A Way to Prosperity: Competitive Analysis of ICT Industries in Taiwan

Bao-shuh Paul Lin, Roger Cheng, and Kristy H.C.K.Sha*

Over the past several years Taiwan has become a leading player in the global ICT manufacturing arena. More than two-dozen diverse products have captured a top three position in the respective worldwide markets. However, the global competition is getting fiercer with slimmer margins and hollowing effect in the manufacturing sectors; on the other hand, the service industries such as distance learning and healthcare solutions are expected to flourish. Taiwan has to move towards value-added production, leveraging its superior ICT industries and reinforcing the value chain integration, to maximize its competitive advantages. Hence, the government has launched key national programs for infrastructure build-up, content creation and service deployment to transform Taiwan into a High-tech Service Island. Several other proactive initiatives have also been taken to move its economy in a new direction and accelerate a transition to the Information Society by talent cultivation, innovation promotion, and technology commercialization. In this paper we first outline the international status of Taiwan’s ICT industries. An analysis based on "diamond model" is then carried out and implementation measures to further enhance Taiwan’s competitiveness are proposed. The final suggestions we make are 1) Repositioning to be the Global Design and Supply Center for the integrated system, key components, and digital content; 2) Fostering technology innovation; 3) Leveraging global sources; 4) Strengthening technology commercialization/ entrepreneurship.

Keywords: Taiwan ICT, High-tech Service Island, R&D Center, talent cultivation, innovation promotion, technology commercialization

I. INTRODUCTION

Observing the development trends of high-tech industries in many countries, we conclude that the success of these industries depends strongly on the interworking of both design factors and chance factors. Those factors that a country can control to develop an industry are called design factors, whereas chance factors are those uncertainties in the technology market, macro-economy and micro-economy that have always influenced the directions and speed of industrial progress and that are beyond the control of a single country. The impact of the latter

*Dr. Bao-Shuh Paul Lin is currently VP & CTO of Communications & Optoelectronics Technologies, Industrial Technology Research Institute (ITRI), and General Director of Computer & Communications Research Laboratories (CCL) as well as SoC Technology Center (STC). ITRI, serving as the primary anchor of the government technology initiatives and policies, has played a vital role in Taiwan’s economic development. CCL, the core member of ITRI, has significantly helped the growth of 3C industries in Taiwan and continues the thrust into new frontiers. Roger Cheng is Director of Internet Software Technology Division of CCL/ITRI. Kristy H.C.K.Sha is a Doctoral student at Institute of Management of Technology, National Chiao Tung University, Taiwan
aspects can be attributed to inexorable factors. An industry that has available both supply and demand advantages can always fit into a more competitive position, especially when the country is ready to invest its resources in an earlier, more rapid and more efficient way. As a result, such an industry can be expected to maintain its success.

The development of the industrial policy plays a critical role in the political system of a modern country. It is always an important issue for a country to spur the industrial development and enhance its competitiveness through the appropriate planning, evaluation and execution of the industrial policy. Even for the case of a super capitalism country emphasizing the free economics such as United States, the public resources are also used to supplement the “Market Failure” by supporting venture capital market, product standardization as well as technology transfer. It is almost becoming the consensus for most countries that industry structure can be in a more competitive position if the government is involved with industrial R&D activities.

Taiwan, similar to the Netherlands in Europe, is a small entity with open economy environment that has high degree of foreign trade dependency. With shortage of natural resources, Taiwanese have been working hard creating the first wave of “Taiwan First” in 1970s. However, with the huge global impact from oil crises, Taiwan realized the urgency of directing to the technology intensive industries from the traditional labor-intensive industries. In the past decades, the government, research organizations and industries in Taiwan worked well together to create competitive advantages in ICT industries. Take Industrial Technology Research Institute (ITRI) as an example. ITRI, a public R&D organization commissioned by the government, exploits internal (local) and external (global) resources first to construct the technical competence and disseminate to the industry, which then speed up the product commercialization, and stimulate the development of new technology-based industries. The success of the collaboration, not only stabilizes the economic development, but also develops the second wave of many ICT products ranked as the second wave of “Taiwan First”.

