

AN ANALYSIS OF THE COMPUTER INDUSTRY IN CHINA AND TAIWAN USING MICHAEL PORTER'S DETERMINANTS OF NATIONAL COMPETITIVE ADVANTAGE

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EXECUTIVE SUMMARY

Both China and Taiwan have pursued aggressive investments in the computer industry over the last five years. Using Michael Porter's Determinants of National Competitive Advantage, the potential of both countries can be analyzed not only separately, but also in terms of the combined resources based on the possibility that Taiwan and China join forces in pursuing a stronger position in the global computer industry. The critical factor in determining the synergies will be the policies of the governments of China and Taiwan.

INTRODUCTION

Although China has a per capita income of less than \$1,000, the Chinese government is aggressively promoting the development of its computer industry. Billions of dollars have already been invested from all over the world with significant participation from Taiwanese companies. The enormous market potential of China combined with the intellectual capital of Taiwan creates a powerful combination that could follow a historic pattern similar to that of the Japanese automobile industry. Taiwan is already a major player in personal computer components; in fact, the 2001 sales of \$43 billion in Taiwanese information technology products (CETDC, 2002) make Taiwan number three in the world after the United States and Japan (Asia Computer Weekly, 2000). Conceivably, China and Taiwan could continually upgrade combined engineering and research capabilities to eventually challenge major areas of the American information technology industry. Many years would be required for all of this to fully develop, but it is worth noting that the Japanese took approximately twenty years to evolve from exporting low cost economy automobiles in the early 1970's to becoming a major force in luxury vehicles in the early 1990's.

Insights into global competitive dynamics are available from the classic work of Michael Porter, "The Competitive Advantage of Nations" (Porter,

1990). Porter describes how nations can develop industry related clusters encompassing companies, suppliers, customers, universities and a skilled work force that become global leaders. Frequently cited examples include Italian footwear, German high performance automobiles and Hollywood entertainment. The information technology industry arguably has several industry related clusters--Silicon Valley with leading edge computer chips and engineering work stations as exemplified by Intel, Sun and Hewlett Packard; Korea in memory devices; and Taiwan in producing and assembling components associated with laptop computers. In the area of software, the West Coast of the United States and Bangalore, India have developed industry related clusters. A big question for the future is how will information technology evolve in China, and what will be the contribution of Taiwan? China has the huge advantage of a market of 1.2 billion consumers and the potential to capitalize on the intellectual resources of Chinese-speaking Taiwan.

TAIWAN'S PHENOMENAL SUCCESS

In 2001, Taiwan sold \$43 billion of information hardware mostly associated with personal computers and laptops (CETDC, 2002). Major customers included Dell, IBM and Hewlett-Packard. The destinations of these products were balanced geographically, with the United States accounting for 35 percent of exports, Europe at 27 percent, and Japan at 14 percent. Of the remaining 24 percent in exports, significant recent growth has occurred in China and the Asia Pacific area. One of the strengths of the Taiwanese computer industry has been its flexibility and the continuing upgrading of its technical capacities. An example of this is the optical-electronic sector encompassing Liquid Crystal Displays used in laptops and various cd/digital products where Taiwanese sales have grown from \$3 billion in 1996 to \$15 billion in 2001 (CETDC, 2002).

The computer and information technology industries are multi-faceted with many inter-relationships. One simplified model below (Figure 1) provides an overview particularly relevant to Taiwan (CETDC, 2002).

