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Yun Kuo

Institute for Information Industry

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**Achievements and Future Potentials of the
Information Industry Development in Republic of China**

MR. YUN KUO

Vice Chairman and President
Institute for Information Industry

ABSTRACT

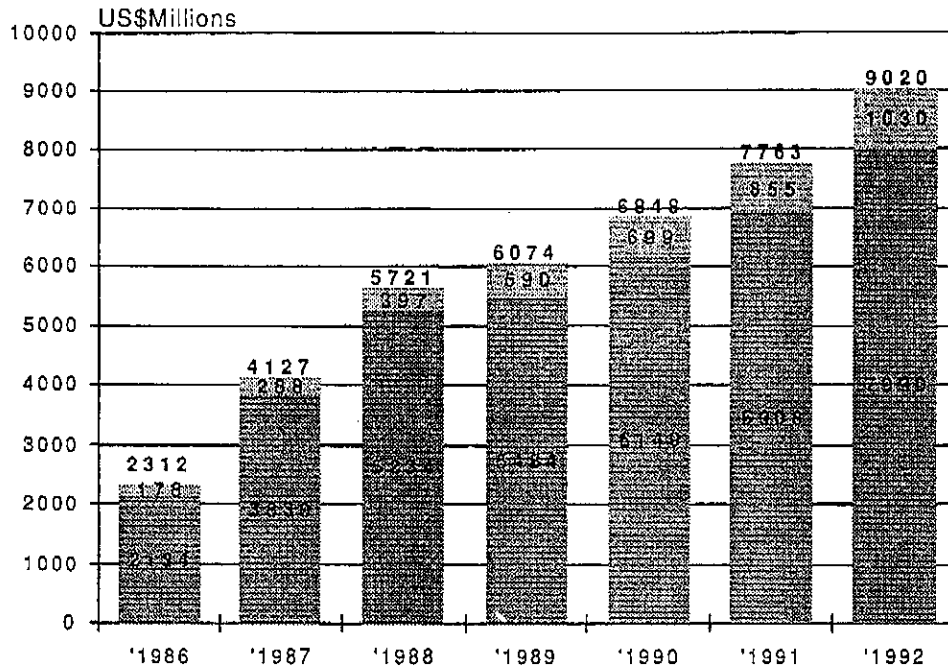
The ROC ranked as the 6th largest IT product supplier in the worldwide computer market, following the U.S.A, Japan, Germany, UK, and France. In 1992, ROC information industry's growth rate (15.7%) was higher than the worldwide growth rate (5.5%), and it will have in 1993 a 11.1% growth rate as compared to 7% of the worldwide information industry. ROC's software industry has played a neglected role in the past, but it will be valued and enforced from 1993 through the formulation and implementation of sound software development strategies. In this paper, we begin with the achievements of the ROC information industry, analyzing reasons for growth in the past five years and uncovering some critical challenges regarding the sound development of the ROC information industry. Then, we present quantitative information industry objectives and the responsive strategies which intend to utilize resources effectively and increase competitive advantages in the world market. This paper covers (1) ROC information industry achievements (2) Challenges for ROC information industry development, and (3) ROC information industry development objectives and strategies.

A. ROC Information Industry Achievements

The ROC information industry has been established for over ten years and has set up a sound basis in the last five years. Looking back on the ROC's information industry in the past five years, we found that the ROC achieved a 25.5% compound annual growth rate in both hardware and software production value. (See Figure A-1) Even in 1992, ROC's information industry production value performed growth at 15.7% which is higher than that of the worldwide information industry. (See Figure A-2) Due to coordinated efforts by the government and private sectors, monitor, motherboard, switching power supply, image scanner, graphic card, mouse, keyboard, terminal, desktop as well as notebook personal computers have played an important role either in sales revenue or in worldwide market share.(See Table A-1)

In 1992, ROC's hardware production value was US\$ 7.99 billion and software production was US\$ 1.03 Billion. Due to shortage of hardware components and key product technology, ROC information hardware products are vulnerable to economic recession and severe price competition. In addition, the ROC lacks experience to develop localized application software; conversely, the ROC imported a lot of expensive and unsuitable package software. These developments had a negative influence on local users' satisfaction level and local software vendors' development and market capability.