However, with the transformation of the global economy in the twenty-one century, to incorporate the digital technology with versatile applications becomes the key to business success. To provide the innovative applications as well as attractive services is now leading the requirements, especially under the current value of the philosophy emphasizing quality of the life. This is also the target that knowledge-based economy and information society are aiming at. To Taiwan, which has been proved excellent in manufacturing capability, it is now the time for a way forward. After making the top achievements with ICT industries, boosting the design innovation and service creation will be Taiwan’s new challenges, and the opportunities, too, to stay top in the world.

II. INDUSTRIAL COMPETITIVENESS THEORIES

Michael Porter introduced in 1990 a competitiveness theory by arguing that national prosperity is not inherited, but created by choices. Porter’s Diamond Model (Figure 1.) is concerned with four fundamental determinants: 1) Factors of Production; 2) Demand Conditions; 3) Firm Strategies, Structure, and Rivalries; 4) Related and Supporting Industries. The second set comprises two additional variables; Chance and Government. The interactions among the factors can cross-enhance the system, driving the country competitiveness in the speed and the direction of the industrial development.

Factors of production include human resources, physical resources, knowledge resources, capital resources, and infrastructure. Demand Factors refer to domestic market and international market and depend on the size of the demand and potential growth. The success of the firm is
strongly influenced by its business strategy and corporate structure. Domestic rivalries refer to the ways in which businesses compete in their domestic market. The strength of the competitors would initiate the growth of the industrial innovation, and the flow of professionals among the industries can enhance the technology dissemination. Related industries and supporting system include the integrated supply chain, the complementary relationships and pull-through effects among the industries.

![Diagram](image_url)

**Figure 1: Diamond Model**


As to the Chances Factors, the scenarios advancing the industrial development chances include: the invention and innovation of the basic technology, the discontinuity on the traditional technology, major changes of global or regional market. War also brings the chances as it breaks the original market order and creates the new competitive space.

“Government” is an important factor influencing the industrial competitive advantages. The subsidizing and educational training can improve the innovation capability for a country. The management on the capital market and the legal system by the government as well as its strong purchasing power can speed up the development of a new industry. Therefore, government is a good help to develop the industry; it can also be a hindrance to the industrial development if the policies are not well planned or executed. One of the roles that the government plays is to create the “Resource Leverage” for the industry. The “Resource Leverage” employed by the government helps making Taiwan and Korea the two stars in developing the ICT industries through bringing in the industrial technologies and industrial clusters. The six principles used as the criteria by Taiwanese government to select the strategic industries are “Market Potential, Industrial Linkage, Added Value, Technology Level, Low Pollution Emission and Low Energy Dependency”, which can also provide the multiplier effects based on the resource leverage.

With the four strategic resources of high quality human resources, solid technology foundation, knowledge and capital, industrial clusters are also considered as the source of industrial competitive advantages. Composed of the upper and down stream industries, supporting business and academia/research institutes, industrial clusters not only minimize the transaction cost resulting from the information asymmetry, but also accelerate technology innovation and new business formation during the industrial development process. Via the agglomeration effect,
industrial clusters can further enhance R&D efficiency, and then the growth of the economics.

As to the other competitive advantages, in the book of “The Criteria of Market Leadership”, Treacy & Wiersema has listed the three criteria of leading business, which are product leadership, operational excellence and customer intimacy. Hope & Hope applied these three models into the industrial value chain and grouped the value activities into three main functions: innovation, operations and customer service. Continuing innovation, optimizing operational efficiency and improving customer service can therefore be the three strategic factors to create the competitive advantages for the high tech industries.

III. INDUSTRIAL PROGRESS IN TAIWAN

The pattern of economic competition has changed with the times. In the following section we describe Taiwan’s overall industrial progress based on Porter ‘s stages of national competitive development before we discuss the specific industrial competitive strategies.

Located at a strategic position in Asia-pacific, Taiwan has a major developmental axis supported by medium and small entrepreneurs as Taiwanese has strong entrepreneurship in nature. Very similar to Nordic Finland, as a very small country, Taiwan is becoming a strong entity that cannot be neglected in the global economics. Finland government has been well planning her pioneering industries, increasing the R&D investment, developing the interactive networking among the research institutes, helping the traditional forestry farm business transforming to the leaders of electronics/communications and biomedical. Below is the chronic description showing how Taiwan transforms into the ICT industries from traditional business focus.