FIGURE 1
Taiwanese View of the Computer Industry

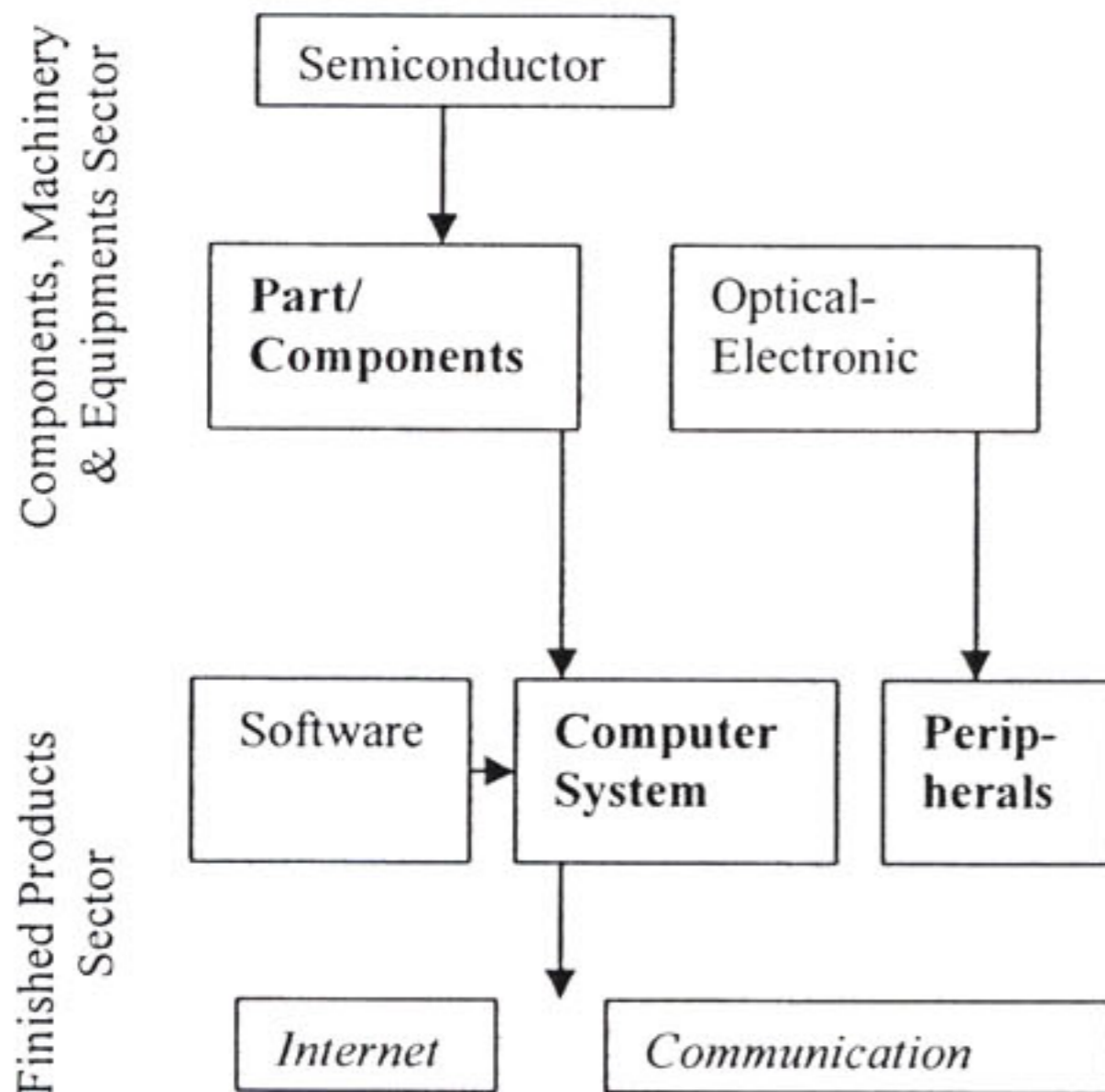
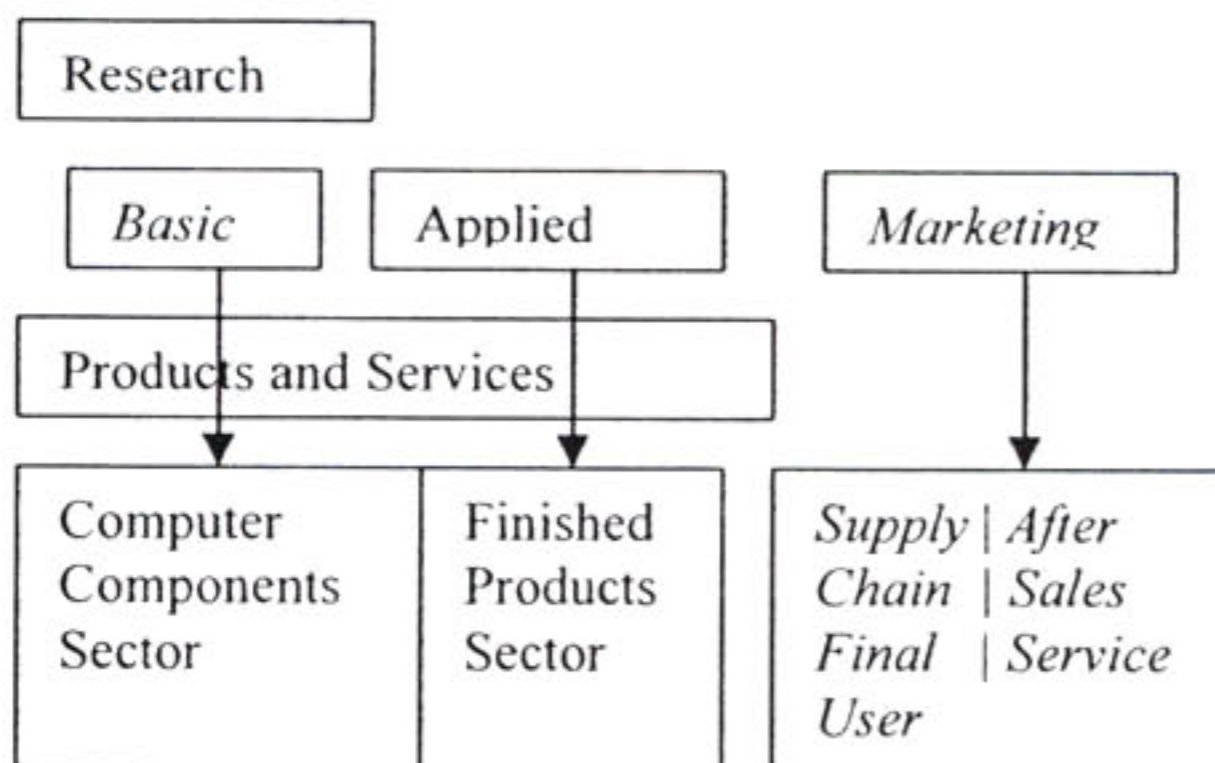


