

OPEN ACCESS

How Firms Develop Linkages for Development and Growth - Cases in Malaysian Greenfield and Brownfield Technology Parks[†]

Awari V. Mohan^{1*}, and Isshamudin Ismail²

Nottingham University Business School (NUBS), University of Nottingham Malaysia Campus¹

Pahang Bio Science, Malaysia²

Abstract : This paper aims to explore how firms develop and grow in regional clusters based in a developing country. The argument is that start-ups / small and large firms are able to grow by developing linkages or networks for resources within clusters – and this tenet is based on studies of firms that are based from such clusters as Silicon Valley in the US, Cambridge in UK and other clusters from which have evolved over long periods of time. Most of the time we hear narratives from the developed world where there are brownfield cluster development efforts. In developing countries governments are making efforts to develop clusters from scratch – which in this paper we term as greenfield cluster versus a brownfield development, which is where the cluster is developed based on existing and new organisations in a region. In this paper, we believe the context of clusters can be important in determining the way firms develop linkages for their growth – and we look at two contexts in Malaysia ie. A greenfield cluster and a brownfield cluster. The paper presents findings from case studies of firms in a greenfield cluster (Cyberjaya) and a brown field cluster (Penang) in Malaysia. The cases reveal fairly different approaches to development of linkages or networks, which we hope will provides insights to cluster development officials and policy makers and implications to researchers for developing studies of clusters and innovation systems.

Keywords: Clusters, Greenfield, Brownfield, Linkages, Start-up firms, Small and MediumEnterprizes (SMEs) Malaysia

1. INTRODUCTION

This paper is concerned with how firms develop and grow in regional clusters based in a developing country. We particularly explore how firms in a new (greenfield) cluster and an

already developed (brownfield) cluster develop linkages for their growth. The argument is that start-ups / small and large firms are able to grow by developing linkages or networks for resources within clusters – and this tenet is based on studies of firms that are based from such clusters as Silicon Valley in the US, Cambridge in UK and other clusters from which have evolved over long periods of time and different elements or actors already exist for firm or start-ups to link up with and grow. In many developing countries governments are making efforts to develop clusters from scratch – which in this paper we term as greenfield cluster. A greenfield cluster is the context where the whole project is developed from scratch, and a brownfield development is where the cluster is developed based on existing and new organisations in a region. In this paper, we believe the context of clusters can be important in determining the way firms develop linkages for their growth, and look at small firms in two contexts in Malaysia ie. a greenfield cluster development and a brownfield cluster. The paper

[†] This paper is developed from earlier studies / papers:

1) Mohan, A.V., Isshammudin, I., and Thiruchelvam, K. (2010) "Inter-Organisational Networks emerging in a Greenfield Cluster: A Study in Malaysia's Multimedia Super Corridor Cluster," Workshop on Regional Knowledge Hubs in Asia: the Social Sciences and Humanities in Science and Technology Human Capital (STHC), Conference on Inter-Asian Connections II. Singapore. December 7-10, 2010.

2) Mohan, A.V. (2009) "Business Linkages for Fostering Innovation Activities: Case Studies of firms in E&E Sector of Penang, Malaysia," Chapter in report on Fostering Production and Science & Technology Linkages to Stimulate Innovation in ASEAN (Oct 2009 – Feb 2010), ERIA funded project managed by DE-JETRO, Bangkok Research Centre.

*Correspondence to : Awari V. Mohan

Associate Professor, Nottingham University Business School, University of Nottingham Malaysia Campus
E-mail : Mohan.avvari@nottingham.edu.my

World Technopolis Review

Copyright©World Technopolis Association

© This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

presents findings gleaned from case studies of firms in a greenfield cluster called Cyberjaya and a brown field cluster, Penang.

Before going into the paper it is felt pertinent to start with an overview about the two clusters that provide the contexts for this paper and then present more details of the cluster. Penang and Cyberjaya are now seen as technology clusters in Malaysia, a middle-income country, which has transformed itself since the 1970s from a producer of raw materials into an emerging multi-sector economy. Malaysia's success story as a "tiger" nation can be argued because largely due to the government's efforts to transform the nation from being predominantly agrarian or resource dependent one, where the focus has been on rubber, palm oil, and petroleum, to an industrial one with a significant manufacturing sector. Industry clusters have been an integral part of Malaysia's industry policy, stipulated in the different industrial master plans. Penang, a small island state in the northern part of Malaysia, adopted a strategy somewhat akin to industrial clustering in the 1970s. Today it has been recognised as one of the top ten most unique industrial clusters in the world by the United Nations. Penang can be considered as a mature industrial cluster/agglomeration, particularly for the Electrical and Electronics (E&E) sector. In the 1990s, a shift was planned to transition Malaysian from a predominantly manufacturing economy to a knowledge-based economy and an information society. The Vision 2020 was introduced for Malaysia to become a developed country by the year 2020, and this has influenced all aspects of governmental activities and policies. The Vision 2020 document, in addition to many other issues, provides a guide for economic development plans and among others, objectives include accelerated industrial restructuring, technological upgrading, human resource development, and industrial linking. The plan also focuses on development of industry, academic, and government relationships. The Multimedia Super Corridor (MSC) project is part of the Vision 2020 (Omar and Avvari 2004) and focuses on the development of information and communication technology (ICT) sector. The MSC project started with the development of Putrajaya (purpose build capital city), Cyberjaya ICT cluster, The Technology Park Malaysia, the airport and such and is now in the phase of spreading across the country. The paper is developed based on cases the two clusters of Penang and Cyberjaya. The paper is structured as follows – in the next section, an background of the two clusters – Penang and Cyberjaya, the contexts for this study

is presented. After the contexts, ideas from research literature are overviewed to provide a frame for the developing the cases. This is followed by the gleanings from the case studies of start-up firms in Penang (brownfield cluster) and Cyberjaya (greenfield cluster) and finally a conclusions section.

1.1 Penang – The Electrical and Electronics Cluster Region of Malaysia

Penang, a small island state in the northern part of Malaysia adopted a strategy somewhat akin to industrial clustering in the 1970s. It has been recognised as one of the top ten most unique industrial clusters in the world by the United Nations¹. Penang can be considered as an industrial cluster/agglomeration, particularly for the Electrical and Electronics (E&E) sector. The growth of the E&E in Penang as an agglomeration/cluster can be summarized in different phases – first phase was in the 70s when it started off with the adoption of export-oriented manufacturing following the Investment Incentives Act of 1968 and the FTZ Act of 1971. With the formal opening of export processing zones since 1972, export-oriented firms began to relocate in large numbers here. In addition to the small domestic market, the promotional role of UNIDO and World Bank, which encouraged developing economies to take advantage of the dispersal efforts of multinationals, was also important (Rasiah 2002). In addition, promotional efforts by the Malaysian Government along with financial incentives being offered also helped to attract MNCs to set up manufacturing base in Penang. Apart from providing an attractive investment climate through the establishment of Free Trade Zones (now known as Free Industrial Zones) and Licensed Manufacturing Warehouses (LMWs), the government also offered a special 10-year pioneer status incentive to investors in the electronics industry.

After some growth there were problems, and then in mid 80s, which can be considered as the second phase of development for Penang, started when the first Industrial Master Plan (IMP) was launched and the export processing zones regained active promotion from the government. Then in the later part of 1990s, particularly after the Asian crisis, some of the TNCs closed shop and moved out of the cluster. During this time the government intervened again with incentives and programmes to retain many of the MNCs (some had moved out of Penang during the crisis), and more recently in the 9th Malaysia plan there seems to be conscious/focussed efforts in developing specific

¹ Invest Penang (2014)

cluster based planning for the rejuvenation of the industry.

The island region, having gone through four decades of development (which included the Asian Financial Crisis and competition from China and other regional players), has come to be recognized as having a strong bases of Electronics and Electrical (E&E) manufacturing companies. The roles of the government, several policies and institutions have been identified as playing an important role in the development of an E&E agglomeration in Penang’s competitiveness.

1.2 Cyberjaya – The greenfield cluster of Malaysia’s Multimedia Super Corridor (MSC) project

Cyberjaya town/cluster is a part of the Multimedia Super Corridor (MSC) Cluster project, which was articulated as a cluster of firms in the ICT (information and communication technology) sector. In August 1995, Dr. Mahathir Mohammed, then Prime Minister of Malaysia, announced the “Multimedia Super Corridor” (MSC) as the centerpiece of the national IT strategy under the Seventh Malaysia Plan (1996-2000). The MSC project is a government led project, and its development is supported with various cluster oriented infrastructure and policies.

