

(Abstract-Revised)

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**National Innovation System and the Transformation to Technology-Based
Economy: Experiences in Taiwan and the Chinese Mainland**

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During 1975-2000, Taiwan has experienced rapid economic growth due to successful transformation of the economy, largely agricultural and light industrial, to one firmly based on industry technology, largely developed indigenously. The success is an illustration of an effective national innovation system operating in this period.

Since the mid-1970's, the government under CHIANG Ching-kuo has taken steps toward building an innovation system with clear goals, positioning and responsibilities of the institutional players involved. The government planned, led and funded several strategic "national thrust" science and technology objectives. Execution of the technical programs was by NGOs with the Industrial Technology Research Institute (ITRI) playing the leading role. The driver and pre-competitive technologies developed were openly transferred to the private sector, consisted mainly of small and medium enterprises, for commercialization. Also in 1980, the government established the Hsinchu Science Based Industrial Park as an incubator for the newly developed technology industries. The development of the semiconductors, notebook personal computers, optoelectronic devices, advanced materials, biotechnology and healthcare, and other high tech products in Taiwan followed this pattern. While not directly involved in commercial activity, the national universities such as Tsinghua, Taiwan, Jiaotong, Cheng Kung, have placed emphasis on education and research. They focused on supplying the technical manpower needed by the growing industries. Thus commercialization of research result progressed smoothly.

In the year 2000, ICT products export from Taiwan has reached over 80 billion US dollars, accounting for nearly 65 % of the total export. Most Taiwan players in the ICT fields, some presently world class, have their origin in SME. With the technology

foundation and global marketing network accumulated over decades, coupled with entrepreneurial mindset and management agility, SMEs have become the mainstream of the economy in Taiwan. Starting from the early 1990's, many companies have also established branched manufacturing operations in the Chinese mainland despite any political crossfire. Total investments from Taiwan in the Chinese Mainland reached 30 billion US dollars in the last decade.

Similar efforts in developing science and technology on the Chinese Mainland were launched in the mid 1980s after DENG Xiao-ping rejuvenated the country from the ruins of the Cultural Revolution. Recognizing science and technology as the foremost factor of productivity, Deng's government has established major agencies to plan, lead and conduct science and technology development. Numerous technical programs were undertaken to establish R&D infrastructure, pursue frontier research, develop high tech industries and support the social and economic modernization of the nation. Funding for R&D increased rapidly. During 1991 to 2000, total R&D expenditure expanded 5.6 folds, or, from 0.74 % to 1% of the GDP. The Chinese Academy of Sciences and major universities including Tsinghua, Beijing, Nanjing, Fudan, Jiaotong, USTC, Zhejiang, Jilin, Nankai, and Zhongshan are key R&D players.

Since 1991, 52 science based industrial parks, or economic and technology development zones, were established with national status. Over 500 others were estimated to have set up subsequently by various levels of local governments. Various policy measures and venture capital funds are instituted inside these parks, or zones, to encourage the growth of technology oriented manufacturing industries. Almost all major R&D institutions engaged directly or indirectly in business operations of the more promising results arising from their R&D efforts. Foreign and Taiwan investments in manufacturing provided very timely assistance to these developments. In the year 2000, high tech products export from China reached over 37 billions US dollars, accounting nearly 15% of the total exports. China is emerging to be a major manufacturing center in the world, ranked 7th in total exports among all nations.

The national innovation system in China, while successful in fueling the growth of technology economy, was also noted for the need of review. Issues of concern included roles and responsibilities, organization and management, efficiency and effectiveness, intellectual property rights and property ownership, etc. In reality, interest in these issues is not limited to China. As nations prepare to compete in the knowledge based economy, the significance of national innovation system will be greatly augmented.