Figure 2 takes the two major Taiwanese manufacturing strengths in Figure 1, the computer components sector and the finished products sector and then adds two historic American strengths, research and marketing in order to provide a broader global setting in which to analyze the computer industry.

FIGURE 2
Global Computer Products Industry Summary



The *italicized* words represent American strengths. American companies, especially Dell, have excelled in sophisticated customer interactions and then have worked backwards in the supply chain to obtain low cost components and assembling of finished products from Taiwanese companies. In addition, the United States is strong in high technology research which has led to a wide range of new industrial and consumer products. Currently, American marketing and technology drives the computer industry. But for the future, if Taiwanese and Chinese companies were able to develop marketing expertise to take full advantage of the Chinese market, China would be in a position to dominate its own country's market in a manner similar to how the Japanese dominate their own automobile market. The key ingredient to fulfilling this potential is the Taiwanese position in components and finished products fueled in the future by the combined capabilities of both China and Taiwan.

In Figure 1, Taiwanese companies are primarily active as individual manufacturing participants in the overall industry. Figure 2 can also be viewed as a strategic summary of what the Chinese government needs to develop to exploit the huge potential Chinese computer market. Within that model, Taiwan already has major research and manufacturing strengths. By systematically encouraging Chinese and Taiwanese organizations to develop sophisticated marketing capabilities, the Chinese government has a terrific opportunity to develop an industry cluster of Chinese/Taiwanese organizations. That cluster could capitalize on the Chinese market as a foundation to strengthen their future participation in the global information technology industry.

PORTER'S DIAMOND OF NATIONAL ADVANTAGE AS APPLIED TO TAIWAN AND CHINA

In "The Competitive Advantage of Nations," Porter featured the Diamond of National Advantage with four major categories. These categories can be used to analyze the separate and combined potential of Taiwan and China in the computer industry as summarized in Figure 3. The first category is Factor Conditions which includes labor, land, natural resources and capital, but Porter emphasizes highly specialized labor and infrastructure. Both Taiwanese and Chinese universities have stressed engineering

with a particular concentration on the computer industry. Taiwan has built industrial parks devoted to the computer industry (Asia Computer Weekly, 2000) and Shanghai is in the process of developing similar industrial facilities including the Singapore Suzhou Industrial Park. That project has plans to build infrastructure for 500,000 people with housing, schools, offices and factories (Detmer, 2002).