Physically the MSC started as greenfield “corridor”, 15 kilometres wide and 50 kilometres long (9 by 30 miles - roughly the size of Singapore) located 30km (20mi) south of the capital. This corridor stretches from the Kuala Lumpur City Center (KLCC) housing the Petronas Twin Towers, down south to Putrajaya (the federal administrative city) and Cyberjaya cities and the Kuala Lumpur International Airport (KLIA)(<Fig. 1>).

The Government Malaysia committed about RM50bn in total in investment for all of the MSC. The MSC plan that is to transform rubber and palm-oil plantations into a cluster of ICT companies, and to be bound by a fiber-optics network,

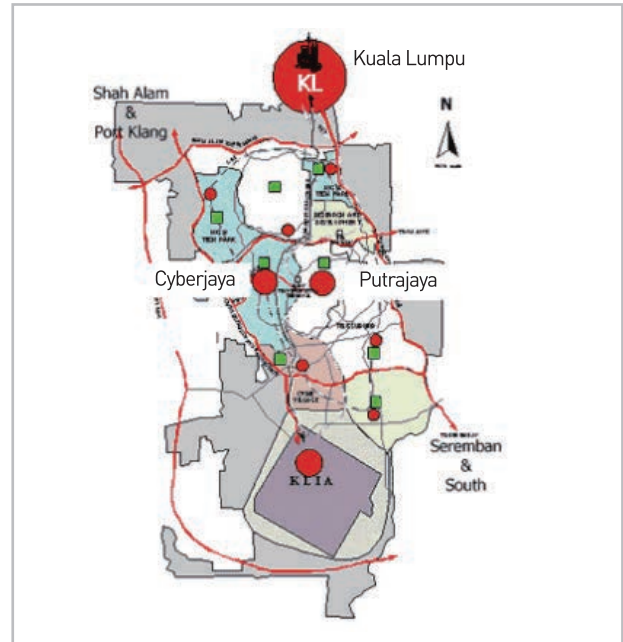


Fig. 1. Map of MSC Malaysia Project Showing Cyberjaya and Neighbourhoods

providing high-speed computer links between Cyberjaya, Kuala Lumpur, the KLIA and the new administrative capital Putrajaya.

To be developed over 20 years in three phases (as shown in Table 1), the current first phase has been somewhat completed, which involved attracting a core group of companies; putting in a legislative framework or Cyberlaws; establishing certain specified areas for development called ‘intelligent cities’, namely, Putrajaya, Cyberjaya and Technology Park Malaysia (<Fig. 1>); and launching of what is known “flagship applications”.

Table 1. Three Phase Development of the MSC Project

| | |
|-----------|--|
| Phase I | Under this phase, the MDeC will successfully create the MSC, attract a core group of world-class companies, launch seven Flagship Applications, put in place a world-leading framework of cyberlaws, and establish Cyberjaya and Putrajaya as world-first intelligent cities. |
| Phase II | The MDeC envisages that during this period, it will link the MSC to other cybercities in Malaysia and the world. It will create a web of corridors and establish a second cluster of world-class companies. It will also set global standards in flagship applications, champion cyberlaws within the global society, and establish a number of intelligent globally-linked cities. |
| Phase III | During this final phase, it is expected that Malaysia will be transformed into a knowledge-based society - being a true global test bed for new multimedia and IT applications and a cradle for a record number of multimedia companies. It will have a cluster of intelligent cities linked to the global information super highway, and become the platform for the International Cybercourt of Justice. |

Currently the MSC project is in its third phase of development with Putrajaya functioning as the capital city and Cyberjaya and Technology Park attracting a threshold of firms and several areas across the country identified as mini clusters and also a ICT related programmes for the public/communities being rolled out.

In this section the context of Penang and Cyberjaya clusters are overviewed and in the next section some research literature is looked into to glean out factors that help start-up or small and medium (SMEs) enterprises grow and develop.

2. SOME THEORETICAL PERSPECTIVES OF HOW FIRMS GROWTH IN CLUSTERS

In this section some selected literature on clusters and issues related clusters and firm innovation development are overviewed.

2.1 Elements that help form a cluster or attract and support start-ups

Porter (1998) describes that cluster is consisted of not only of firms, but also of a specific institutional environment. This institutional environment comprises beneficial institutions like cluster organisations and research and educational institutions that are the basis for innovation networks and human capital. The firms of a cluster and their institutional environment cannot be seen as separated from each other, since their respective development is closely connected (Kenney and Von Burg 1999; Maskell 2001a). Therefore, institutions and firms are basic units of a cluster. Nevertheless, there are a number of other elements that can also influence the development of successful clusters. Every region has some distinctive characteristics and one or more concentrations of interdependent firms that are above national average concentrations, even though they do not meet commonly accepted definitions of “clusters” (Rosenfeld 2002).

Studies by Rosenfeld (2002) effectively summarise (what several authors write about factors that attract firms into cluster) three elements for the development of a cluster: concepts, connections, and competencies. Cluster concepts include innovators who generate and commercialise new ideas, find more efficient production processes, or create new markets. Innovators could be universities, advanced research centre and also employees in firms, customers, suppliers, competitors, and tool builders are important sources of these

innovations. In addition, they talk about imitation and competition and entrepreneurial energy as elements that draw firms to a cluster. The other key factor is termed as “Connections”, which is the ability to network extensively and to form networks selectively and finally Competencies – availability of specialised work force – through the existence of Industry leaders in the cluster, hence availability of talent and tacit knowledge. Rosenfeld (2002) summarise barriers to formation of clusters into deficits in physical infrastructure, lack of access to capital, weak technology institutional structures, Regional insularity and lock-in, lack of skills and opportunities to acquire the and finally cluster hierarchies.

2.2 Clusters Dimensions and Knowledge flows

Studies of knowledge flows and knowledge management in clusters have been widely carried out. Researchers distinguish between the horizontal and vertical dimensions of a cluster, and identify the advantages of local or regional as opposed to extra-local or inter-regional interaction between firms (Maskell 2001a; Maskell and Malmberg 1999b; Bathelt 2001). The horizontal dimension of a cluster consists of those firms that produce similar goods and compete with one another. Porter (1990; 1998) has demonstrated that strong competition and rivalry between firms is an important incentive for innovation and product differentiation. Due to their co-presence, the production conditions are basically the same for all regional firms. The vertical cluster dimension consists of those firms, which are complementary and are inter-linked through a network of supplier, service and customer relations. Marshall (1920) described the process of how variety at the horizontal level stimulates growth in the vertical dimension: “[...] if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus becomes the source of further new ideas. And presently subsidiary trades grow up in the neighbourhood, supplying it with implements and materials, organising its traffic, and in many ways conducing to the economy of its material.” The idea behind this is that, once a specialised industry cluster has been established, the firms of this cluster develop a demand for specialised services and supplies. This creates an incentive for suppliers to be near these firms because they form important markets. In locating close to these markets, the suppliers can gain economies of scale and distribute large parts of their production at low costs (i.e. transportation costs). As a consequence, one would have expected the development of dense networks of transaction and material linkages within a cluster.

2.3 Localised capabilities or local Buzz

Contributions by Storper and Venables (2002), Maskell and Malmberg (1999a) and others have pointed out that the existence of economies of scale and other kinds of traded interdependencies are simply not enough to understand the processes behind spatial clustering. In emphasising 'localised capabilities' and 'untraded interdependencies', it has been shown that socio-institutional settings, interfirm communication and interactive processes of localised learning play decisive roles in processes of innovation and growth (Maskell and Malmberg 1999a). Overall, the shared knowledge basis enables cluster firms to continuously combine and re-combine similar and non-similar resources to produce new knowledge and innovations. This stimulates economic specialisation within the cluster and results in the development of localised capabilities (Maskell and Malmberg 1999a), which are available to cluster firms. Locating within an industrial cluster has further advantages that are not available to firms situated elsewhere. Again, Marshall (1927) expressed this in his famous notion of 'industrial atmosphere', as being something that is 'in the air', limited to the people within a particular region or place. Through observations in the cutlery industry of Sheffield and Solingen, Marshall (1927) concluded that such places "have acquired industrial 'atmospheres' of their own; which yield gratis to the manufacturers of cutlery great advantages, that are not easily to be had elsewhere: and an atmosphere cannot be moved."

Storper and Venables (2002) have, for instance, identified what they see as a particularly important sub-set of urbanisation economies, which they label 'buzz'. In a similar way, Owen-Smith and Powell (2002) use the notion of 'local broadcasting' - the idea that a certain milieu can be vibrant in the sense that there are lots of piquant and useful things going on simultaneously and therefore lots of inspiration and information to receive for the perceptive local actors. Buzz refers to the information and communication ecology created by face-to-face contacts, co-presence and co-location of people and firms within the same industry and place or region. Participating in the buzz does not require particular investments. Firms develop similar language, technology attitudes and interpretative schemes (Lawson and Lorenz 1999).

