

## Taiwan: Green Silicon Valley\*

\* Extract from Lopez-Claros, Augusto and Mata, Yasmina, “The Innovation Capacity Index: Factors, Policies, and Institutions Driving Country Innovation,” *The Innovation for Development Report 2009–2010*, pp. 50–52.

A recent and insightful contribution to the debate on the policies that contribute to economic growth is the 2008 study published by the Commission on Growth and Development,<sup>1</sup> which examined the experiences of 13 countries which, beginning in 1960, grew at an annual average rate of at least 7 percent over a period of 25 years or more, and identified those factors which contributed to such remarkable economic performance. The 13 economies examined include Taiwan. And since Taiwan’s real growth rate over the 30-year period beginning in 1960 was 9.2 percent, one can assume that it must have been very near the top in this high-growth league. Indeed, between 1952 and 2007, income per capita rose from US\$197 to US\$16,800, arguably the most remarkable case of catching up seen in the post-World War II period.

### **Sound policies**

A closer look at the Taiwan experience suggests that a combination of sound policies, the strong engagement of the private sector, effective governance, imaginative institutional arrangements, and good macroeconomic management has lifted its population from poverty and helped it join the ranks of the most prosperous and innovative economies in the world.<sup>2</sup> Major investments have been made in both human resources and infrastructure by both government and the business community, and the benefits of economic growth have been widely shared by all segments of society. Targeted and well thought out government intervention, aimed at facilitating the emergence of a strong private sector role in ICT has worked in Taiwan, because the government has kept active consultative mechanisms in place to attract the input and technical expertise of the private sector, to agree on common approaches, and to bring into its institutions the best technical experts to support both government and business.

### **A global leader in ICT**

Taiwan ranks among the world’s top producers of notebook personal computers, flat panel displays, modems, motherboards, and other electronic components and products. In 2007, it ranked fourth globally in the production value of its semiconductor industry (US\$44.4 billion) and was first in the world in the production of image display hardware

(US\$54.5 billion). Taiwan has an impressive capacity for innovation, firm-level technology absorption, collaboration between institutions of higher education and the business community in research, and a pre-eminent position in the use of the latest technologies, from mobile telephones to personal computers and the Internet. Its rank of 13 in the Innovation Capacity Index reflects exceptionally high performance in a number of indicators including patent registration (per capita), in which Taiwan is number 1, schools connected to the Internet (1), R&D worker density (4), tertiary enrolment rate (4), fixed telephone lines (4), students enrolled in science and engineering (5), among others. In fact, Taiwan is ranked 1 in the world in the ICI’s Research and Development pillar. In research productivity, Taiwan ranked 7th in papers indexed in the 2007 *Science Citation Index*, 7th in papers indexed in *Engineering Index*,<sup>3</sup> and 4th among all countries in US patents granted in 2008. Figure 6 shows some of Taiwan’s key strengths.

### **Human capital development**

Although seemingly a disadvantage at the time, the brain drain of the 1960s and 1970s—when some 50,000 of the brightest young Taiwanese went overseas (principally to the United States) for university and advanced studies—allowed Taiwan to build a large pool of qualified and experienced people before its economy was ready to absorb them. From 1985 onwards, incentives drew them back to Taiwan as entrepreneurs, to create start-ups in the science parks, or to take up research, academic, and management positions, bringing not only their knowledge and experience, but also their networks of contacts and working relationships with leading international companies, and enabling today’s Taiwanese universities to educate its own manpower for continuing expansion at home. These informal networks, supplemented by overseas offices of various institutes and research centers, facilitate technology transfer, innovation, and strong entrepreneurial relationships.

Launched in 2000, the government’s Department of Industrial Technology has vigorously promoted e-business, following four strategic elements: policy, environment, applications, and promotion, with the goal of establishing a global logistics operation system based on a highly efficient e-

supply chain framework, linking leading international IT companies (IBM, HP, and Compaq) with 42 Taiwan contract manufacturers, and 15 domestic e-supply chains among domestic IT manufacturers.