3.1 “Factor-Driven” Stage (1950 – 1970)

Between 1953 and 1960, Taiwan focused on developing the industries of consumer products such as textile, food processing, leather and plastics products to replace the imported products. Domestic or imported raw materials were used for manufacturing the finished goods to reduce the imported products. The stage is called Import Substitution Period. From 1961 to 1972, Taiwanese government realized the policies of providing the investment incentives, creating export industries and developing the overseas market. It is then called Export Expansion Period. The strong export demand brought up the production volume resulting in the rapid growth of Taiwanese light industries, thereafter creating the first wave of “Taiwan First” such as plastics, shoe making, umbrella, and hat. Based on the data compiled by the Council for Economic Planning and Development, Executive Yuan (Taiwan Statistical Data Book, 1989; IMF International Financial Statistics Yearbook, 1989), Taiwan had an average growth rate of 10.2% between 1961-1972. During the same period of time, average growth rate was 4.6% for the industrialized countries, 5.6% for developing countries. Taiwan therefore was credited as a country of “Economic Miracle”.

Cheap labor was then the driving force to drive the Taiwan’s economics. With the facts of lacking the advanced technology, bottleneck to promote the productivity and weak R&D capability, the country or the industry had very rigid flexibility of the response facing the challenge when the macroeconomics became unstable. Taiwan realized the urgency of directing the labor-intensive industries to technology intensive industries during the first energy crisis. The government funded money to establish the non-profit research organizations such as Industrial Technology Research Institute (ITRI) in the mid-70s. Very clear target and appropriate flexibility have been granted to the institutes as the pioneers to upgrade their technology level and uplift the traditional industry structure. ITRI, playing the role of “Innovation Engine”, successfully made
up the technology lag through the self-innovation and overseas technology transfer. With the concerted efforts continuously made by government, industry, academia and research institutes, Taiwan earned the new wave of “Taiwan First” in semiconductor, optic electronics, communications and information industries.

3.2. “Investment-Driven” Stage (Late 1970 – Mid 1990) –

During this period, Taiwan not only kept developing overseas market for trading, continuing the investments in the ten infrastructure construction projects, but also trying to make up the technology lag with advanced countries by making the new policy with investment incentives. The foundations of the transportation, communications, financial and legal system were therefore solidified. The technology efficiency of small and medium size enterprises were also promoted through the overseas technology import or domestic technology transfer. The government further established Hsinchu Science Based Industrial Park (Fig. 2) in 1980 to provide a good investment environment, attract the overseas high-tech professionals, and upgrade Taiwanese industries. A very famous high tech corridor was later formed, covering Hsinchu Science Park, ITRI and two very reputed national universities, Tsing Hwa and Chiao Tung universities. The bridging of the technology and market then brought up the birth of Taiwanese ICT industries. With the successful experiences from Hsinchu Science Park, the government copied the model in the late 1990 and has been planning to bring the model island wise, including the north, central and south science based parks in line with the development of the bases of supporting services. It was expected that the aggressive planning could place Taiwan onto the list of high-tech advanced countries.

**Figure 2: Economic Development Progress in Taiwan**

Source: National Information and Communication Infrastructure (NICI), Executive Yuan, April 2003
3.3. [Innovation-Driven] Stage (Mid1990 and after)

Taiwan has been facing the dual pressures internally and externally since mid 1990. Externally, cheap labor force and low cost land, plus the huge market potential of China caused the industry hollowing effect in Taiwan because of the outbound movement of manufacture industries. Internally, the labor quality and the discipline that were emphasized by the traditional manufacturing industries have been gradually facing the erosion. In order to successfully meet the fiercer global competition, it is necessary for Taiwan to establish the capabilities of technology innovation. Taiwan also promotes the e-government and e-commerce to enhance the administrative and management efficiency, with the vision of developing Taiwan as the Asia-Pacific business center. The global ranking of Taiwan’s "e-Government” is shown in Table 1.