But a key problem in the above discussion is identified in Karaska's (1969) classical study of input-output linkages in the Philadelphia manufacturing sector, which revealed that only a relatively small percentage of material linkages took place within the region. This modest importance of regional in-

put-output linkages has been confirmed in some studies of older industrial regions as well as high-technology production spaces (e.g. Chapman and Walker 1987). If it is not the cost advantage of intra-regional input-output linkages, what are then the incentives for firms to locate within a cluster and remain there?

2.4. Knowledge Creation across Clusters: Global pipelines

While a large number of studies in economic geography and related social sciences have emphasised the importance of local networking (in addition to the earlier studies referred there are also Scott 1988, Saxenian 1994, and Maillat et al. 1997), an increasing number of studies have begun to question the seemingly dominant character of local learning processes (Bathelt 2001; Vatne 2001). Owen-Smith and Powell (2002) use the term 'pipeline' to refer to the channel used in such distant interactions. They conclude from their study of the Boston biotechnology community that even though knowledge spillovers may be more effective within a regional network than across its borders, physical distance is not the only influence. Decisive, non-incremental knowledge flows are often generated through 'network pipelines', rather than through undirected, spontaneous 'local broadcasting'. Utilising this concept Owen-Smith and Powell (2002) have shown in the case of the Boston biotechnology industry that access to new knowledge does not just result from local and regional interaction but is often acquired through strategic partnerships of inter-regional and international reach. The argument to call for actors in a local milieu to establish systematic linkages with external information sources to maintain the flow of important information about market trends and new technologies into the milieu is also supported by Crevoisier and Maillat (1991). In addition, such clusters have been able to attract specialised skills from other localities and regions. In a similar vein, Scott (1998) has pointed out that the performance of localised production systems depends on the right mix of local and non-local transactions and that strong growth can only result if external markets are linked to the production cluster. Although they point out the importance of external linkages,

2.5 Summary of Background Literature and key issues that support start-up firms

From the discussion so far, the concept of clustering and various related issues that are important for clustering, there are elements like government policy and market related ones that attract some firms to come into a cluster. In terms of de-

velopment and growth of firms, one of the critical factors in clusters is networking possibilities within the cluster and that networking has to be also beyond the cluster. Thus attracting firms to participate in clusters and develop their linkages with other firms help in the overall development of the firms and the clusters. But most of the studies are related to mature clusters, and there appears not much studies about the elements that would attract and help firms into a new or greenfield cluster. In this paper we look at cases of firms in greenfield cluster and also a brown field cluster in Malaysia.

The paper is developed by gleaning out issues from the cases developed in Cyberjaya (the greenfield cluster) and Penang (which is considered as the brownfield cluster). In the next section we outline the cases of start-up and SMEs in Penang or the brown field cluster, followed by cases from Cyberjaya.

3. GLEANINGS FROM CASES OF HOW FIRMS IN BROWNFIELD CLUSTER DEVELOP LINKAGES TO GROW

3.1 Case of Creative Bliss Sdn. Bhd.

Creative Bliss Sdn. Bhd. was officially incorporated in August 1994, and is principally involved in producing and supplying of high quality customized metal stamping parts/components as well as undertaking the entire process of designing tools and dies for its associates. Creative Bliss Sdn. Bhd is involved in design engineering and undertakes customized stamping for a very wide range of products and currently manufactures precision metal parts for multi-national corporate and other industries such as Audio & visual industries, Electrical & Electronic, Office automation equipment and also for Furniture accessories, Automobile parts firms.

Key Drivers and for growth and Innovation

The key driver appears to be from the owner’s philosophy, i.e. from within the organisation and a conservative quality oriented philosophy of the main partner /CEO and training in Japanese continuous improvement philosophy also seems to be key. But there are other support factors for innovation at

Creative Bliss. Key institutions that have been supportive for the setting up for the facility include MITI through MIDA² – through the provision of grants for R&D activities in addition to other support like tax incentives given under programmes for development of SMEs. At the regional level, PSDC and JAICA provide support in training and other advisory services. But the most important factor is its customer, Sony—in addition to providing the demand for the products and services, the TNC also sends their engineers for providing training to Creative Bliss technical staff on new technology/design issues.

Linkages developed by the firm

Creative Bliss has a firm to firm linkage within Penang cluster with Sony’s Penang unit. The firm does not have linkages with any suppliers in other locations. Other actors with which Creative Bliss has strong linkages include Penang Skills Development Corporation (PSDC) and JAICA³. PSDC is a unique tripartite, industry-led skills training and education centre in Penang to support growth and development of SMEs and today is also involved in some research and development. While PSDC provided direct support, JAICA supports supplier firms of Japanese TNCs (for training or visits to Japan for knowledge upgradation etc.).

The following diagram provides an overview of the linkages Creative Bliss in Penang has for Innovation.

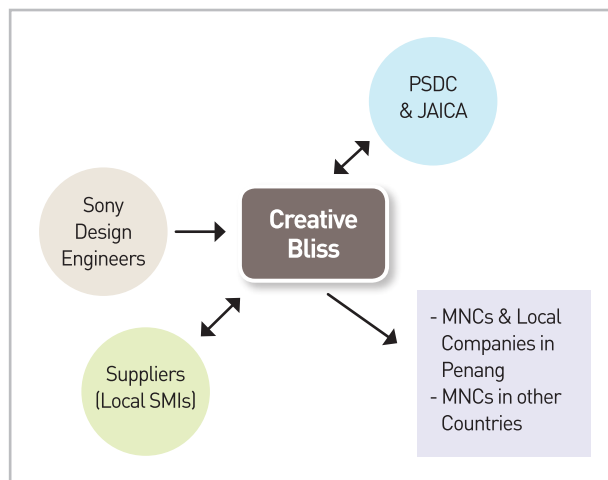


Fig. 2. Diagram of Creative Bliss’ Linkages

¹ MIDA was the Malaysian Industrial Development Authority (now Malaysian Investment Development Authority) and MITI is the Ministry of International Trade and Industry

² Japanese International Cooperation Agency (JAICA)

Conclusions

From the Creative Bliss perspective, the key issues in Penang cluster that are helpful for going up the value chain from manufacturing to design and innovation activities are availability of highly skilled human capital, presence of large base of local suppliers, presence of its major customer and cluster institutions. At the national level, provisions made by the MITI ministry and in general, the stable political environment are deemed as useful. Reducing procedural delays to utilize existing grants and more incentives to further develop the cluster are considered as critical for the further development of E&E sector in Penang.

3.2 Case of Mayang Manufacturing Sdn. Bhd.

Mayang Manufacturing (Mayang), a local SME/I, started its operations in Penang in 1995. Mayang is a private limited company in Malaysia with production facility only in Penang and is principally involved in producing and supplying customized metal stamping parts, electrical components and industrial electrical fans. Mayang operates from its own premises in Sunway Business Park of Perai Industrial area in Penang. Current staff strength at Mayang is about 50 and its sales turn over in 2008 is about RM 5 million (approximately 1.45 million USD). Mayang currently manufactures precision metal parts, electrical components and electrical fans for companies in Perak and Kedah states in Malaysia and multinational companies in Penang in Audio Visual, Automobile and Electrical & Electronic industries. Their MNC customers include Robert Bosch Malaysia, Sony Malaysia and Perodua the car manufacturer in Malaysia is its local customer.

Factors in Cluster helpful for the firm's growth

Mayang chose Penang to setup its manufacturing unit due to the availability of skilled technical staff and cheap labour, and low operation costs. Supportive policies of the federal government and good infrastructure in Penang also helped Mayang to start its production quickly. The presence of a large TNC base as a market was a critical factor. Though the initial operations were mainly in manufacturing, later Mayang started distribution of laboratory and high-end technical equipment.

Types and Motivations for Innovation

Innovation at Mayang is driven by requirements from its customers. Majority of these innovations are aimed at improvements in products to meet the specific design require-

ments of customers and improving existing products to reduce the costs and hence achieve competitiveness in the market. Process innovations are aimed at both to reduce costs and the overall time in production

Support and Linkages for Innovation

The main source for innovation at Mayang is their in-house design engineers. The in-house design team uses information from internet sources to enhance their design skills. Key institutions that are supportive to Mayang for innovation include the MIDA and MOSTI at the national level. Mayang is successful in getting grants from both these ministries to procure special fabrication machinery. To a smaller extent, professors from the University Malaya (UM) helped Mayang to develop new designs for industrial electric fans.

