Disk Drive Cluster Development - A Comparison between Thailand and Singapore

Presented in 1st Data Storage Technology Conference (DST-CON 2008)

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Abstract

Recently, Thailand has overtaken Singapore as the largest exporter of hard disk drive (HDD). In Thailand, more than 100,000 workers are currently employed by the industry, which accounted for more than US\$ 2.25 billion worth of exports during the first half of 2005, or six per cent of Thailand's total exports. Four HDD giants – Seagate Technology, Hitachi Global Storage Technology (HGST), Fujitsu and Western Digital – have production bases in Thailand. In addition, companies supplying materials to these four manufacturers have production bases or representatives in Thailand. Because of this, the HDD industry has an almost complete supply chain in Thailand.

This paper examines and analyzes the position of Thailand as the world leader in HDD manufacturing by comparison with the situation faced by Singapore in 1990s. By analyzing the size of the industry, government policy, human capital, and local firms' technological capability, a framework for long-term development is proposed to

Keywords: Leave one blank line after the abstract

Introduction

Foreign investment in South-East Asia has grown steadily since the 1950s, led by the American and Japanese firms seeking lower cost for their labor-intensive operations. In 1960s and 1970s, components such as transformers, television tubes and tuners were among the first that began the production in the region. Later, facilities to produce and assemble computers and electronics components such as PCBs and hard disk drives (HDD) were relocated to the region in the 1980s. However, foreign investment can become a crucial part to economic transformation in the host country only when it stimulates local firm production linkages and/or results in lifting to more value-added activities within the subsidiaries of multinational companies (Henderson and Appelbaum, 1992). This is important because local suppliers can contribute to long-term economic development even after the initial investment by the MNCs. The presence of MNCs in the host country can help nurture local suppliers in 3 important ways (Wong , 1999). First,

National Electronics and Computer Technology Center, 112 Paholyothin Rd., Klong Luang, Pathumthani, 12120 *corresponding author; e-mail: chayakrit.charoensiriwath@nectec.or.th MNCs provide a market for the local suppliers, especially those that make components and parts. Second, knowledge spill-over effect can occur through the trainings of local engineers and technicians. Some may start their own companies to supply parts and components to MNCs. Lastly, MNCs can help lifting the technical capability of local suppliers by providing product specifications and transferring technology. However, the technology transfer process can be difficult to achieve, even though it is the most important objective desired by the host country (Patel , 1995). Therefore, a host country that can develop strong local suppliers and subcontractors would benefit more from FDI than those that merely provide benefit of cheap labor supplies to MNCs.

Regarding the HDD industry, the current situation in Thailand is similar to what happened in Singapore during the 80s and 90s when Singapore produced around half of the total HDD production in the world. With more than 60 companies in HDD industry in the country, Thailand hopes to have a successful technology transfer process to grow local supplier base for the HDD industry. The government has established the Hard Disk Drive Institute (HDDI) as a center to develop infrastructure for research capability for the industry. With a framework to develop supply chain, technological capability, human resource, and supporting policies, Thailand is aiming for a sustainable development of HDD industry in the country. This study compares the case of Singapore and Thailand and the roles and strategies of their government to formally manage an industrial cluster and build national technological capability on specific industry.

Literature Review

There are quite a few studies on foreign investment and Southeast Asia economic and technological development. There are researches done both from the strategic aspect of host countries and the strategic aspect of the multinational companies. Williams and Conway (1992) analyzed the value chain of multinational companies operating in newly industrialized countries (NICs). Ronstadt (1978) studied the R&D activities in American companies with relation to national technology strategy in the host country. Behrman and Wallender (1976) and Wong (1993) examine the cross-border technology transfer process within multinational enterprises. Natarajan and Miang (1992) examined linkages between the host country national strategy and development and investments by foreign multinational companies.

There are studies on the technology transfer from the perspective of multinational companies as well. Hobday and Rush (2007) studies the factors that influence the technological capability upgrading process of subsidiaries of MNCs in developing countries using Thailand's electronics industry as a case study. Their empirical results also show that Japanese and Korean firms tend to operate under more centralized and 'technologically closed' corporate environments than American and European MNCs. Therefore, it is more difficult for local government to initiate a technology transfer process with Japanese firms.

