

SPOTLIGHT

Industrial Cluster Learnings

HONEYCOMB GLOBAL HCG ELECTRONICS HUB

V 1.1 Dec 20

Contact info@honeycombglobal.com if you have any queries.

CONFIDENTIALITY & DISCLAIMER STATEMENT; This document is copyright of © HC Global Strategy & Innovation Solutions (India) LLP 2020 & Honeycomb Global Ltd. 2020 (hereafter referred to as HC Global). All rights reserved. This document contains privileged/confidential information and may be subject to legal privilege. Access to this document by anyone other than the intended is unauthorised without the explicit permission of the author. If you are not the intended recipient you may not use, copy, or distribute it (or any part of it). If you have received this document in error notify us immediately by emailing info@honeycombglobal.com. **LIABILITY** HC Global has taken great care to ensure that all the information and data contained within this project proposal are as accurate as possible at the time of writing. However, HC Global does not accept responsibility for any inaccurate data or information and cannot be held liable for third party content. **LIMITATION** HC Global will not offer financial advice. Illustrations will be offered based on scenario planning for the purposes of strategic planning and marketing activities, but any financial decisions are to be the sole responsibility of the client. It is advised that further independent financial advice should be sought before acting on those illustrations as a matter of good practice and to ensure impartiality.

Industrial Clustering in Developing Regions

Clustering is not new and understanding the recent history of cluster development in developing regions provides useful insights. China has not been included in this review as it is seen as a unique scenario, a one-party state in control of over 1 billion people, exercising absolute power. Without dwelling on or expressing any opinion of the politics involved, it is clearly an unusual case, creating a unique set of circumstances, probably never to be repeated in the foreseeable future. Instead, regions in Malaysia, The Philippines and South America have been considered.

Malaysia

Penang State became the top manufacturer of electronics products in Malaysia in the early 1970s. It has built up a high reputation in the assembly and testing of semiconductors and components, computers and peripherals, machine tool support, as well as consumer electronics. The first phase of Penang's industrialisation process (1970-1986) was largely based on the abundant pool of cheap and trainable labour as well as the availability of pioneer status incentives. However, from the late 1980s, utilisation of robotics and automation increased. The 1990s saw the emergence of computers and peripherals manufacturing in Penang.

Figure 1-1 Malaysia Penang Cluster



Penang's electronics industry has also created spill over effects for Kedah and Perak states. The establishment of Kulim Hi-Tech Park (KHTP) in Kedah which houses corporate, academic, and government tenants specialising in R&D activities related to electronics, is an example. Pioneering tenants at the KHTP include Intel Products (US), Akashic Kubota Technology (recently acquired by Stormedia), Empak, AIC, Maxmedia, Fuji Electric, MEMC Electronic Materials (US-Germany), and Hitachi (Japan). While Penang is evolving as an integrated cluster, Kedah

and Perak still appear as uncoordinated supplier states of both labour and inputs, despite government efforts to promote the Kulim High Tech Park in Kedah as the Northern centre for high tech electronics manufacturing. For these reasons, this section discusses Penang only.

As one of the earliest regions involved in the electronics industry, Penang has the critical mass of firms for clusterization. The State Government of Penang and the Penang Development Corporation have successfully developed networks that encourage horizontal information sharing and considerable inter-firm employee interactions.

Public and private partnerships in skill formation and monitoring through the Penang Development Corporation are also evident. There are also signs of entrepreneurial firms emerging in Penang, utilising its skill base for maximum effect.

Differentiation and Division of Labour

Penang region has built a high-volume production capability in electronic components which spread to hard disk drives and, more recently, to a wide range of elements of the PC chain. While many of these parts and components are elements in global production networks which are co-ordinated at the headquarters of MNCs and do not cross penetrate, the 1990s witnessed a transition to a regional supply base with a growing degree of local horizontal integration.