Overall the linkages developed by Mayang are of a short term nature. Though the firm is successful in getting grants from national ministries MIDA and MOSTI, there appears to be no follow in terms of accessing newer funding options for encouraging R&D activities. Mayang has no firm to make linkage within Penang cluster. The firm does not have any linkages with both suppliers and customers within cluster and in other locations. Links with UM also appears weak.

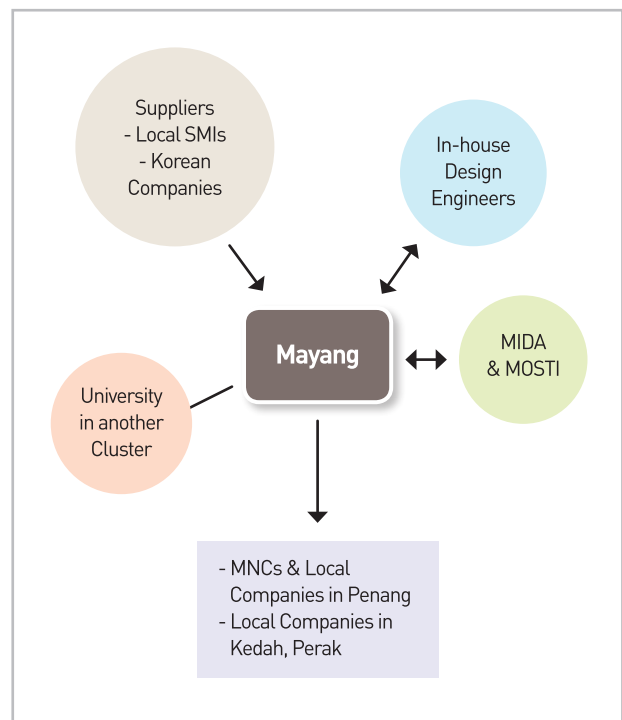


Fig. 3. Diagram of Mayang Linkages

Conclusion

From the Mayang perspective, the key factors in Penang cluster that are helpful in innovation activities are TNC base as customers, availability of highly skilled engineering manpower and good infrastructure. The government policies, both at the national and state level, are considered to be favourable and supportive for innovation – be it in terms of grants, infrastructure provision, policies like tax rebats etc. Finally, the stable political environment is seen as highly useful.

3.3 Case of XYZ (in Solid State Devices SSD Sector)⁴

XYZ (SSD Sector) designs, develops, manufactures and markets custom and open-standard memory solutions based on Flash memory and DRAM technologies, and external storage solutions. The company was founded in 1990 as XXX Technology and changed its name in 2001. Further, it changed its name to XYZ (SSD Sector), Inc. in March 2007. The firm is headquartered in Santa Ana, California and set up first South-East Asian manufacturing site in Penang, Malaysia in 2006.

XYZ (SSD TECH.) Penang has a new facility built on 10.5 acres of land, of which 6 acres are currently utilized. The plant currently has a built-up area of 210,000 sq feet, which houses manufacturing cells and SMT lines, as well as an R&D laboratory, offices, and other amenities including a multiple conference rooms equipped with full video conferencing facilities to manage the global integration of XYZ’s (SSD TECH.) business. XYZ (SSD TECH.) is currently experiencing growth and evidenced through recruiting additional engineers and manufacturing-based employees to support the company’s production ramp. XYZ (SSD TECH.) is also hiring R&D engineers to complement the existing R&D team in Penang. The R&D team in Penang is engaged in advanced ASIC & firmware Design and Implementation as well as New Product Prototyping. The team also performs Product Level Testing.

XYZ (SSD TECH.) flash products include Solid State Drives which are designed to meet the data storage requirements of a range of industries, including defence and aerospace, automotive and transportation, industrial, and communications industries. They also offer Compact Flash Memory cards, Flash Disk Modules, Secure Digital Memory cards, MM (Multimedia) Card Plus Memory cards, USB Flash Drives and Single Chip Drives.

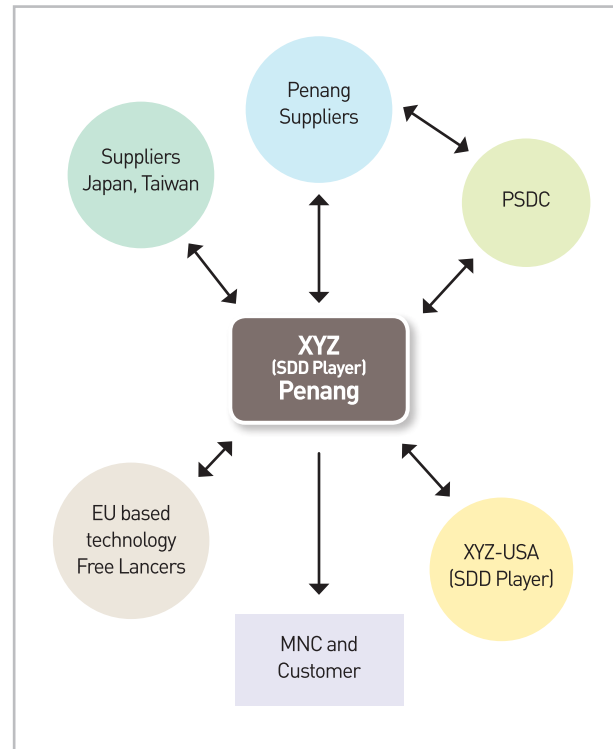


Fig. 4. f XYZ (SSD TECH.) - Penang Linkages

Drivers and Support for Innovation

The main Innovation is product, and the product is a new to the world (SSD technology). Ensuing process innovation activities would hence also exist. The main support for Innovation (in this case for being able to start up the new firm in a new technology area) comes at the national level supportive policies from MITI and MOSTI⁵ – MITI for supportive policies in general and for the issue related to imports of equipment etc. and certain grants made available. MOSTI for the supporting with incentives and grants for the R&D activities.

Linkages and Collaborations

The linkages that XYZ had developed with other organisations were for a short term needs . It was mentioned that SDD, the new technology firm, preferred to go at it alone rather than to develop long term strategic alliances. There appears to be almost no formal firm to firm linkages within Penang cluster or out of cluster also. There are linkages with suppliers within cluster and in other locations, which are considered very strong.

⁴ This firm requested not to reveal their identify

⁵ MOSTI is the Ministry of Science, Technology and Innovation of Malaysia

Several of the suppliers groups are in Korea and Taiwan.

Some interesting linkages have been developed, with what we can term as technology free-lancers, who are based in the EU for helping in technology development. In addition it has strong links with its US office, which is close to customers in that region and to other technology players.

Issues in Collaboration and policies for Supporting Innovation

Overall XYZ (SSD) sees collaborations particularly joint ventures as not so vital for R&D based innovation activities – it sees any collaboration as short term activity for specific problem solving and actively seeks out to develop links (as it does with freelancers in the EU for technology development) – constantly referring to the R=G metaphor. XYZ (SSD) sees the software development as an integral part of R&D in the electronics sector, and would like to have benefits that the ICT sector receives. But this requires to have application for the ‘MSC’ (Multimedia Super Corridor project) status in order to get the benefits accorded to ICT firms.

Conclusion

For XYZ the critical factor for supporting the firm and innovation activities in Penang is the availability of highly skilled human capital (with experience in the TNCs and supplies firms located in Penang), particularly what it termed as the 30 year of pooled talent in the region. In addition, the mobility of the human capital is considered an important point. The strong industrial base in Penang and supportive policies from the national and state governments has been instrumental for being located in Penang.

3.4. Summary of (manufacturing) start-up firms growth story in Penang Clusters

How firms develop linkages (within Penang and outside Penang) for growth and innovation.

One of the key institutions in Penang with which all the firms have some form of association is the Penang Skills Development Corporation (PSDC) – which is credited for providing training of operators and other skilled people needed for the manufacturing function of firms and now in training higher level skills personnel for the Design function also – in addition PSDC is also providing some facilities to SME for testing purposes. Linkages with universities within / near the cluster are generally for student internships and they are seen as suppliers of manpower.

In the case of local firms – their linkages to Transnational Corporations (TNCs) is a significant factor. Many of them

started out as sub-contractors/supplier to the TNCs in the region and founders get their training from the TNCs – hence the TNCs themselves as an important factor in innovation system playing multiple roles – firstly as providers of demand and development of supplier firms, thus involved in technology transfer and capability building among the supplier firms. TNCs have also been involved in the development of the workforce in general providing a place for learning.