While Japanese strategy is for the parent to control the supply chain tightly, the American strategy encourages the growth of indigenous companies by their willingness to use local suppliers (Williams and Tilley, 1996). Mansfield et. al. (1979) analyzed the overseas R&D activities by American companies and concluded that most of the R&D activities overseas are more at the development stage rather than at the basic research end. Ferdows (1993) (Ferdows , 1989) examines the ability of offshore electronics manufacturing sites to upgrade from being assembly operations to include higher levels of engineering and research and development.

Ritchie (2002) shows that the training and technology transfer activities of MNCs in Southeast Asia can be enhanced if the local government acts as collaborative facilitators of public-private technological accumulation processes.

Hard Disk Drive Industry in Singapore

Seagate was the first HDD company to relocate its final assembly plant to Singapore in 1982, seeking cheaper labor cost. It was established a little before the assembly plant in Thailand. Following Seagate's move to Singapore were several leading competitors of Seagate from the US, including Maxtor, Miniscribe, Microscience and CDC (known later as Imprimis) during 1983–4. Then, after the recession in 1985, Micropolis, Conner, Rodime (from Scotland), and Western Digital soon followed.

While initially relying on supplies of parts and components from the US and elsewhere, These HDD companies played a key role in stimulating the development of local supporting industry by actively pursuing a local vendor development program. Singapore government played an important role in this local technological capability building. The government launched the Local Industry Upgrading Program (LIUP) in 1986 to facilitate technology transfer from MNCs to local suppliers. All the HDD assemblers in operation at that time were selected for participation. Through the indirect learning process from the product specification and customers' feedback, local firms were able to learn and upgrade their technological capabilities (Wong , 1999).

Singapore was able to upgrade local suppliers and integrate them within the global HDD supply chain. Studies show that some ex-employees of MNCs became successful entrepreneurs and can supply parts to their former companies (Lim and Pang , 1982). More than a hundred supporting industry firms in Singapore are known to have been significant suppliers to the HDD industry, with largest group in precision engineering and PCBA. With the technological capability, local suppliers in Singapore can move up the value chain and have a better chance to prosper even after the relocation of assembly plants by HDD makers to its neighboring countries like Thailand or Malaysia.

In 1992, the Singapore government established the Magnetic Technology Centre (MTC) to develop indigenous technological capabilities and to provide support for possible R&D activities by HDD companies in Singapore. Initially, very few R&D activities by the HDD companies occurred, despite incentives and the effort of MTC. In 1996, MTC were upgraded to Data Storage Institute (DSI) to cover not only magnetic recording technology, but also other data storage technologies, especially optical storage technologies.

Despite initial unsuccessful attempts, DSI gradually began to build some strong core competencies in selected technology areas. This has enabled DSI to attract a growing number of major data storage technology companies to enter into R&D collaboration with DSI. Since its inception, DSI has initiated many successful research programs, both in the magnetic and optical technology. Furthermore, the support from Singapore government in the form of direct R&D grants also assists the relocation of more R&D activities to the country. This supports encourage foreign companies to relocate their the R&D activities to Singapore and be able to create local knowledge in HDD technology.

Hard Disk Drive Industry in Thailand

After Seagate's first operation in Thailand started in 1983, IBM soon followed but finally sold its plant to Hitachi Global Storage Technology (HGST) in 2004 when IBM decided to leave the HDD industry for good. Western Digital (WD) entered Thailand after a buyout of production plants from both Fujitsu and Read–Rite in 2002.

With the presence of the 4 HDD makers, most of their suppliers have decided to have production bases or representatives in Thailand as well. Currently, there are more than 60 companies supplying parts or components to the industry in Thailand. This makes Thailand to have an almost complete supply chain of the HDD industry. The inflows of foreign investment in HDD-related manufacturing have made Thailand the largest exporter of hard disk drive since 2006.