### ***Deploying the information society***

At the heart of Taiwan's ICT revolution is the Institute for Information Industry (III), a joint government-private sector think tank and management consultancy, promoting the development of the ICT industry and deploying the information society. The III provides a neutral source of expertise independent of both partisan politics and individual corporate agendas, helping Taiwan to increase productivity, raise efficiency, and develop international collaborative projects with key industrial and academic partners and global offices in various important ICT centers. The government contracts a wide range of functions to the III, making use of its human resources in a flexible manner, from proposing policy, providing market analyses, incubating startups, developing such concepts as the integrated service model and the digital home, to generating consumer, communications, and computer technologies, and generating over 100 patent applications annually. The III provides professional IT training in both the public and private sectors, develops programs to address the digital divide, creates digital opportunity centers in remote areas and internationally for developing countries, and provides services to small and medium enterprises, as well as disadvantaged and handicapped groups. Over the years, III has provided training to some 400,000 professionals. It also designs and manages projects to strengthen ICT infrastructure, including the planning of e-Taiwan, to extend broadband access to all households, and M-Taiwan, to provide mobile access through a combination of cellular telephone and WLAN networks. As manufacturing moves offshore, it moves the industry forward from tangible to intangible products, and aims to establish best practices in Taiwan as a model for the rest of the world.

With a million or more Taiwanese working in mainland China, trade with that country involves well over US\$100 billion in investment—the logical place for Taiwanese businesses to locate production and take advantage of low land prices and cheap labor. Competition with the mainland is now forcing Taiwan to search for new areas of comparative advantage as a center for research and for corporate headquarters, maintain its engineering and management talent, and invest more in research and collaboration between industry, the research institutes, and universities.

In addition to manufacturing them, Taiwan is quickly adopting ICTs. The III estimated that already in 2007, there were over 10 million Internet users in Taiwan, with a penetration rate of 44 percent, and showing signs of reaching saturation. There were also about 12.5 million mobile Internet subscribers and 4.7 million broadband subscribers. Taiwan's network of 10 science parks helps incubate startups and offers an environment in which companies can take several years to grow before they decide to build their own building on leased government land, shielding them from high property costs. They screen applicants in relation to national priorities and for synergies with park activities. Each science park focuses on a different area, such as semiconductors, integrated circuits, computers and peripherals, telecommunications, precision machinery, biotechnology, and recycling technology, among others. They account for some 40 percent of total exports and imports, or close to US\$190 billion and a significant share of government revenue.

In Taiwan, ICTs are not only a matter for business, but play a role in promoting its own social and economic development. The interaction of the two sheds important light on Taiwan's success in this area. However, despite the high value placed on education in Chinese culture, and the efforts made by the government to build human resources, there is still a gap between academia and industry, because the traditional Chinese educational approach at the primary and secondary level does not encourage the kind of innovative thinking necessary for success in scientific research and development, making the student transition to university more difficult. With a work force mostly under 30, the challenge will be to retrain maturing workers as technologies, production processes, and whole industries evolve, to emphasize lifelong learning, using ICTs as well as ongoing programs in the science centers and elsewhere, to sustain momentum and make the educational system as flexible and entrepreneurial as industry.

With the ICT industry having reached a stage of maturity, it will have to support new ventures that leverage Taiwan's comparative advantages, all of which are typical of Porter's innovation-driven stage of development. This may involve venturing into such areas as using ICT to boost alternative energy sources, helping to create digital homes and deliver new services in such burgeoning fields as long-distance patient care and other forms of biomedical research, services aimed at enhancing the quality of life for the elderly, and keeping abreast of developments in the world's leading technology centers to maintain a competitive edge. In this re-

spect, it will be essential to improve the regulatory framework for services, which at times suffer from excessive regulation. This observation is borne out by Taiwan's relatively poor ranking in pillar 3 of the ICI which captures various dimensions of the regulatory environment and where Taiwan's rank of 39 out of 131 countries shows much scope for improvement.

<sup>1</sup> See The Growth Commission, 2008, available at: [www.growthcommission.org](http://www.growthcommission.org) The Growth Report was funded by the World Bank, several industrial country aid agencies

(Australia, Canada, the United Kingdom), and some private foundations. The Commission was chaired by Nobel Laureate in Economics Michael Spence.

<sup>2</sup> For further details see Dahl and López-Claros, 2006. "The impact of information and communications technologies on the economic competitiveness and social development of Taiwan." In *The Global Information and Technology Report*. World Economic Forum. Hampshire: Palgrave Macmillan. pp. 107–18. This section on Taiwan also draws from a visit to Taipei made by López-Claros in February, 2009.

<sup>3</sup> National Science Council, 2008, available at: <http://www.nsc.gov.tw/tech/>

**Figure 6. Taiwan: Significant indicators above income group average**