There is a difference in linkages for firms that seek innovation for product differentiation versus those making innovation efforts for cost reductions only – the product differentiation seeking firms develop more linkages ‘externally’ (outside the cluster) and with universities/research centers, their sources of information include research journals (and not just customers).

Public Policies Supporting Innovation Activities

Overall the supporting policies – be it related to infrastructure development, tax incentives, Grants etc are all considered critical for the moving up the value chain into design and development activities by the firms in Penang. Key institutions at the national level include the Ministries for Intl Trade and Industry (MITI) and Science, Tech. and Innovation (MOSTI), MIDA – the industry development authority. The policies that have attracted MNCs to have a major presence in the cluster are important – the MNCs play multiple roles – as a employers of qualified engineers, as large customers, as developers of supplier firms, as developer of human capital (one of the local R&D firms calls it the ‘musical chair movement’ of high calibre engineers from MNCs to local firms).. PSDC, as mentioned before, is a unique and one of most important cluster based organisations that provide training, testing and R&D functions and more importantly also helps in developing linkages.

Local Buzz – Cultural Factors

There are several cultural factors that can be helpful or can be hindrance for firms to Innovate and grow. An interesting aspect firms in Penang mentioned – is the cultural identity of the people – particularly the engineers in the manufacturing sector – be it electrical and electronics engineering or others also. There is a strong commitment of these people to the city/island and the respondents as well as other people interviewed state that overall Penang has a stable “population” and that while there is internal mobility i.e. people coming in – most of the people have been living there for a long time that

has build a community and hence 'learning' has taken place in a context over a long period of time. There is also what has been mentioned as 'Engineer Nobilities' in this city. There is an entrepreneurial culture emerging slowly with the incentives being provided by the government helping.

Overall the cases indicate that factors that have helped or been leveraged by the firms in the Penang cluster are quite similar to discussions in literature – linking up or networking with supplier or customer firms, role of business association type organisations etc. (revision needed) Other critical factors are national and regional government policies and benefits that are offered. What are unique to the way firms develop in this cluster are the role of the TNCs and the "Local Buzz" or the cultural factor that has helped in the development of the firms and the cluster.

In this section the cases of the firms in Penang – the brown-field cluster were presented. In the next section, cases from the greenfield cluster of Cyberjaya are presented and findings are summarised.

4. CASES OF FIRMS IN CYBERJAYA – THE GREENFIELD CLUSTER

4.1 Case of F Studios

Profile of the Firm

Incorporated in year 2000 and started as a Start Up company by joining incubation program under MSC Central Incubator located in Multimedia University (MMU), Cyberjaya. Flare Studios Sdn. Bhd. Has stand-alone studios, such as audio, video, interactive programming and digital animation. The Company's specialises in Digital Animation (2D and 3D) and Simulations, Audio and Video Production, Editing and Special Effects, Virtual Reality and 3D Game Development for the worldwide web and standalone multimedia systems. The company (at the time of developing the case) had grown beyond incubation program and aimed at entering the market globally. They had kicked off few commercial animation projects in 2D/3D animation, which already aired in Malaysian local TV in 2002 and in Thailand, Singapore, China and Middle East TV in 2003. In addition, the company signed an inaugural agreement, which promotes bilateral trade with a Syrian company to develop and produce creative works as well as to exchange expertise for both countries creative content industry. The company

also managed to move to the next level of their operation when they manage to secure a contract of RM8 million to produce six episodes of 3D animation for a British channel. The company also was active in developing creative content in the State of Perak prior (involved in the state's ICT development project of "K-Perak 2010").

Factors that helped the Firm in the Cluster

Started as an incubatee in MSC Central Incubator Program, the company was exposed with range of customised programs and guidance to nurture and develop towards the next phase of maturity provided by Multimedia Development Corporation (MDeC). The company was provided grants made available for MSC Status Companies and involving with MSC-MDeC Global Marketing channel. In addition, the company enjoyed:

- Tax allowance up to ten years and no duties on the import of multimedia equipment for their operation;
- Freedom of ownership; and
- Having facilitation from MDeC as one stop centre and having the 10 Bill of Guarantees (BoGs) provided for MSC Status Companies.

The location also provided a connection to the supply of knowledge workers in respective skills from the educational institutions set up specially in the clusterie Multimedia University (MMU).

Formation of Linkages

Flare Studios Sdn. Bhd. used to be an incubatee under the umbrella of MDeC customised incubation program, which has enabled it to benefit from the various networking platforms like workshops, seminars, and forums as well as the marketing channel by participating in MSC road show internationally. Such programs provided the startup with local (MikimotoSdn. Bhd. and Maybank Ventures) and foreign connections (India, Syria and USA) for hardware support, technology collaboration and venture capital. Flare Studios also got support from the Nokia Content Development Program. The cluster universities provided interns and product application test-bed for gaming software introduced by the company.

Flare Studios Sdn. Bhd. been established through the customised development program intended to drive the realisation of the National IT initiative of the MSC. The company

went through the initial stages at incubation level to become sustainable technopreneur and small medium enterprise. The company benefited incentives provided in MSC and managed to establish linkages with other MSC organisations including

firms, universities, associations, public agencies to venture capital providers. Such initiation helped the company to grow and sustained in the industry along with having capability to acquire new market at the international level.

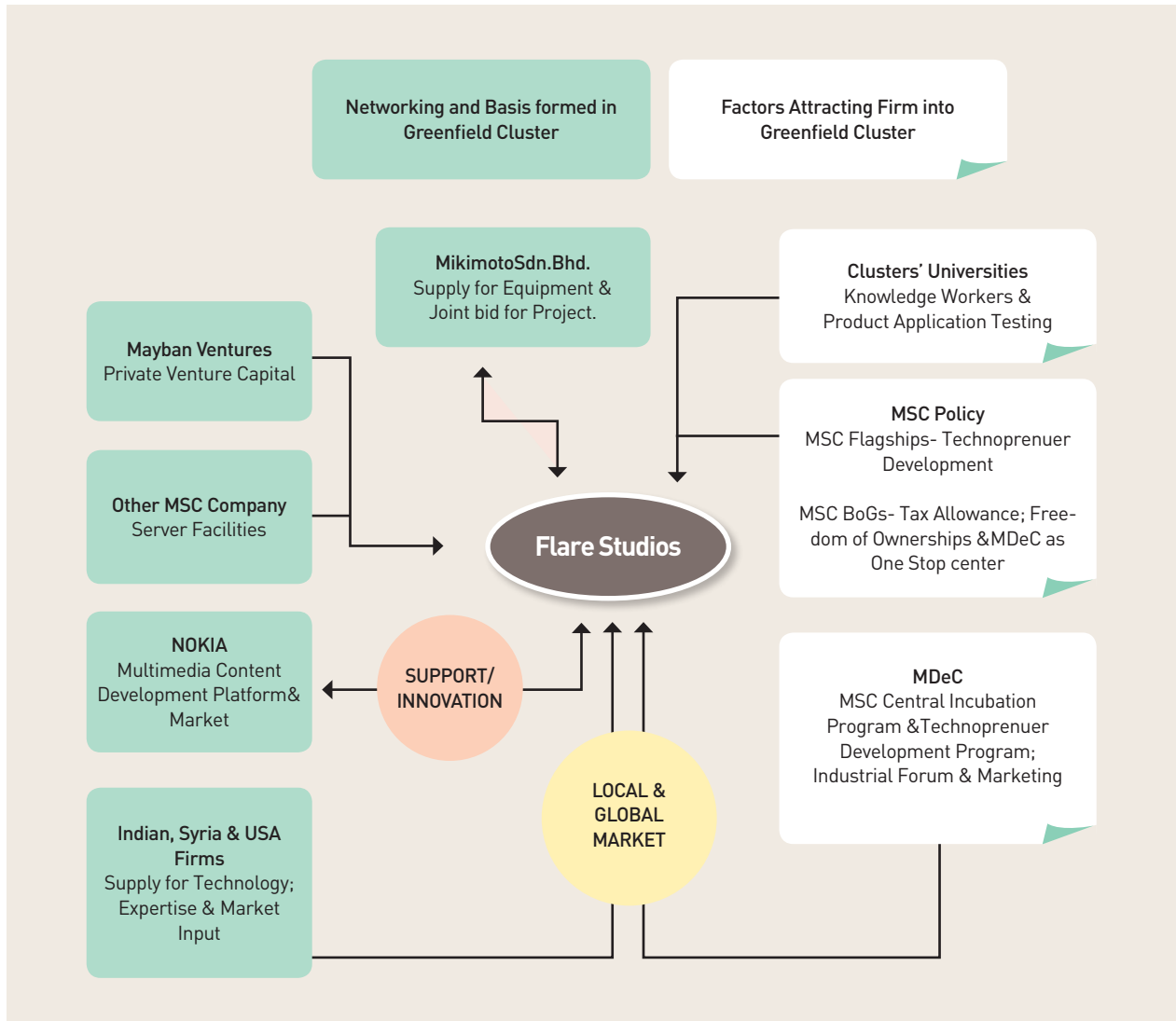


Fig. 5. Factors in Cluster Leveraged and Linkages formed by F Studios

4.2 Case of PUC Founder Bhd.

Established in 1995 and incorporated in 1997, PUC Founder Bhd. stands among one of the major subsidiary under multinational group of Founder Holding Limited registered in Bermuda, whom its parent company known as Peking University Founder Group Corporation (PUC) based in People Republic