Table 1. The Global Ranking of Taiwan’s "e-Government"

<table>
<thead>
<tr>
<th>Global Ranking</th>
<th>Evaluation Agency</th>
<th>Countries/date Evaluated</th>
<th>Evaluation Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO.1</td>
<td>Brown University</td>
<td>198 (Sept.2002)</td>
<td>Service functions and the contents of the website provided by government agencies</td>
</tr>
<tr>
<td>NO.2</td>
<td>World Marketing Research Center (WMRC)</td>
<td>196 (Sept.2002)</td>
<td>Government Web links, Information Access, and Online Payment Mechanism</td>
</tr>
<tr>
<td>NO.4</td>
<td>World Economics Forum</td>
<td>82 (Feb.2003)</td>
<td>Government Applications in the Network Readiness</td>
</tr>
</tbody>
</table>

Source: Research, Development and Evaluation Commission, Executive Yuan, Mar. 2003

Innovation is the driving force of the national development and national power can be built by the “Investment to the Future”. In the “Challenge 2008” of the Six Years National Development Program formulated by the government, the four major investments include “Cultivating Talent”, “R&D and Innovation”, “Global Logistics” and “high-quality Living Environment”. Through leveraging global R&D resources, Taiwan can be developed as the Asian base for R&D and innovation. Vigorous measures are adopted to promote Taiwan as the operations headquarters and R&D centers for both domestic enterprises and multi-national corporations. Meanwhile, the “Digital Taiwan” program is underway to develop Taiwan into a high quality information society visioning “The most e-Nation in Asia”. The major five targets are “Broadband to the Home”, “e-Life”, “e-Commerce”, “e-Government”, and “e-Transportation”. All these comprehensive programs together with science and technology development programs such as the “Two Trillion & Twin Star” aim to transform Taiwan into a “Green Silicon Island” with sustainable development and the promotion of knowledge economy.

Based on the report of “2002-2003 Global Information Technology Report”, Taiwan’s broadband penetration rate is 9.7%, only second to the 14% of South Korea. The penetration rate of mobile phone is as high as 111%, ranked as No.1 globally. According to “Global Competitiveness Report (2002 – 2003)” edited jointly by World Economics Forum and Harvard University, the top three countries are United States, Finland and Taiwan based on the Growth Competitiveness Index (GCI). In addition, the 2003 statistics data from US Patent Office indicated that Taiwan had the US patents granted as No.4 globally, after United States, Japan and Germany (Table 2). In terms of the density of granted patents, which is the number of patents granted per million populations, Taiwan can be listed as No.2 globally, second to the United States. These data have illustrated the strong capability of innovation from Taiwan’s technology advantages.
IV. COMPETITIVE ANALYSIS ON TAIWAN’S ICT INDUSTRIES

4.1 Current Status of Taiwanese ICT Industries

The achievements of Taiwanese ICT industries can be attributed to the close collaboration among the government, industries, academia and research institutes. The highly integrated industrial chain in the semiconductor and information industries and its efficient peripheral supporting services provide the accumulated benefits for the development of digital contents and momentum required for the advanced knowledge-based services. Taiwan had over 25 ICT products listed as the global top three in year 2002 (Table 3), placing Taiwan in a position of global high tech nation. The total production value of information industries reached US$87.5 billion in 2002, expecting to approach US$97.6 billion by year 2003. Another word, it accounts for 30.3% of Taiwanese GNP in year 2002 and it would reach 33% by year 2003, demonstrating the importance of the ICT industries in Taiwanese economy.

<table>
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<th>Table 2 Patents Awarded in the USA</th>
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<tbody>
<tr>
<td>America</td>
</tr>
<tr>
<td>1998</td>
</tr>
<tr>
<td>2000</td>
</tr>
<tr>
<td>2002</td>
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Source: US Patent Website, July 2003

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<tr>
<th>Table 3</th>
<th>Taiwan’s ICT Products Ranked Global Top One (in Units) in 2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>Global Market Share (%)</td>
</tr>
<tr>
<td>IC Foundry</td>
<td>72.5</td>
</tr>
<tr>
<td>IC Packaging</td>
<td>32.0</td>
</tr>
<tr>
<td>Mask Rom</td>
<td>66.4</td>
</tr>
<tr>
<td>CD-R Disk</td>
<td>78.4</td>
</tr>
<tr>
<td>CD-RW Disk</td>
<td>84.9</td>
</tr>
<tr>
<td>DVD-video</td>
<td>74.0</td>
</tr>
<tr>
<td>DVD-recordable</td>
<td>60.3</td>
</tr>
<tr>
<td>WLAN</td>
<td>80.0</td>
</tr>
<tr>
<td>Ethernet Card</td>
<td>66.5</td>
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</table>