The second major category is Demand Conditions particularly in the home market. Sophisticated customers can challenge companies to become even more competitive. Although the Taiwanese market of 22 million residents is quite small, the Taiwanese component manufacturers are very competitive with each other in seeking to become suppliers to American companies. But key to the Chinese/Taiwanese future is the market potential of 1.2 billion Chinese customers. Merrill Lynch predicts that the Chinese market for chips will grow to \$43 billion in 2005 encompassing both domestic and export markets. Domestically, Chinese consumers are buying air conditioners, DVD's, and other products requiring chips. Export sales of wireless phones and computer peripherals are also anticipated to grow significantly (Einhorn, 2002).

The third major category is Related and Supporting Industries. Porter emphasizes the "advantage that home-based related and supporting industries provide in innovation and upgrading—an advantage based on close working relationships. Suppliers and end-users located near each other can take advantage of short lines of communication, quick and constant flow of information, and an ongoing exchange of ideas and innovations. Companies have the opportunity to influence their suppliers' technical efforts and can serve as test sites for R & D work, accelerating the pace of innovation" (Porter, 1990; p. 83). Taiwanese companies have benefited from government-sponsored industrial parks and have become famous for their continual upgrading and innovation. When direct air links between Shanghai and Taiwan are established, the communication lines between Shanghai and Taiwan will become even closer. Moreover, both areas speak Chinese, thus facilitating easier and deeper interaction.

The fourth category is Firm Strategy, Structure and Rivalry. Porter begins this section by stating: "National circumstances and context create strong tendencies in how companies are created, organized and managed." Porter then goes on to also talk about the influence of national cultures, especially "on the types of education its talented people choose, where they choose to work, and their commitment and effort. The goals a nation's institutions and values set for individuals and

companies, and the prestige it attaches to certain industries, guide the flow of capital and human resources" (Porter, 1990; p. 84). Taiwan, as a nation, has focused on the computer industry and its free market philosophy has led to a constantly innovating, dynamic cluster. China has developed plans to educate a high technology work force to support its computer industry that will be implemented over the next twenty years (Ranhoff, 2002). Xiaolin Xu, Secretary General of the China Semiconductor Industry Association says China now has ten fabrication companies, over ten packaging facilities, and about 100 design houses. In the first half of 2002, China produced 2.6 billion integrated circuits (Liu, 2002). Again, the combination of the industry strengths of Taiwan and the huge potential of China offer powerful possibilities.

After describing the four categories, Porter discussed the Diamond of National Advantage as a system emphasizing the interaction among the various facets of an industry related cluster. Specifically, Porter says: Once a cluster forms, the whole group of industries become mutually supporting. Benefits flow forward, backward, and horizontally. Aggressive rivalry in one industry spreads to others in the cluster, through spin-offs, through the exercise of bargaining power, and through diversification of established companies. Entry from other industries within the cluster spurs upgrading by stimulating diversity in R & D approaches and facilitating the introduction of new strategies and skills. Through the conduits of suppliers or customers who have contact with multiple competitors, information flows freely and innovations diffuse rapidly. Interconnections within the cluster, often unanticipated, lead to perceptions of new ways of competing and new opportunities" (Porter, 2000; p. 86). This quotation exemplifies what has happened in Taiwan, particularly with the impact of the optical capabilities on the computer industry. Taiwan is a world leader in liquid crystal technology which has been central to the development of laptops and has the potential for many other future products. Infusing the Chinese market with Taiwanese abilities could easily lead to an even stronger industry cluster in China.

THE FUTURE ROLE OF THE CHINESE GOVERNMENT—POSITIVE OR NEGATIVE?

After discussing the Diamond as a System, Porter then highlights the role of government. He says: "Government's proper role is as a catalyst and challenger; it is to encourage—or even push—companies to raise their aspirations and move to

higher levels of competitive performance, even though this process may be inherently unpleasant and difficult. government's role of transmitting and amplifying the forces of the diamond is a powerful one." (Porter, 1990; p. 87) The government of Taiwan has already performed its role very well in developing the Taiwanese computer industry.