MNCs such as Intel have created spin offs of their own, including Globetronics, UNICO, Shinca, Shintel and Samatech. Wong Engineering, Prodelcon, Metfab, Rapid Synergies and SEM owe much to MNC support. Intel has also assisted the establishment of Altera and AIC, while Motorola has done the same for BCM, which has been accompanied by the emergence of a locally owned supplier base with increasing capabilities in technology management.

A number of studies attest to the superior performance of the Penang region amongst the three regional concentrations of electronics and electrical products in Malaysia. Most supplier firms in Penang have passed through the third and fourth stages of technology absorption and diffusion. The high level of technology diffusion in Penang compared to other states in Malaysia is due to a much higher proportion of local outsourcing by MNCs and local firms. Local supporting firms in Penang sourced 46 percent of their inputs locally.

A detailed study on linkages between seven electronics component MNCs and nine local machine tool firms in Penang showed that the latter fostered the growth of second and third tier suppliers. The first-tier vendors (those who had the first links with the electronics sector

firms) have, in time, chosen to specialise in certain functions, and passed on some of their previous tasks to second-tier machine tool firms whom they now nurture. These second-tier firms have gone on to spawn their own third tier subcontracting firms, giving them simple tasks like parts fabrications which are no longer profitable for the former. In this way, not only has the number of machine tool firms increased but there has been a greater degree of specialisation among them. These findings suggest a wider diffusion of technology through the agency of first-tier firms to smaller firms servicing them.

With totally truncated operations with all production inputs and output arriving and exiting the country, MNC operations in the early 1970s enjoyed no local supplies. In fact, the FTZ (Free Trade Zone) legislation until the mid- 1980s required a company had to export at least 80% of its output and 80% of its raw materials/ components had to be imported. Despite the lack of supplier companies and capabilities to support the needs of the MNCs, using the PDC (Penang Development Corporation) as an intermediary organization and relying strongly on old boy networks in business chambers, some MNCs spawned local suppliers. Intel managed to support the modernisation of companies such as LKT, Metfab, Prodelcon, Rapid Synergy, SEM and Eng. Teknologi and its staff founded Shintel, Samatech, Unico, Globetronics and Shinca. Motorola was instrumental in the modernisation of Wong Engineering.

Penang's electronics benefited from considerable growth in local suppliers. Local sourcing in the electronics industry in Penang went up from 2.3% in 1980s to 25.1 % in 2001. While MNCs have claimed that they would like to increase their local sourcing, some of the major components with a high share in the production cost are not available in significant quantity locally. Examples of such components include wafers, TFT-LCD, STN-TFT, aluminium and lead frames.

Entrepreneurial and Developmental Firms

PDC sought the world's leading electronics firms by wooing them through both formal and informal visits to the Silicon Valley in the early 1970s. Many of these firms fit what Intel's Andy Grove describes as the new horizontal computer industry. Interestingly Grove himself was approached by PDC officials and made a visit to Penang before deciding on relocating there. Other leading examples include Motorola and AMD. Dell relocated in the early 1990s.

Penang's electronics industry has advanced with the development of these companies. Intel's progressive moves from assembly to incremental change generating capabilities made it possible for its headquarters to transfer technology to Penang and for the local plant to move to more complex higher value-added activities such as testing and later redesigning of mature product technologies.

The evolution of production capabilities, including rapid ramp up has ensured that Penang moved beyond the first stage of absorption in the genealogy of technology transfer. It is at the moment at the stage of adapting and redesigning mature technologies. The learning experience from working in MNCs and network support has assisted the movement of local capabilities in Penang up to the redesigning stage. This stage has to be passed before a critical mass of firms begins inventing at the frontier.

Human capital deepening in local divisions of MNCs fostering technology transfer, particularly via skilled personnel has been instrumental in the birth and growth of several local firms. Unisem, Carsem, Globetronics, UNICO and Shinca are just a few who have benefited from absorbing staff who gained their experience from MNCs.

Although the number of Malaysian-owned entrepreneurial firms (firms with design and new product development capabilities) in electronics is limited, outstanding examples in Penang are Eng Teknologi, UNICO, Prodelcon, Rapid Synergy, SEM, LKT, Metfab, Polytool, Wong Engineering and Globetronics.