of China (PRC). It was listed on the Malaysian Exchange of Securities Dealing and Automated Quotations (MESDAQ) board of Kuala Lumpur Stock Exchange (Technology), with in software solutions, commercializing biometrics technology and creating e-business solutions. PUC Founder Bhd. owned three subsidiaries as below:

| | |
|---|---|
| <p>PUC Founder Technology Sdn. Bhd.</p> | <p>Managing the sales and marketing of publishing equipments and supplies, computer hardware and accessories, and Chinese applications in local market.</p> |
| <p>FingerTec Worldwide Sdn. Bhd</p> | <p>In charge of sales and marketing for fingerprinting products produced by PUC Founder Bhd.</p> |
| <p>Founder GlobalTech Ltd. (Hong Kong)</p> | <p>Acts solely as overseas outfit responsible in the maintenance and software development projects involving media and press industry, as well as other related industries.</p> |

PUC's products, electronic publishing systems (EPS) and management information systems (MIS), managed to gain 80% of the Chinese language press business including customers like Sin Chew Jit Poh, Nanyang Siang Pau, Kwong Wah, Guang Ming Daily, and Singapore Press Holdings. The Group managed to tap overseas markets for their biometric access security technology to resellers as well as end users in Singapore, Taiwan, Hong Kong, Philippines and Indonesia.

Factors in the Cluster that helped the Firm

Granted with MSC status, the PUC Founder Bhd. has access to financial initiative for MSC R&D development activities under R&D Cluster Flagship such as MSC R&D Grant Scheme (MGS). The firm had secured a MGS grant amounted of RM 854,400 from the MDeC, which covered 70% of the total R&D costs of developing their fingerprint identification system (FingerTec) product. The project was accomplished in collaboration with Multimedia University (MMU) and Peking University of China. As a recipient, the company gains from the MSC industrial forum and global reach marketing program organised by MDeC. The Group also enjoys professional services such as legal advice and immigration administration services from MSC Management Service Sdn. Bhd. (MSCMS), a dedicated agency under MDeC. The firms also benefited from the different incentives from the MSC 10 Bill of Guarantees (BoGs) for their operation like:

- Tax allowance up to ten years and no duties on the import of multimedia equipment for their operation;

- Freedom of ownership;
- Freedom of sourcing capital globally;
- Unrestricted employment of knowledge workers;
- Competitive telecoms tariffs; and
- Having facilitation from MDeC as one stop

Formation of Network in Greenfield Cluster

PUC Founder had linkages to the Peking University Founder Group Corporation (PUC) of China (PRC) getting support for the FingerTec technology. The university helped in development of the product and in terms of access to knowledge.

PUC Founder Bhd. was amongst the first companies to achieve MSC-status in 1997. Under the R&D Cluster flagships, the company received the MGS grant in 2000 to finance its R&D in fingerprinting project, which also established the industrial and universities linkages between the company with local- and foreign-based university. PUC Founder Bhd. had enjoyed the benefits within the cluster like gaining access to R&D grants, knowledge workers and joint research from the local university, markets for its products locally and globally and even listed in the MESDAQ the stock exchange for technology firms in Malaysia.

As a start-up in the cluster and a subsidiary of a larger group, the firm has leveraged the cluster specific factors and its linkages with its parent and allied organisations for its growth and development.

⁶ MGS was a grant scheme for the firms that had the 'MSC' status given to qualifying firms in MSC project

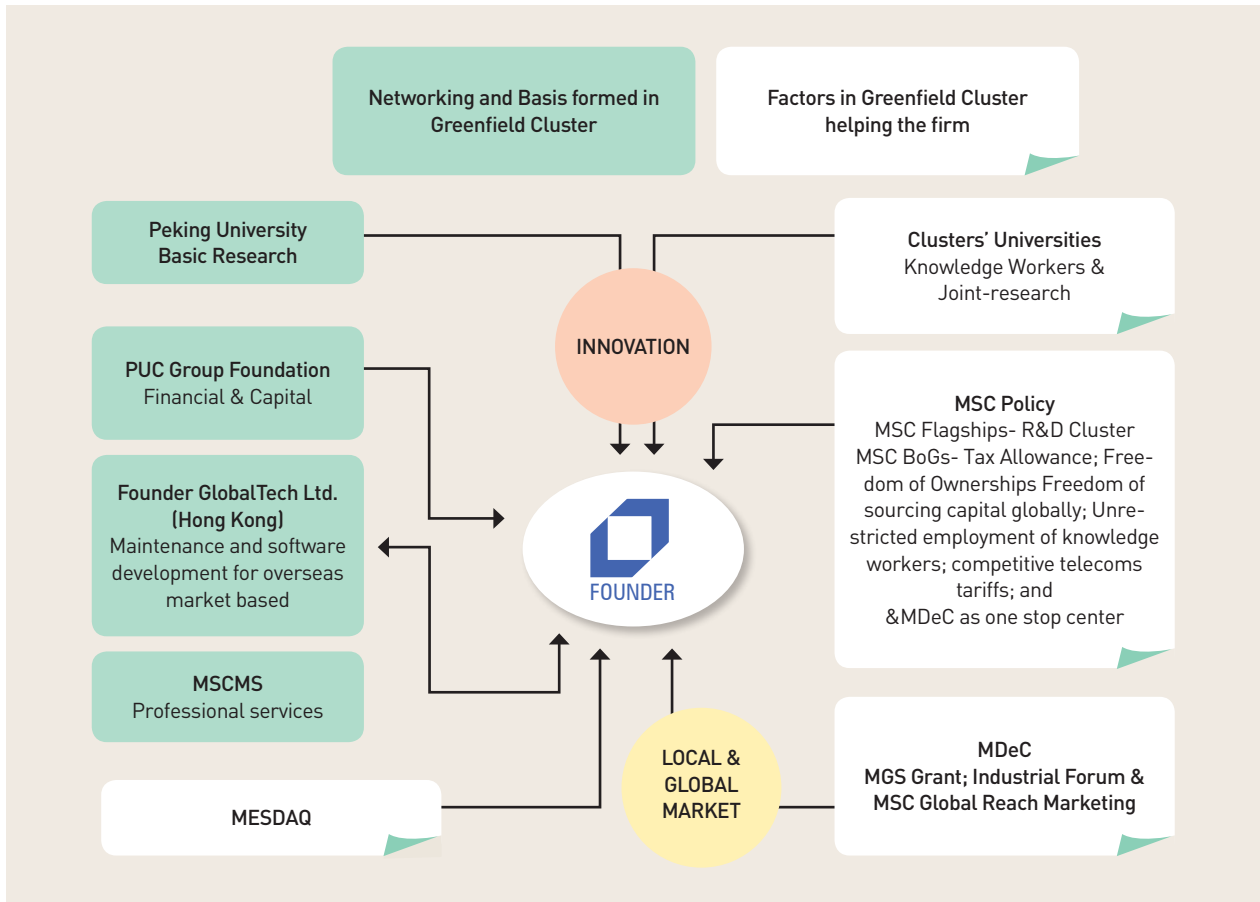


Fig. 6. Factors in cluster leveraged by PUC Founder Bhd and Linkages Formed

4.3 Case of SiRES LAB

Founded in year 2000, SiRES LABS (MSC) Sdn. Bhd. was established as a Start Up company by a group of local engineering postgraduates. The firm was awarded with MSC status in 2002 followed by recognition for being one of the top five SME technology companies in Malaysia as identified by Malaysian Industry-Government Group for High Technology (MIGHT). SiRES LABS (MSC) Sdn. Bhd. is an analog and mixed-signal IC design company, which designs and produces optical microchips for the Very Short Reach (VSR) market. SiRES LABS (MSC) Sdn. Bhd. markets segment include the telecommunications, consumer electronics, signal processing, automotive, defence, aerospace and medical industries, which related to optical module producers for Communications and Networking, Digital Visual Interface (DVI) and laser printer applications. At that time, it was the

only analogIC design company in the country which focused on multi-gigahertz range products. The company subsequently managed to market its product globally such as Asia (Singapore, South Korea and Japan), Europe (UK, France, and Germany) and USA.