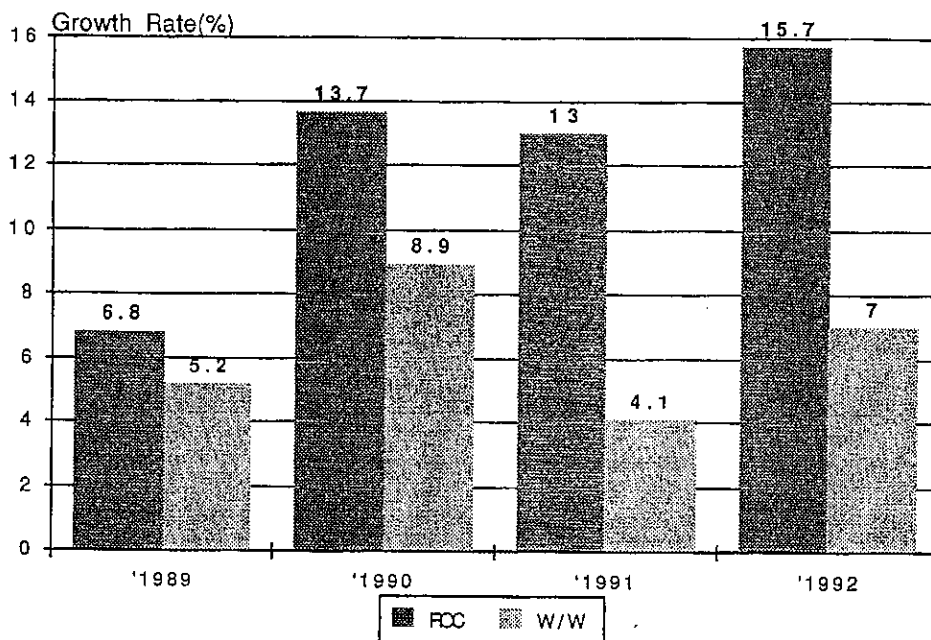
FIGURE A-1: ROC Information Industry Growth Status



* 1986-1992 Average Compound Growth Rate Was 25.5%

SOURCE: MIC/III, R.O.C.

FIGURE A-2: ROC Information Industry Production Growth



* 1986-1992 Average Compound Growth Rate was 25.5%

SOURCE: MIC/III, R.O.C.

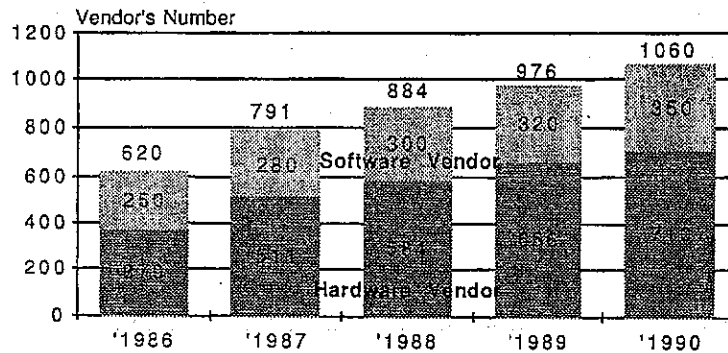
TABLE A-1: ROC Top 10 Hardware Information Product in 1992

RANK	PRODUCT	Production Value (US\$M)	Production Unit (1,000 Set)	ROC VS World Production Unit (%)	Worldwide Production Rank
1	Monitor	2,435	11,070	47.0	1
2	Desktop PC	1,220	1,940	8.9	3
3	MotherBoard	1,042	5,963	68.0	1
4	Notebook PC	947	861	25.2	N/A
5	Switching Power Supply	378	10,500	N/A	N/A
6	Graphic Card	274	6,230	N/A	1
7	Terminal	249	998	N/A	N/A
8	Image Scanner	189	694	50.4	1
9	LAN Card	174	2,755	25.0	2
10	Keyboard	158	8,850	26.1	2

Source : MIC/III, R.O.C.