Technological Variation

MNCs undertake redesigning of mature products rather than state-of-the-art product design and new product development in Penang. The early stages of technological variation can be seen in the region. The earlier developments of precision engineering and machining are examples of sub-sectors to the region that enhanced the potential for technological diversity. Penang already has local firms manufacturing robotics products, plating, computer monitors, disk drive components such as actuators, and flexi-boards and other surface-mount technology products.

The emergence of Altera in 1999, the first design studio, signalled a new, critically important development in Penang's transition. The skills needed for front-end operations like chip design, systems integration, and applications engineering are in short supply in Penang. Some

firms have second-order R&D facilities. Intel's Design Centre offering designing capabilities became part of the wider cluster of capabilities for Penang's transition to a more powerful cluster dynamic. The PDC helped start the Penang Design Centre, which accounts for 3 phases in the development of design capabilities and tools across the following disciplines: mechanical engineering, electrical engineering, software engineering, media and communications, industrial design, and manufacturing.

Horizontal Integration and Reintegration

Companies such as Intel, Motorola, and HP have attracted world-class first-tier suppliers including contract manufacturers such as Solectron and disk drive makers such as Seagate, Komag and Quantum, which, in turn, have filled in the PC supplier base making the region attractive to innovative PC assemblers such as Dell. Dell's strategy of combining the Toyota production system with the internet distribution channel has revolutionised the PC industry; a second feature of Dell's strategy, simultaneous product launches world-wide has created pressures in the Penang supplier base to operate at the frontier of production capabilities with first generation technologies. Attracting world-class first tier suppliers is a key component of the Cluster strategy design.

Malaysia Conclusion

Penang offers capabilities for state-of-the-art manufacturing and rapid ramp-up to high performance standards to market-led or design-led companies from anywhere in the world. Xircom, which was acquired by Intel in 2001, for example, started the mobile computing revolution with small, inexpensive, adapters that make it possible for notebook PC users to access their corporate networks. The Xircom adapter turned notebooks into desktop PCs in terms of connectivity to local area networks but without sacrificing the mobility of the notebook. Xircom's products are made in Penang only. The local managing director was chosen because of his contacts in Penang. He was able to build a management team; assemble the operations personnel; identify, set-up and equip a plant; and get it running to high performance in a short time span. Making the plant operational has involved ongoing interaction with Automated Technology, a process automation supplier literally across the street. Automated Technology personnel work inside Xircom's plant.

Philippines

The importance of the electronics industry in the Philippines cannot be denied. From 1998 to 2007, the industry contributed 60% to almost 70% of total export earnings of the country. The figures recently went down to 58% in 2008 and about 57.8% in the first three quarters of 2009 due to the impact of weak demand arising from the global economic slowdown. Still, it remains apparent that electronics in the country continues to be its top export earner and indeed, an export winner.

Many of the electronics firms in the country, big or small, are located in economic zones concentrated in the CALABARZON and Metro Manila regions. This implies the export orientation of these firms, whether directly or indirectly to various parts of the world. The US, Japan, Netherlands, and Hong Kong are traditionally the major destinations of electronics outputs, with China beginning to take on the role of major market for Philippines electronics in recent years. In 2008, mainland China earned the distinction as the top export destination of Philippine electronics, having had the highest percentage among 11 of its major trading partners, followed by Hong Kong. In terms of niches, it has been observed that the Philippines have taken on the role of assembler and tester for the electronics industry as a whole, and mainly on semiconductors in the past 30 years.

This denotes that many of the electronics firms in the country find themselves in the lower tier of the production chain. There are, however, notable exceptions to this fact, indicating that there are firms that were able to evolve from assembly and testing activities to turnkey production.