Factors in Cluster that helped the firm

SiRES LABS leveraged the different facilitation benefits given under MSC Bill of Guarantees like Tax allowance up to ten years and no duties on the import of multimedia equipment for their operation. The firm also could access funds from the Multimedia Super Corridor Research and Development Grant Scheme (MGS) for their R&D. Other benefits included technoprenuer coaching and monitoring programs, market access through exhibitions and road shows held by MDeC, and knowledge workers from neighbouring universities.

Linkages Formation in Greenfield Cluster

SiRES LABS Sdn. Bhd. Had developed tie-ups with foreign associates to help its R&D programs, sales & marketing. The associate, who also provided the company offices, was located in Galway, Ireland for European headquarters and in Cheltenham, England for sales and support office. As for their tech-

nology alliance, SiRES LABS managed to establish alliances with Paragon IC Solutions from Silicon Valley, USA and Taiwan Semiconductor Manufacturing Co, Ltd (TSMC), of Taiwan. On the local front, the company has tie-ups with local wafer foundry SilterraSdnBhd located in Kulim Hi-Tech Park, Kedah.

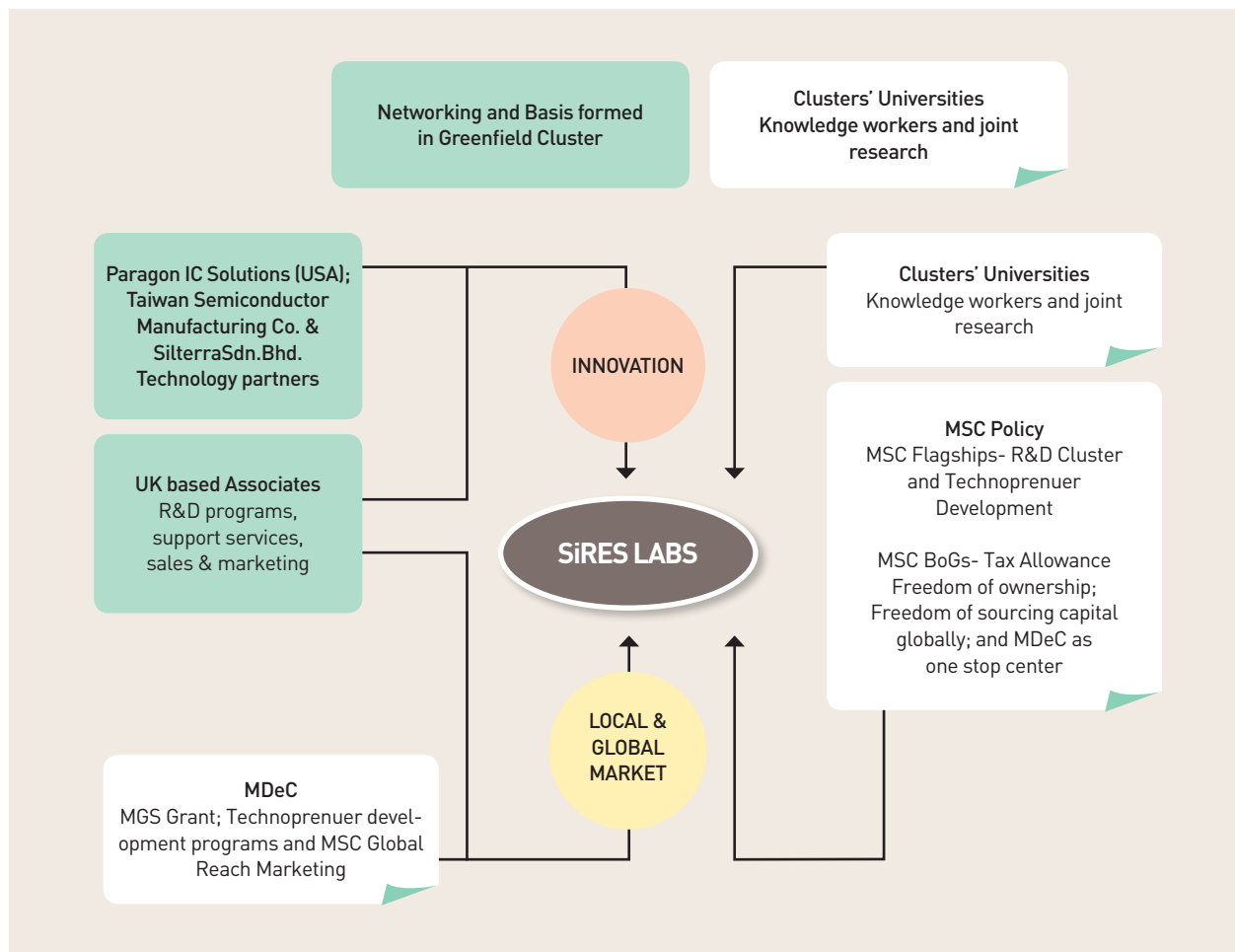


Fig. 7. Factors in Cluster Leveraged and Linkages developed by SiRES Lab

SiRES LABS Sdn. Bhd. has leveraged the benefits within the cluster like the R&D grants, Technoprenuer development programs and MSC Bill of guarantees. However, the company's linkages with the other firms in the MSC are still relatively low. Most of the linkages are outside the cluster, while the cluster factors that helped the firm are those provided by MDeC, the cluster development organisation.

4.4. Summary of start-up firms growth story in the Greenfield Cyberjaya Cluster

From the results of the case studies Government Policy related MSC projects through the "Bill of Guarantees" (BoGs) along with MSC Flagships projects are important elements that attracted firms into this new or greenfield cluster. The

cases reveal that the several BoGs components were crucial for setting up of the firms in the cluster and they include financial and non financial incentives, like tax incentives, duty exemption on import of multimedia equipment for their operation; unrestricted employment for Knowledge Workers (KW); freedom of sourcing global capital and borrowing funds; competitive telecoms tariffs; Market factors like the possibility to tender for key MSC infrastructure contracts were offered to firms which were willing to use MSC as their regional hub; physical and information infrastructure (including having a university within cluster proximity); and MDeC as one stop centre in MSC.

The cases also indicate the start-ups developed linkages within cluster with the university and also with MDeC (the cluster or regional development authority). This was mostly for access to human resources be it for their employees or for the interns – based on a programme supported by MDeC where it paid for interns hired from local universities by the cluster firms. The linkage with MDeC was also for access to grants and other support like training or to be part of the MSC flagship programmes to network with MNCs for technical knowledge. The next most important linkage that start-ups and SMEs were forming was with TNCs within the MSC. Quite a few TNCs were attracted into the cluster with policy related elements like tax incentives and freedom and ease of bring in knowledge workers (faster visas etc). Examples of such TNCs include Nokia which had a developer programme with Start-Ups and SMEs and also an accreditation programme. There were also Sun Systems and Microsoft, which had office in the cluster to support start-ups and SMEs in their software development needs.

Interesting Role of University in Cluster

Overall from the cases it can be observed that there is a very important role for the cluster development organisation (MDeC) and the university in a Greenfield cluster like Cyberjaya.

The start up firms and SMEs developed linkages through the MDeC to access interns from the university. In some cases they accessed the laboratories for testing their products. The role of the university is also quite different to the role of universities play in mature clusters. Being a new university in the cluster it had to take support from several MNCs for the development of its research agenda and their laboratories. Several

resource persons from the Industry were posted in the university for this purpose and in some cases young faculty from MMU were sent to the main R&D centres of the firms. This indicates a very significant difference in university-industry interactions as seen in literature based on mature clusters and long established universities. What is not in the cases, but was revealed in interviews with administrators from the university, is that the university plays an important role in being among the first ‘occupants’ creating a threshold population for development of some essential services within the cluster, thus promoting and attracting other firms to move in. In addition, the presence of a technical university helped to profile the cluster in the global markets.

5. CONCLUSIONS

Penang’s E&E cluster can be seen as an internationally linked cluster. It is a cluster that is based on supporting policies and institutions (actors) that provide support for innovation at both the national level and the regional level, and driven by foreign TNCs and now also local TNCs. In general interviewees all agree on (1) Human Capital (2) Low Costs (3) Entrepreneurial Culture (4) Pro Industry Policy as key factors for the development of Innovation activities in the Penang region. In addition to national institutions, the key actors in the Penang regional innovation system include the Penang Skills Development Corporation, the University (albeit at a lower level), Training Institutes, MNCs and presence of large supplier network. Intra-cluster firm linkages are very weak but global linkages within a firm are very strong. This strong orientation towards headquarters or research and development centre’s of multinational corporations and users in technologically advanced countries appears to yield pattern of linkages in which firms are able to ‘leapfrog’ from mere supplier firms to developing some design capabilities.