Source: Industrial Economics & Knowledge Center, ITRI, April 2003

4.2 Competitive Analysis on ICT Industry in Taiwan

There were many academic in-depth research reports presenting the related issues about the industrial development of Taiwan’s ICT industries; the market trends and technology development have long been monitored or reported regularly. Many science & technology conferences or meetings organized by the government (e.g. Science & Technology Advisory Group meeting, Strategic Review Board meeting of the Executive Yuan,) had a continuous
discussion on the topic in the past many years and many feasible suggestions were made. Our research surveyed data and compiled information from the archived reports, analysis, survey and meeting minutes, making a summarized presentation covering the competitive advantages, challenges and strategies respectively.

4.2.1. Advantages Created

The following sector describes the competitive advantages of Taiwan’s ICT industries based on Porter’s Diamond Model.

Table 4. Competitive Advantages on Taiwan’s ICT Industries by Diamond Model

<table>
<thead>
<tr>
<th>Determinants</th>
<th>Competitive Advantages</th>
</tr>
</thead>
</table>
| Factors of Production            | • High quality technical professionals; Very hard working entrepreneurs and employees with high adaptability  
• Strong manufacturing capabilities in global OEM/ODM market  
• Efficient cost control; Strong flexibility to the customer demand.  
• Excellent knowledge on management know-how  
• Ample foreign reserve as well as the capital supply  
• Good national information infrastructure                                                                                                               |
| Demand Conditions                | • Emerging industries derived from Digital Convergence integrated with 3C, initiating the technology demand  
• Macroeconomics expected to turn around; prospective upward Asia-pacific market bringing in the demand of IT market as well as the new mobile phones.  
• Ample business opportunities generated from the digitizing and networking functions of home appliances  
• Increasing Chinese market demand is placing a better competitive position on Taiwan against other countries due to the same culture and languages |
| Firm Strategy, Structure, and Rivalry | • Prompt adaptability to meet customer demands  
• Highly efficient OEM with competitive pricing advantages  
• Strong global logistics with efficient supply chain management;  
• Good in leveraging overseas resources and relationship capital  
• Strong partnership with global giants                                                                                                                    |
| Related and Supporting Industries | • Excellent Industrial Cluster; incorporated with efficient supporting industries.  
• Technology information dissemination promoted by industrial R&D alliances providing the information for an accurate investment decision and reducing the business learning cost  
• High network readiness and penetration rate of mobile phone and broadband access                                                                      |
| Chances                          | • Digital and wireless technology bringing the development of knowledge-based services such as remote home-based healthcare, low temperature logistics and on-line financing  
• Broadband networking enabling digital entertainment and e-commerce  
• Integration of mobile cellular network and WLAN initiating plenty of business opportunities  
• Many emerging IC applications services for mobile enterprises…                                                                                           |
Government

- Taiwanese government lists ICT as the strategic industries
- “Challenge 2008 National Development Program”, “Digital Taiwan Project”, targeting at building Taiwan a “High-Tech Service Island”, can release many business opportunities
- Strong promotion on digital content industries by the government and venture capital
- Active stock and venture capital markets reducing the capital cost
- Financial support and tax incentives from government

4.2.2. Challenges Faced

Taiwan has the most famous manufacturing capability, however, there are some bottlenecks that Taiwan’s ICT industries have to break. The challenges its ICT industries face are as follows:

- The production volume is not proportional to the production value
- Profit margin is low though the production is high. In the example of Wireless LAN, its shipment volume accounts for 80% of the global production, the production value is only 30% of the global value
- The value of IC design in Taiwan is far behind of that from the multinational enterprises (MNEs) in the US
- The industry hallowing effect caused by the migration to overseas in the manufacturing sector, and threats of substitution from Korea.
- International standards and specifications controlled by the MNEs and dominance of foreign owned intellectual properties (IP)
- Products with highly homogeneous characteristics and less innovativeness resulting in vicious competition cycles among manufacturers.
- Lack of internationally well-known brand names and marketing visibility
- Insufficient supply of senior professionals for SoC design, system integration and content creation

4.2.3. Strategies Proposed

Based on the situation assessment, in light of the dynamic environment and the goals set for our desired future, the primary strategies for Taiwan to take will be leveraging its superior ICT industries and reinforcing its value chain integration to move towards value-added production such as SoC design, IP creation, system integration and service creation (Fig. 3). The implementation measures we propose are as follows:

1) Re-positioning - Transform the current global high-tech manufacturing center into
   - Global Design and Supply Center for the integrated system, key components, and digital content.