However, even though HDD industry has been in the country for more than 25 years and has steadily grown to become a crucial part of electronics industry in the country, until 2004 there was no formal support from the government to encourage long-term research collaboration between researchers in universities and HDD companies. Realizing this gap, in 2005, National Electronics and Computer Technology Center (NECTEC) initiated a collaborative training program for the HDD industry. The program proved to be very successful. In 2005, a roadmap was created to strategically support the HDD industry in the country and encourage local innovations on HDD-related technologies.

The Hard Disk Drive Institute (HDDI) was established inside Thailand Science Park in early 2006 under the supervision of NECTEC. The objective is to strategically manage Thailand HDD cluster. To do so, HDDI established 3 Industry– University Cooperative Research Center (I/U CRC) at three universities in 2006. Each research center specializes on different research areas.

The objective of the establishment of 3 research centers is to increase level of formal collaborative R&D activities between local universities and MNCs. Aside from these 3 universities, there are 12 other universities joining the cluster as well. This network of universities provides researchers to solve specific problems as required by the industry. Each collaborative research project can be fully or partially funded by the government, depending on the requirements on Intellectual Property (IP) ownership.

Furthermore, HDDI also provides scholarship to both undergraduate and graduate students who conduct research on HDD-related topics. It also provides trainings to employees of MNCs on various HDD-related topics. The trainings can be conducted on-site or at a facility in Thailand Science Park. In 2007, Hard disk Technology Training Institute (HTTI) was established in collaboration with Western Digital. The institute locates in the same building as HDDI. Any employee in the Science Park can join any class if he/she is interested in the offered topics.

Ta	ble	1.

	Singapore	Thailand
First HDD	1982	1983
Companies	(Seagate)	(Seagate)
Institute/Center	1992 (MTC,	2006 (HDDI)
	later to DSI)	
Role of	R&D in both	No R&D within
Institute/Center	magnetic and	the institute but
	optical	managing
	storage	networks of
	technology	universities for
		industry
		collaborations
Grants	Direct grants,	Subsidies only
	subsidies to	to university-
	companies	industry
		collaborative
		projects
Universities	Not formally	14 universities
		with 3
		excellence
		centers
Human Capital	Trainings	Scholarships,
	courses	training courses
Local Industry	1982	Not exist
Upgrading		
Program		
Number of	14 (mostly	1
leading local	in precision	
suppliers	and PCBA)	
Current	Seagate just	WD plans to
developments	opened a	invest \$170
	media plant.	millions in
	Singapore	expanding the
	now produces	production
	25 percent of	
	HDD media.	

The Comparisons

Comparing to Singapore, Thailand is still in the initial stage. Even with the establishment of an institute to oversee the whole cluster development, there is still no formal infrastructure to support local suppliers. As the development of indigenous suppliers is crucial for long-term development, Thailand should initiate the similar program as the Local Industry Upgrading Program (LIUP) that Singapore started since 1986. The table below summarizes and compares the government supports in the two countries.

Conclusions

Thailand is following Singapore footstep to become the main production base of HDD and components. Thailand has established the Hard Disk Drive Institute (HDDI) to oversee and manage the R&D and technology transfer process within the industry. The network of universities has established to collaborate on R&D activities with the industry. Scholarships are offered to students who wish to conduct research on HDD-related technology. These activities are to prepare human capital for the industry expansion in the future.

However, Thailand is still lacking local companies with technological capabilities to supply the HDD industry. In this context, Singapore is very successful in nurturing local companies, especially in precision engineering and PCBA. The development of local suppliers is very important for long-term benefit to the country. Singapore established the local industry upgrading program (LIUP) since 1982 to lift the capability of its companies. Thailand has yet to create such program.

Financial incentives are also important to encourage university-industry research collaboration. Singapore offers direct grant while Thailand mainly offer subsidies.

All of these mechanisms have to be re-evaluated and revised by Thai government to create an environment that can nurture local suppliers to the HDD industry. Further investigation to the effect of these mechanisms must be carried out to create the suitable plan for long-term sustainable benefit to the country.

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