In the case of the new or greenfield Cyberjaya cluster - the SMEs and startups preferred to set up there to gain legitimacy when operating in the global markets – this shows an additional role the cluster institutions can play in emerging markets to assist start-ups and SMEs in their respective countries. While there was evidence of global networks showing that firms in the MSC were forming global pipelines or being part of global value chains/supply chain – support to firms for developing such networks is important as these global pipelines

are sources of knowledge both technological and market related for the success of the firms and the cluster as a whole. A finding related to global pipelines formed by foreign firms, showed that it was with their own subsidiaries whether locally or globally. One of the respondents in the study indicated that this was of concern as there was no direct knowledge being transferred to local firms, but of course there was indirect knowledge transfer to 'local' employees in organisation.

The firms in the two clusters are similar in many ways of developing linkages for their growth and development – the role of the government – both national and regional governmental organisations and their roles in helping firms. The role of cluster specific development organisations – in the case of the greenfield Cyberjaya cluster – the MdeC organisation providing branding and market access support for the start-ups provided legitimacy to small firms when going global. MDeC also was like the intermediary developing linkages between the cluster university and start-ups through its support programmes. In the case of Penang, PSDS offers various support in terms of human resources training. In both the cluster, universities played a different role than those in clusters of developed countries. Finally the presence of TNCs in both the clusters – in Penang they were customers for the SMEs while in Cyberjaya they were providers of technical support for the start-ups directly or through the university in the cluster. In the case of Penang, the issues of culture and identity also emerged as an important factor.

While overall the paper contributes in terms how firms develop by leveraging factors in greenfield and brownfield clusters, it is based on case studies where information was collected through interviews. This has obvious limitations, as they are snapshot cases in terms of time. Development and analysis of longitudinal cases would be more interesting to see how a firm / firms evolve in the clusters over a period of time to see how firms' networking patterns and strategies change as the cluster evolves and incentives are reduced. Nevertheless, the paper can offer some initial ideas for emerging economies that are trying to develop clusters and also to startups to see how to leverage various factors / resources in clusters.

REFERENCES

- Bathelt, H. (2001) *The Rise of a New Cultural Products Industry Cluster in Germany: the Case of the Leipzig Media Industry*, IWSG Working Papers 06-2001. Available at: <http://publikationen.uni-frankfurt.de/frontdoor/index/index/docId/4889>.
- Chapman, K., and Walker, D. (1987) *Industrial Location: Principles and Policies* (London: Basil Blackwell).
- Crevoisier, O., and Maillat, D. (1991) "Milieu, industrial organization and territorial production system: towards a new theory of spatial development," in edited by Camagni, R., *Innovation Networks: Spatial Perspectives* (London, New York: Belhaven Press), pp.13-34.
- Kenney M., and Von Burg, U. (1999) "Technology and Path Dependence: The Divergence between Silicon Valley and Route 128," *Industrial and Corporate Change* 8(1): 67-103.
- Karaska, G. J. (1969) "Manufacturing linkages in the Philadelphia economy: some evidence of external agglomeration forces," *Geographical Analysis* 1: 354-369.
- Lawson, C., and Lorenz, E. (1999) "Collective learning, tacit knowledge and regional innovative capacity," *Regional Studies* 33: 305-317.
- Maillat, D., Lécho, G., Lecoq, B., and Pfister, M. (1997) "Comparative analysis of the structural development of milieu: the watch industry in the Swiss and French Jura Arc," in edited by Ratti, R., Bramanti, A., and Gordon, R., *The Dynamics of Innovative Regions: The GREMI Approach* (Aldershot, Brookfield: Ashgate), pp. 109-137.
- Marshall, A. (1920) *Principles of Economics*, 8th edition (Philadelphia: Porcupine Press).
- Marshall, A. (1927) "A Study of Industrial Technique and Business Organization; and Their Influences on the Conditions of Various Classes and Nations," *Industry and Trade*, 3rd edition (London: Macmillan).
- Maskell, P. (2001a) "Towards Knowledge Based Theory of the Geographical Cluster," *Industrial and Corporate Change* 10(4): 921-943.
- Maskell, P., and Malmberg, A. (1999) "The Competitiveness of Firms and Regions, Ubiquitification and the Importance of Localised Learning," *European Urban and Regional Studies* 6: 9–25.
- Maskell, P., and Malmberg, A. (1999b) "Localised Learning and Industrial Competitiveness," *Cambridge Journal of Economics* 23(2): 167-85.
- Omar, A. A., and Mohan, A. V. (2004) "The Malaysian E-Government Flagship: A Policy-Driven Inter-Organisational Network Approach to Developing Competencies," The Fourth International Conference on Knowledge, Cul-

- ture and Change in Organisations, August 3-6, University of Greenwich.
- Owen-Smith, J. and Powell, W. W. (2002) "Knowledge Networks in the Boston Biotechnology Community," presented at the Conference on 'Science as an Institution and the Institutions of Science' in Siena.
- Porter, M. E. (1990) "The Competitive Advantage of Nations," *Harvard Business Review* 68(2): 73-93.
- Porter, M. E. (1998) "Clusters and the New Economics of Competition," *Harvard Business Review* 76(6): 77-90.
- Rasiah, R. (2002) *Systemic coordination and human capital development: Knowledge flows in Malaysia's MNC-driven electronics cluster*, The United Nations University Institute for New Technologies Discussion Paper 2002.
- Rosenfeld, S. (2002) *Creating Smart Systems: A guide to cluster strategies in less favoured regions*, European Union-Regional Innovation Strategies.
- Saxenian, A. (1994) "Lessons from silicon valley," *TECHNOLOGY REVIEW-MANCHESTER NH*- 97: 42-42.
- Scott, A. J. (1998) *Regions and the World Economy: The Coming Shape of Global Production, Competition, and Political Order* (Oxford, New York: Oxford University Press).
- Storper, M., and Venables, A. J. (2002) "Buzz: The Economic Force of the City," Paper presented at the DRUID Summer Conference on 'Industrial Dynamics of the New and Old Economy -- Who is Embracing Whom?' in Copenhagen & Elsinore.
- Vatne, E. (2001) "Local versus Extra-local Relations: The Importance of Ties to Information and the Institutional and Territorial Structure of Technological Systems," presented at the Annual Residential Conference of the IGU Commission on the Dynamics of Economic Spaces in Turin.

WEBSITE

- Invest Penang (2014) <http://www.investpenang.gov.my/why-penang.php?pid=3>

GENERAL REFERENCES

- Maskell, P. (2001b) "Towards a Knowledge-based Theory of the Geographical Cluster," *Industrial and Corporate Change* 10 (4): 921-943.
- Mohan, A. V. (2006) "Promotion of High-Tech SMEs through Clustering and Networking - Cases from Malaysia's MSC Cluster and the MSC Technopreneur Development Flagship Programme," National Workshop on Sub-national Innovation Systems and Technology Capacity Building Policies to Enhance Competitiveness of SMEs 2006.
- Mohan, A. V., and Ismail, I. (2002) "Factors Facilitating the Formation of an ICT Cluster: The Case of Malaysia's Multimedia Super Corridor," *Regional Cluster in ICT, Trends in Communication (TIC) Journal*. Netherlands, Editorial 3, The European Institute For The Media, TIC 2002/10.
- Organisation for Economic Co-operation and Development (OECD) (1999) *Boosting Innovation: The Cluster Approach* (Paris: OECD).
- Porter, M. E. (1997) "Knowledge-Based Clusters and National Competitive Advantage," Presentation to Technopolis 97, September 12, 1997, Ottawa.
- Powell, W.W. (1990) "Neither Market nor Hierarchy: Network Forms of Organisation," *Research on Organisational Behavior* 12: 295-336.
- Powell, W. W., Koput, K. W., Bowie, J. I., and Smith-Doerr, L. (2002) "The Spatial Clustering of Science and Capital: Accounting for Biotech Firm-Venture Capital Relationships," *Regional Studies* 36(3):291-305.
- Sölvell, Ö., Lindqvist, G., and Ketels, C. (2003) *The Cluster Initiative Greenbook* (Stockholm: The Global Cluster Initiative Survey (GCIS)). Available at: <http://www.cluster-research.org>.

Received April 01, 2015

Revised May 07, 2015

Accept May 19, 2015