There are an increasing number of local vendors participating in the ROC information industry. Due to limitation of market size, the growth rate of vendors' number is declining, and number of hardware vendors was twice that of software vendors.(See Figure A-3)

FIGURE A-3: ROC Information Vendor's Participation Status



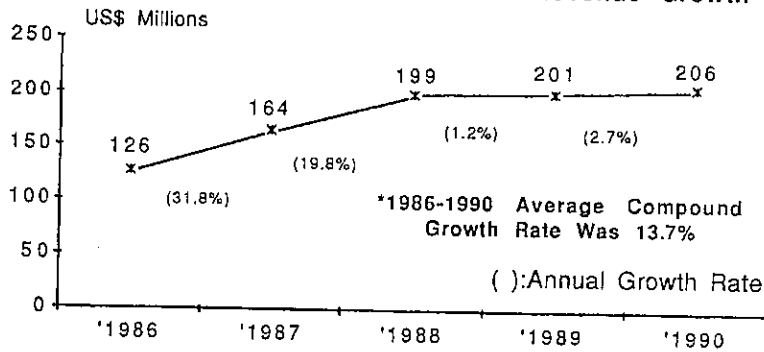
* 1986-1990 Average Compound Growth Rate was 14.3%
SOURCE: IDB/MOEA,Compiled by MIC/III, R.O.C.

If we look at the top 100 local information vendors' worldwide sales record, the average sales revenue was US\$ 0.2 billion in 1990 and the growth rate was very flat. This fact shows that the ROC industry structure lacks large scale vendors and encounters obstacles in business expansion(See Figure A-4).

We further look at profitability status which tells us that the average profit after tax was sharply down from 4.3% in 1986 to 2.1% in 1991. The key reason of profit loss came from both short product life cycle and dependence on the Japanese for hardware components. Marketing incapability and large scale investment in channel setting also decreased profit margin. But capital scale was obviously accumulated during the last five years, and this shows local vendors' confidence in the ROC information industry and their desire to invest more in information industry. (See Figure A-5)

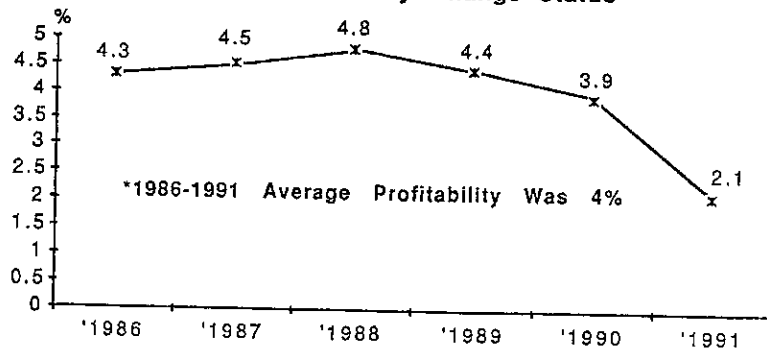
In the past five years, ROC vendors' capital increased yearly. The changes in the rate of increase are remarkable, but the rates moved toward a flat increase by the end of period. (See Figure A-6)

FIGURE A-4: Top 100 Information Vendor's Revenue Growth Status



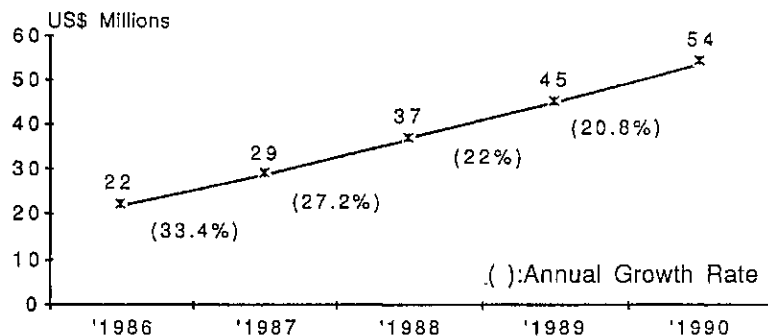
SOURCE: Common Wealth , Compiled by MIC/III, R.O.C.