2) Fostering technology innovation
   - Enhance quality and quantity of technology manpower by strengthening training courses and setting up education programs for emerging technologies
   - Set up international recruiting network to attract the international R&D professionals
   - Create the life-long learning environment to strengthen overall human resources
   - Promote National R&D programs in Telecommunications, System-on-Chip, e-Learning, Digital Content, nano-technology, and so on
• Reinforce the R&D in pioneering technologies (such as nano-electronics, terabyte) and software as well as applied services.
• Optimize the executive system to assure the quality and effective integration of the internal resources.

(3) Leveraging global sources
• Promote R&D Centers and Operations Headquarters for MNEs and domestic enterprises.
• Strengthen international R&D cooperation by setting up international knowledge network, technology exchange and joint development
• Set up R&D alliances include IP management, information service, advanced design/testing/verification
• Utilize low-cost manufacturing advantages from the emerging economies such as China, and develop our own brand names.
• Forming strong partnership and alliance with globally reputed major companies to advance the technology level, develop the marketing strength and set up the marketing channels.

(4) Strengthening technology commercialization/entrepreneurship
• Promote technology transfers and technology trading mechanisms such as IP mall
• Strengthen digital right management (DRM), valuation system for intangible assets, venture capitals and incubation capabilities
• Establish strategic consortia and knowledge-based service industries include IP Mall, information service, advanced design/testing/verification

**New Directions for ICT Industries in Taiwan**

- box making => + IP & SoC design
- system integration & solution provisioning
- service-enabling tech.
- WLAN/cellular integration

**Fig. 3 New Direction for ICT Industries in Taiwan**
4.3 Action Plans for Specific ICT Industries

In this part, we describe the key measures formulated for the five main sectors of ICT industries in Taiwan, namely, semiconductor, optoelectronics, communications, information and digital content. (Table of Abbreviations is shown in the Attachment for reference.)

4.3.1. Semiconductor Sector

Taiwan’s IC industry takes the global lead in foundry, packaging and Mask ROM. The global semiconductor market is expected to grow and the Asian region has the highest growth rate. Taiwan should maintain its capability and quality in high-end process control and service delivery. Advanced process and SoC design technologies should be further explored and the innovated IP be developed. Efforts should also be exerted to transform from the “quick-follower” to the innovator by making Taiwan the High Value-Added SoC Innovation and R&D center.

4.3.2. Optoelectronics Sector

Taiwan’s LCD panel, LED has been ranked as No.2 globally in terms of the production volume. Large Scale LCD becomes the major high end product line for Digital TV (DTV) as digital entertainment gains popularity in the world. Yet high gross profit LCD TV has very high entry barriers in technology, product design and marketing issues. Taiwan has to control the technologies of new generation (such as Terabyte nano technology, MPEG-4 Codec) and expand channels for the global market. Efforts should be dedicated to compete for the new specification at DVD Forum, and dominate the global market of the blue light HD-DVD.

4.3.3. Communications Sector

Taiwan’s communications industry had long-term stable growth with superior performance on manufacturing the customer premises equipment such as ADSL and Cable Modem. It’s anticipated that innovative new telecom services and products integrating WLANs and cellular phone systems will become mainstream. Taiwan should leverage its superior positions in manufacturing WLAN equipment and mobile phones, address related technologies and systems including security and billing systems. Innovations in services and field trials involving both operators and vendors should be encouraged. Actions to promote the vision worldwide and submit contributions to related standards bodies should also be conducted. Through these initiatives, Taiwan has the strong potential to emerge from being a follower in the telecom industry to become a leader capable of shaping future integrated communications landscape.