Future Positive Role of Govt.	Encourages Taiwanese Investments in China	Encourages Taiwanese Investments in China	Exploits Taiwanese Experience to Build Greater China Strengths
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FIGURE 3
The Diamond of National Advantage
Taiwan and China in the Computer Industry

<u>Porter Determinant</u>	<u>Taiwan</u>	<u>China</u>	<u>Greater China Combined</u>
Factor Conditions	Highly Specialized Computer Workforce	Early Stages of Developing Computer Workforce	Strong Future Potential
Demand Conditions	Small Taiwanese Market but With Excellent American Linkages	Huge Potential Market	Chinese Market & Taiwanese Linkages to U.S. Market
Related and Supporting Industries	Well Developed In Computer components	Very little but has Plans for Shanghai	Taiwanese Strength Plus Chinese Potential
Firm Strategy Structure & Rivalry	Innovative Climate in Taiwan	Very little	Taiwanese Strength Plus Chinese Potential
The Diamond As system	Well developed	Huge Potential	Potential Chinese Synergies
Role of Government	Taiwan Industrial Parks	Shanghai Computer Parks	Potential Chinese & Taiwanese Linkages
Future Negative Role of Govt.	Discourages Taiwanese Investments in China	Threatens Military Actions in Taiwan	Mutual Suspicion and Hostility

One of its major achievements has been the development of science based industrial parks such as the huge success of Hsinchu and another one in Tainan County which is expected to be finished in 2005. Another example of government serving the role of catalyst is the plan by the Taipei city government to become a cyber city with paperless systems. (Asia Computer Weekly, 2000).

The big question is the future role of the Chinese government. Will it welcome the Taiwanese industry into China? Moreover, will it actively encourage Taiwanese companies to be the catalyst for a Greater China industry related cluster? The potential appears to exist; what will be fascinating to watch is what the Chinese government will actually do? The negative alternative is to threaten the Taiwanese government which then in turn could severely limit Taiwanese participation in China.

The "Competitive Advantage of Nations" speaks of national advantage on the assumption that individual nations or regions within countries are the basic unit of analysis. Taiwan and China raise the interesting question of whether we are talking about two countries or one nation with two inter-connected regions. Governmentally, there are two entities which have had a difficult relationship during the last fifty years, but to the extent that Taiwan and China share a culture and a desire to prosper within the global computer industry, they may jointly develop an industry related cluster linked between Shanghai and Taiwan. An important factor in the future relationship between China and Taiwan comes from the Taiwan Semiconductor Industry Association (TSIA) which has 145 members including several prominent companies. Gordon Chen, President of TSIA, has said that Taiwan must invest in China to lower its production costs in order to maintain its global competitiveness. To obtain cooperation from the Taiwanese government which has restrained investments in China, a delegation from TSIA launched intensive discussions in 2001 (China Post, 2001). That dialogue resulted in the government of Taiwan formally lifting its ban in April, 2002 on Chinese foundries (Shamen, 2002).

An example of the potential for Taiwanese and Chinese linkages is the Chinese government

owned Central Semiconductor Manufacturing Corp (CSMC) which has been run since 1997 by Taiwanese managers and has been very successful in supplying chips for Chinese companies. Another Chinese company, Grace Semiconductor Manufacturing Corp (GSMC), is jointly led by Winston Wong of Taiwan and Jiang Mianheng, who is the son of the recent President of China, Jiang Zemin. GSMC is building a \$1.6 billion facility in Shanghai. Its President, Nava Tsai, used to work for the Taiwanese chipmaker Mosel Vitale. Although the Chinese government is actively encouraging foreign investments in the computer industry, many obstacles still remain including insufficient entrepreneurial spirit and incomplete infrastructure. Furthermore, it is sometimes difficult for companies to move quickly within the constraints of the bureaucratic red tape of a government still strongly influenced by communist practices (Arensman, 2002; Clendenin, 2001).

CONCLUSION

The global computer industry is both complicated and very dynamic. As such, it is extremely problematic to make specific predictions for the next five to ten years. For example, Bridwell and Richard (1998) using Michael Porter's concepts evaluated Korea as having significantly more capabilities than Taiwan. But the financial crisis in Asia during the late 1990's hurt Korea much more than Taiwan. Taiwan also showed great entrepreneurial skill in liquid crystal display technologies and in the assembly of personal computers. That same review also spoke of Asian cultural strengths in mathematics and engineering that could lead to future Asian advancement in the computer industry. Evidently, analysis of the Competitive Advantage of Nations should now pay close attention to a broad definition of the Chinese nation. The combination of Mainland China and the Overseas Chinese from Taiwan, Singapore and those who have worked for high technology companies in the United States could become an even more powerful force in the global computer industry of the future.

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