FIGURE A-5: ROC's Information Industry Vendors' Profitability Change Status



SOURCE: Common Wealth , Compiled by MIC/III, R.O.C.

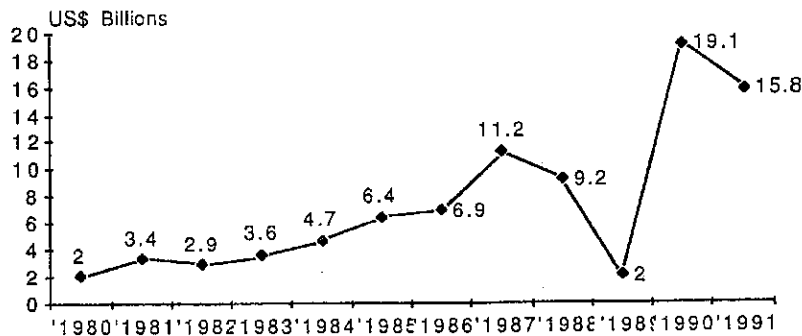
FIGURE A-6: ROC Information Industry Vendors' Capital Change Status



SOURCE: Common Wealth, Compiled by MIC/III, R.O.C.

Finally, we seriously look at foreign vendors' investment withdrawal during recent years. The main reasons are higher land and salary cost compared with other Asian countries except Japan. Foreign investment definitely provides capital to the ROC's information industry and cultivates management people and experience. Associated with the shifts toward other countries, the decrease of foreign vendors' investment domestically prompted ROC government to formulate responsive strategies.(See Figure A-7)

FIGURE A-7: Foreign Vendors' Investment Change Status



SOURCE: Computer World

B. Challenges for Future Development

In addition to the above stated reasons for retarded industry development, there are several critical challenges which are worthwhile to be noticed in the ROC. For example:

- (a) Royalty fees reduce profit margin.
- (b) Small vendors' scale limits marketing and R&D investment and makes own-brand product strategy difficult.
- (c) The strong Taiwanese dollar weakens exports.
- (e) The domestic market is not large enough.
- (f) The local vendors lack quality-consciousness and quality-control mechanism.
- (g) The local vendors lack market/user oriented product definition capability, i.e. shortage of "know-what" and "know-how" capability.
- (h) The industry resources are limited and highly fragmented so that the local vendors did not achieve economic scale level.
- (i) The local vendors lack international marketing business and project management people.
- (j) Software is usually undervalued due to both unsuitable software and user's still lack of this perception.
- (k) The local vendors lack of technology-transfer channels and professional people.

To solve these challenges and, to establish a sound basis for industry development, the ROC has set up measurable and accomplishable industry goals and strategies, which will utilize the available resources efficiently and effectively.

C. Development Objectives

From a production point of view, the ROC information industry ranked 6th in the world. Yet it is dominated by hardware. Efforts should be made to pay more

attention on software development in view of the ever growing importance of software in the international market. Under ten-year IT industry development plan and the proposed five-year software industry development plan, the ROC would like to change the unbalanced ratio of hardware and software production from 9:1 in 1991 to 4.7:1 in 1997. By that time, the total production value is estimated to be almost US\$ 20 billion, with virtually reciprocal ratios of the hardware to software production in the domestic versus international markets. Even by 1997, the hardware production is expected to be for export while software heads mainly to the domestic market. (See Table B-1) Because the information industry is positioned for export, ROC software vendors must focus more on the horizontal and vertical niche product market in the ROC as well as in the targeted area of the neighboring countries. In the meantime, ROC local software vendors must capture more often new domestic software market.