Cluster History and Performance

As Philippines was one of the first countries to open its borders to foreign investment in Asia, the cluster is actually an old cluster. The cluster traces its roots back to 1967, when the Japanese company Matsushita established a JV with a local Filipino company, Matsushita Electric Corporation of the Philippines. Intel entered the market in 1984 with an assembly and testing facility. A host of companies followed Intel's lead, as in TI and Philips in the late 80s with the addition of semiconductors and peripheral production. In addition, a number of contract manufacturers such as Anam and Amkor established operations in the country. Initial

foreign MFNs expanded their operations as well through the 1990s; Matsushita also has several divisions in the Philippines (including Panasonic). The Philippines has evolved into essentially an assembly and testing centre for many products and developed competitive related and supporting industries which served the cluster, particularly in the areas of chemicals, packaging, shipping, and logistics. In the semiconductor sub-segment, domestic suppliers expanded their contributions in the value chain from the 1980s to recent years. However, many of the high value-added functions within the cluster, like wafer fabrication and design, remain weak. In fact, most of these inputs are imported, processed in the Philippines, and shipped out, suggesting that much of the cluster's innovation and development is being done abroad.

Whilst the Philippines has been successful in developing a place on the world stage for labour intensive lower value operations in manufacturing, the linkages to R & D and knowledge transfer has not taken place to the expected or required degree (so far) for the cluster to continue to prosper.

Mexico

Although Mexico's export performance faltered in early 2014 due to reduced demand from the US, Mexico bounced back and is in pursuit of certain reforms to protect its exporters from such situations in future. Mexico is expected to benefit from the approval of new reforms in the energy sector, and a diversification in the export markets. [HSBC, 2014]

Mexico is continually innovating both its policies and businesses, to combat competition and maintain its position as the top manufacturing and components assembling destination. Another significant feature of Mexico is the emphasis on developing certain expertise before diversification. The focussed cluster activities enabled it to be a world leader in components assembly, thus increasing the confidence of foreign investors.

Although certain companies host clean room facilities and manufacturing capabilities, the essence of the electronics manufacturing industry in Mexico is focussed on industrial assembly of PCBs, box-build, new product introduction, testing and a parallel focus on logistics and quality compliance.

Mexico is not focussed on highly mechanised production like fabricating PCBs or manufacturing basic electrical components like resistors or diodes. The general approach is to

utilise the low-cost labour, with capabilities for high-volume production, without compromising on quality and compliance standards. Mexico EMS is usually concentrated on manufacturing products from components which are shipped in from the north of Mexico.

The Mexican manufacturing economy has been built largely on the back of its location, close to one of the largest markets in the world, the US. It provides many of the advantages of Chinese manufacturing in being low cost but is culturally closer. Transportation and shipping costs are also lower. It is interesting to note that Mexico's growth in electronics manufacturing is based around assembly services, and manufactures few semiconductors of its own, relying on imports from the US for its components.

Mexico's development in electronics manufacturing has been driven by the US market and has been successful by recognising where in the value chain it can lever most value.

Overall Summary Conclusions

The business model for cluster designs should seek to avoid the mistakes of Costa Rica, Mexico and the Philippines and replicate best practice from the activities of Thailand and Malaysia who have been able to successfully transfer knowledge and experienced gained from working with foreign MNC's to their own manufacturing and skills development. The business models presented in this document incorporates those learnings and best practices in ensuring strong leverage of the global supply chain.

The development of MNC-dominated well-functioning electronics clusters has been considered. The propensity of local procurement was still relatively low and concentrated in low-medium technologies. Moreover, it is evident that MNCs do transfer knowledge to other firms in the country, but this knowledge tends to diffuse within an enclave of foreign firms, with only a small number of domestic firms benefiting from it. On the other hand, MNCs do have an impact in fostering product and process upgrading in domestic firms, if not directly, indirectly generating a stimulus and a market.

The MNC-dominated clusters may have boosted the learning processes of local firms and their revenues, but there also seem to be circumstances of MNCs benefiting from finding a fabric of local firms that not only began operating as suppliers, but also as a training ground for the local workforce. To conclude, we have provided here evidence that the formation of linkages

between foreign investors and domestic firms is still an incipient process in all the long-established clusters.