4.3.4. Information Sector

Taiwan plays a leading role in the global IT hardware market, but the size of global information software market is far bigger than that of hardware. (E.g. For the year 2002, the ratio of software to hardware was 13:1) One major share of the information software market is accounted by IT Services (e.g. More than 87.9% in year 2002), which can be integrated with computer, communications, consumer entertainment (3C) to take the lead in the next generation information industries. The market for the intelligent mobile devices and digital/interactive TV will also have the explosive growth. Therefore, Taiwan should target at the development of TV-centered home appliances and smart Internet Appliances such as Wireless PDA, E-book, and smart phones. Taiwan should also extend its capability in IT services and establish a high quality environment for the knowledge-based services through the execution of the “Challenge 2008” National Development Program.
4.3.5. Digital Content Sector

Knowledge-based economy triggers the investment in the distance learning, on-line game and mobile devices, which have huge potential market. Besides the comprehensive network environment, Taiwan has a long history of Oriental cultures, mixing with Western cultures, which can provide rich digital content. Therefore, Taiwan has a better position to enter the Greater China market by designing high quality digital contents with the special characteristics of Chinese culture. The approaches Taiwan can take to promote its digital content industry are as follows: attracting the investment and the international cooperation, recruiting the professionals with multi-cultures, training the local creativity industry professionals and promoting international marketing strategies. Reinforcement of intellectual property rights and enhancement of user-friendly platforms for different users are also highly advised.

5. CONCLUDING REMARKS

Taiwan has taken the global lead in ICT industries with more than two-dozen diverse products have captured a top three position in the respective worldwide markets. The success of Taiwan’s ICT industries can be attributed to the efficient interaction and the tight collaboration among the government, industries, academia and research institutes. A well-linked mechanism for technology development, knowledge diffusion and product commercialization plays a critical role in the leverage of internal (local) and external (global) resources and the creation of the competitive advantages in industrial process. However, as the global competition is getting fiercer and the margins are becoming slimmer in the manufacturing segment, the future competitive advantages demand not just low-cost productions, but also low-cost innovations. High value-added production, global logistics, and innovative R&D are the ways to maintain the leading edge of Taiwan’s ICT industries. Therefore, the primary strategies for Taiwan will be to upgrade from a manufacturing-oriented industry towards an innovation-driven society. The action plans we proposed are 1) Repositioning to be the Global Design and Supply Center for the integrated system, key components, and digital content; 2) Fostering the technology innovation; 3) Leveraging global sources; 4) Strengthening technology commercialization/ entrepreneurship.

In summary, Taiwan has to leverage its superior ICT industries and reinforce the value chain integration to move towards value-added production such as SoC design, IP creation, system integration and service creation. Cost advantages should be maintained while service differentiation should be emphasized. Innovative R&D incorporated with brand names and marketing channels can be used to maximize the Taiwan’s competitive advantages. All these efforts will move Taiwan’s economy in a new direction and pave the way to a long lasting prosperity.

REFERENCES


**ATTACHMENT**

Table of Abbreviations

<table>
<thead>
<tr>
<th>Full Name</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Asymmetric Digital Subscriber Loop</td>
<td>ADSL</td>
</tr>
<tr>
<td>Application Specific Integrated Circuit</td>
<td>ASIC</td>
</tr>
<tr>
<td>Beyond the Third Generation</td>
<td>B3G</td>
</tr>
<tr>
<td>Compact Disk - Recordable</td>
<td>CD-R</td>
</tr>
<tr>
<td>Compact Disk - ReWritable</td>
<td>CD-RW</td>
</tr>
<tr>
<td>Digital Still Camera</td>
<td>DSC</td>
</tr>
<tr>
<td>Digital Versatile Disk</td>
<td>DVD</td>
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<tr>
<td>High Density Digital Versatile Disk</td>
<td>HD-DVD</td>
</tr>
<tr>
<td>Liquid Crystal Display</td>
<td>LCD</td>
</tr>
<tr>
<td>Light Emission Display</td>
<td>LED</td>
</tr>
<tr>
<td>Moving Picture Experts Group</td>
<td>MPEG</td>
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<td>Original Design Manufacturing</td>
<td>ODM</td>
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<td>Original Equipment Manufacturing</td>
<td>OEM</td>
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<tr>
<td>Personal Digital Assistant</td>
<td>PDA</td>
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<td>Small Office, Home Office</td>
<td>SOHO</td>
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<tr>
<td>Set Top Box</td>
<td>STB</td>
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<tr>
<td>Wireless Local Area Network</td>
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