TABLE B-1: ROC Information Industry Production:
US\$19,870 Millions

1997	
HARDWARE 82.4%	Domestic Market 4,090 25%
	Export 15,780 75%
SOFTWARE 17.6%	Domestic Market 2,800 80%
	Export 700 20%

Compound Growth Rate: 17% (1990-1997)

SOURCE: MIC/III, R.O.C.

It is projected that the production compound growth rate will surpass 20% during these five years. Employee number is projected to reach 150,000 people, and the ratio between R&D investment and sales revenue is expected to rise to 5%, up from 3% currently. It is projected that ROC will take a 2.78% share of worldwide information market in 1997. (See Table B-2)

TABLE B-2: ROC Information Industry Goal (1997)

GOAL ITEM	Hardware	Software	TOTAL
1. Production Value (US\$ Millions)	16,370	3,500	19,870
2. Production Compound Growth Rate	20.7%		
3. Employee Number (Thousand People)	112	38	150
4. R&D/Sales Revenue	5.0%		
5. Worldwide Market Share	4.7%	0.96%	2.78%

Note: Assume exchange rate US\$:NT\$= 1:23

By the year 2000, it is expected that the ROC production value of the ROC information industry will be US\$ 28 billion, with hardware contributing US\$ 21.2 billion and software contributing US\$ 6.8 billion. By that time information will play a very important role in ROC's economic development.

D. Development Strategies

To solve the hardware vs software imbalance and to tackle problems as described previously, the ROC government has formulated development strategies to upgrade IT competitive capabilities and industry infrastructure. They are summarized and analyzed as followings:

(a) . To actively develop information products which can compete in the international market

Due to limited resources and ROC's information industry strength in the PC related products, it is necessary to conserve resources and concentrate efforts in products which have the greatest success in the international market. The products selected, which include hardware, software and telecommunication products, should be of high added value, critical to the continued growth of our information industry as well as to other applicable industries, and good market potential. Careful study and analysis of the products technology and market are needed before selection.

(b). Expediting the Five Year Software Industry Development Program

The principle to launch a 5-year Information Industry Development Program was approved by The Executive Yuan in April of 1992. Furthermore, the Ministry of Economic Affairs (MOEA) has completed a proposal for a 5-year Software Industry Development Program at the end of this January. It will be necessary to formulate detailed plans for product development, technology research, and cultivating professional people on an annually updated basis. R&D Institutes are urged to develop critical technologies and to assist local vendors in developing and transferring leading key product technologies, performing marketing surveys and writing product business plans. These are needed to improve the competitiveness of the ROC software industry and to develop new markets in order to reach the national goals for 1997 and the year 2000.

(c). Promoting government computerization and publishing the annual White Paper

Government computerization can help improve administration efficiency, integrate resource utilization, and trigger the development of software and hardware technologies. In order to expedite the computerization process, it is suggested to have every Ministry designate a vice minister to oversee its progress. Demands are thoroughly planned to match the needs of the nationwide information systems and should be coordinated by the Steering Committee for Information Development of the Executive Yuan. It is also suggested to publish the annual White Paper describing the objectives and implementation status of each government computerization project. It is intended to match government computerization goals to the needs of the next century.

(d). Promoting the coordinated research on leading information technologies among universities and government-sponsored R&D Institutes

The ROC is currently behind advanced countries in the development of leading

information technologies. MOEA (Ministry of Economic Affairs) formulates directions for the information industry based upon overall needs. Then, government-sponsored R&D Institutes and NSC (National Science Council) assist universities in the creation of joint research centers. These centers are responsible for leading information technology research on a long term basis. The centers can therefore cultivate talents most needed in the industry.

(e). Cultivating Human Resource

To relieve the shortage of software engineers, it is necessary to continue efforts to retrain college graduates of non-computer related backgrounds. The IDB (Industrial Development Bureau) has also designed an on-the-job training program for software engineers to strengthen its software development and project management capabilities. From elementary schools to graduate schools, MOE (Ministry of Education) has allocated budgets to promote computer education and set up computer facilities for research and teaching purposes which will cultivate abundant human resource at different ages. In addition, MOEA continues to sponsor and cultivate professional industry information analysts and technology transfer experts to provide specialized surveys, research, and plans for both government and vendors.

