full clustering advantage.

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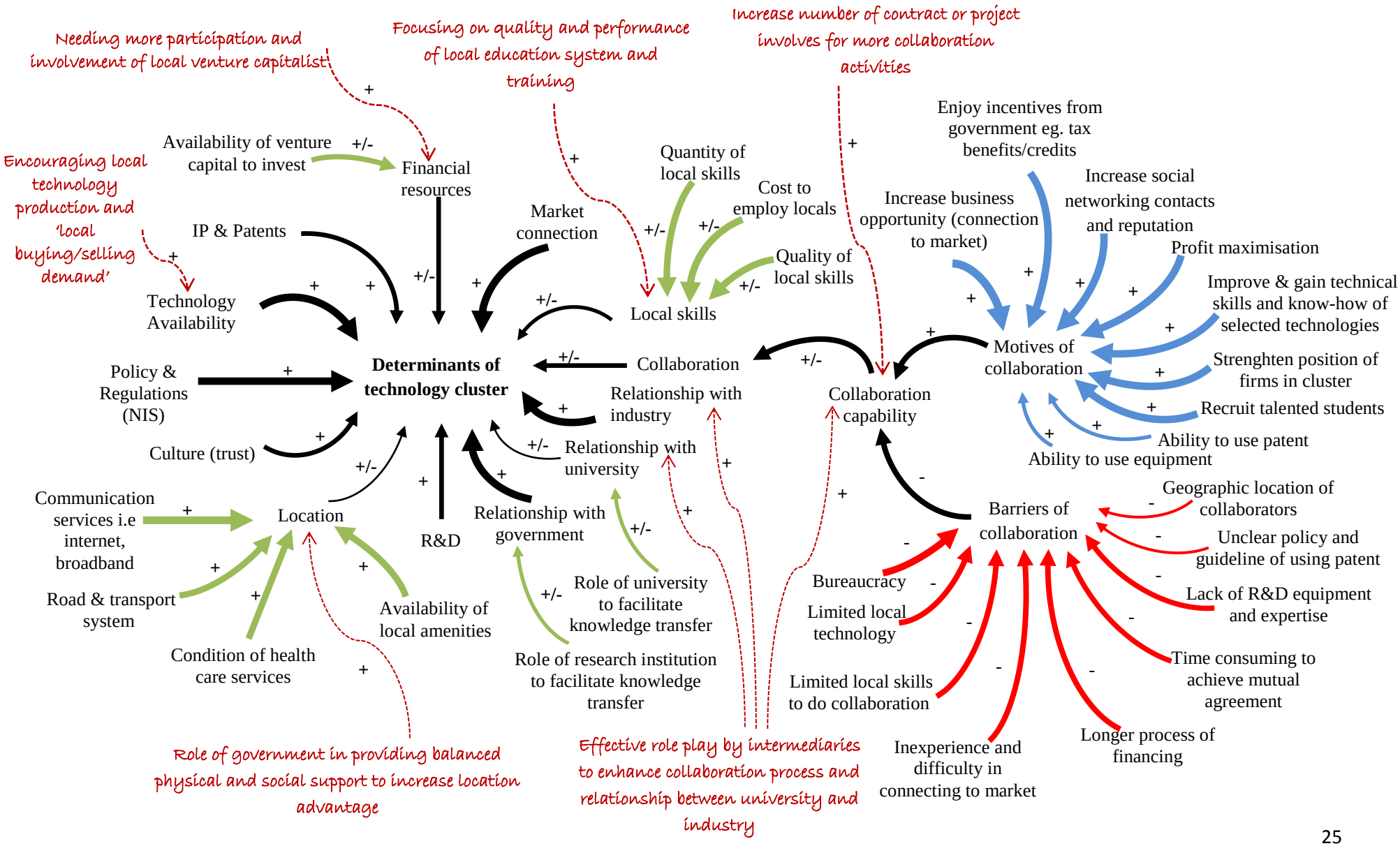
Appendix 1: Summary of survey data analysis based on conceptual model



Appendix 2: Summary of interview data analysis based on conceptual model