(f). Enforcing and Protection of Intellectual Property Rights

Insufficient protection of intellectual property rights (IPR) has already caused damages to the ROC information industry as well as foreign computer companies operating in Taiwan. In 1992, the ROC government set up penalty measures and a professional inspection team for the detection of illegal hardware and software copies. These actions have proven useful for USA-ROC trade negotiations and show the ROC government's determination. In addition, to promote further the IPR concept and to offer consultation services, communications with private vendors in the formulation and execution of IPR procedures is necessary.

(g). Promoting Valid Computer Technology Application

In addition to driving the domestic computer market, the proper application of computer technology will improve administrative and service quality in both the private sectors and government sectors. The productivity of each vertical industry will be affected by the appropriateness of computer technology application. The ROC government has also designated one month of the year as "Information Month", and it sponsors the Information Science and Technology Exhibition Center, which provides an organized introduction to the multifaceted fields of information technology for the public. In addition to promoting its publications, the ROC government sponsors lectures and seminars on basic computer concepts and the new application of information technology for all members of society, from high-end public officials and private industry executives to small and medium sized business professionals and interested citizens. EDI (Electronic Data Interchange) promotion, the selection and demonstration of good local software are examples of other useful measures made by the government in recent months.

(h) Expediting the establishment of Standards (MOEA)

The trend of open system architecture has led to the standardization of hardware and software products for integrated usage and to the reduction of development costs. Many international organizations are actively formulating computer and communication standards. The ROC must effectively collect technical data conforming to those standards and participate in the

conferences of the organizations. MOEA must invite related private institutions to formulate standards for Chinese-related information and communication, and come up with a timetable for their completion.

(i) Facilitating domestic information projects and cultivating local vendors' market-driven manufacturing capability (Steering Committee for Information Development of Executive Yuan)

The ROC government has fostered a plan to develop government leading large-scale information systems such as the Land Information System, Medical Information System, Customs Information System, Commercial Information System, etc. Through outsourcing and subcontracting these large-scale information projects, local vendors are cultivating product, market, and service capabilities, initiating technology transfer, strategic alliance, and vertical integration within the industry.

(j). Actively promoting the establishment of the Software Park

The establishment of the Software Park is essential to improving the ROC's software development environment. By sharing modern and integrated resources, development costs can be reduced. To establish this industrial technology environment and thereby improve software productivity and quality, it is essential that software development tools, high speed and high quality networks, training tools and other facilities to be forward-looking and coordinated with each other. It is also necessary to hold periodic meetings with software vendors regarding construction plans, management procedures, facilities so as to attract software vendors to the park. It is hoped that the park will function as the driving force for improving the technology transfer, development, and packaging capabilities of ROC software industry.

E. Conclusion

Continued technological developments, shifts in products and market demand, standardization, and intense competition are fundamentally changing the nature of the information industry. The ultimate measure of the value that IT create must be the user's success. Success in the new industry structure will stem from the ability to focus clearly on business priorities, develop skill-based advantages, and out-execute the competition. The ROC information industry must focus on specific goals with limited resources, and identify industry-wide crises. To achieve the ROC's information industry production value goal for the year 2000 (US\$ 28 billion), the ROC strive in the following directions:

(a) To construct better industry infrastructure, the ROC government should actively invest on the software industrial park, information technology, training of professionals, computer-related regulations, technical and market information analysis, and communication cost and quality. In addition, the updated government's industry policies, strategies, and financial incentives for the industry are essential to increase competitive advantages domestically and internationally.

(b) To motivate technology and product innovation, both public and private sectors must aggressively look for new niche products and establish market-driven vision.

(c) To develop the domestic computer market, both valid application of information technology and government-driven large-scale information projects

play critical role in survival and worldwide competitive advantage of ROC local vendors.

We believe that the directions and strategies, when properly implemented, will help ROC's information industry to be more competitive in the international market as well as contribute to the overall economic development in the years ahead. Thanks for your listening.