For the Internet Age, Taiwan's ICT Industry Needs a New Model

By Andy Yee

Taiwan has been a world leader in high-tech hardware manufacturing for many years. Yet the industry faces grim prospects as it remains stuck on the lower rungs of the value-added chain. The key to its reinvention depends on whether it can get plugged into the Internet age, writes Google policy analyst Andy Yee.

Vision of the future: A notebook computer made by Taiwanese giant Acer is one of the catwalk stars at COMPUTEX Taipei 2013 in June. The show is the world's second-largest computer exhibition after CeBit in Germany. But Taiwan's computer-makers face the need for innovation in the face of changing digital trends.
Photo: David Chang/EPA

TAIWAN IS A GLOBAL POWERHOUSE in the information and communications technology (ICT) industry. Chances are, if you own an electronic device, part of it is either made or was designed by a Taiwanese manufacturer. Its companies command huge market shares in critical ICT products, ranging from computer chips and memory, LCD panels and smartphones to personal computers. Taiwanese firms account for more than 90 percent of the world's notebook and tablet production. In other words, Taiwan has carved out a distinctive niche as the world's pre-eminent hub for the manufacture of high-tech hardware. The ICT industry, which makes up one third of gross domestic product, is the cornerstone of Taiwan's economy.

Yet the island's ICT industry is currently mired in a climate of gloom and doom. Never focusing on establishing its own high-tech brands, Taiwan has long assumed the role of a high-tech contract manufacturing hub. Its mostly anonymous original equipment manufacturers (OEMs) and original design manufacturers (ODMs) make devices for global consumer electronics brands. For example, Apple's iPhones are made by Hon Hai Precision Industry/Foxconn or Pegatron; Macbooks are mainly made by Quanta. Getting squeezed between cheap competition from China and the strong brands of global leaders, Taiwanese manufacturers face shrinking profit margins. The major paradigm shift in the ICT industry from hardware to software and services further exacerbates the already bleak profit prospects that threaten Taiwan's industry and the economy as a whole.

1 Shelley Rigger, *Why Taiwan Matters: Small Island, Global Powerhouse*, Lanham, MD: Rowman & Littlefield, 2011.
2 Sarah Mishkin and David Pilling, "Taiwan: Time to change gear," *Financial Times*, April 9, 2013.

3 "After the personal computer," *The Economist*, July 6, 2013.
4 Dieter Ernst, "Upgrading through innovation in a small network economy: insights from Taiwan's IT industry," *Economics of Innovation and New Technology*, Vol. 19, No. 4, June 2010, pp.295-324.

5 Keith Bradsher, "In Taiwan, Lamenting a Lost Lead," *The New York Times*, May 12, 2013.

6 Martin Fransman, *The New ICT Ecosystem: Implications for Policy and Regulation*, Cambridge: Cambridge University Press, 2010.

THE END OF THE 'GLOBAL HIGH-TECH FACTORY' MODEL

The roots of Taiwan's high-tech industry go all the way back to the era of export-oriented industrialization.[1] In 1960, the ICT industry in Taiwan was virtually non-existent. Recognizing that a shift of Taiwan's economy away from low-cost manufacturing was crucial to its long-term economic health and security, the state decided to promote science and technology as a national priority by the late 1960s. This paved the way to the subsequent flourishing of Taiwan's ICT industry. In 1973, the highly successful Industrial Technology Research Institute (ITRI) was created to promote industrial upgrading. In 1976, it began semiconductor research using technology licensed from RCA, an American company. ITRI would later give birth to some of the largest semiconductor companies in the world, namely United Microelectronics Company (UMC) and Taiwan Semiconductor Manufacturing Company (TSMC).

After decades of double-digit growth during its rise from pre-industrial poverty to a global economic powerhouse, Taiwan's annual GDP growth has stagnated in recent years, averaging about 4 percent in the past five years. Without major reforms, particularly in its prized ICT industry, many question whether Taiwan's current business model can continue to deliver economic growth for its 23 million people, who are increasingly frustrated with a falling standard of living.[2] Industrial transformation has become a top priority for the government, as President Ma Ying-jeou acknowledged that "Taiwan cannot grow faster without a fundamental overhaul of its economic structure. Its companies must add greater innovation to their efficiency."

Companies, experts and policymakers continue to debate the best path forward for Taiwan's ICT industry. For many, it is simply a matter of adapting to the new tech paradigm shift from notebooks and PCs to mobile devices and cloud computing. Indeed, at a time when people would rather buy smartphones or tablets, the change is a challenge for Taiwanese firms — which control 90 percent of the final design and manufacturing of the declining notebook and PC markets, but less than a fifth of the smartphone market. Many of them are already branching out from the Wintel (Microsoft and Intel) landscape to become partners with the new tech giants. Quanta and Inventec, both leading notebook manufacturers, are making servers for cloud and social networking services providers such as Facebook. Pegatron, a PC specialist and formerly part of Asus, has seen its consumer electronics business (which includes tablets) double in a year to account for over one-third of its revenue.[3]

This may be a good short-term cure. After all, the speed and flexibility of Taiwanese manufacturers have been hailed as a competitive advantage by their foreign partners. In the 1980s, they were among the first to establish factories in China when the country opened up and labor was cheap. But it masks a deeper problem faced by Taiwan's ICT industry. Taiwan's "global high-tech factory" model is simply incompatible with the age of the Internet, which is driven by software and services while the value of hardware declines.

"The reality is that Taiwan companies by and large remain at the lower rungs of the value-added chain, where profit margins are low and innovation is minimal," President Ma has said. While its technology is world class, the Taiwanese ICT industry is structurally stuck one level below the high-margin, global brands in the hierarchical global production networks. With the possible exception of HTC, Taiwan boasts no Apple or Samsung. Instead, Taiwan's most prized technology companies are OEM/ODM suppliers for global brands. TSMC, the world's largest semiconductor foundry, earns US$7 for every smartphone sold. Foxconn, which employs over 1.2 million people, produces some of the most popular gadgets such as the iPhone, Kindle and XBox. But both are hardly recognized as global brands.

As a result, Taiwanese firms typically concentrate on incremental innovation within the architecture defined by global brand leaders. They may be the most efficient contract manufacturers, but they are heavily constrained in their ability to develop new products, roadmaps or standards, due to a lack of knowledge about customer needs.[4] Decades of experience in meeting computer performance benchmarks from foreign brand leaders have fostered a habit of pursuing a "good enough solution" rather than the "perfect solution" that can capture the hearts of consumers, in the words of Asus Chairman Jonney Shih.[5] Such a mentality has now become an obstacle for Taiwan to come up with revolutionary products or services that are the hallmarks of the Internet. The question for Taiwan is: how can its ICT industry transform from a cost-down, efficiency driven industry to a value-up, innovation driven industry?

'HARDWARE AS THE NEW SOFTWARE'

The well understood layered model of the ICT industry gives us some structure and form from which to examine Taiwan's strengths and weaknesses. Furthermore, by looking at the intersection of the layers, which are the sources of innovation, we can capture the future opportunities.

In *The New ICT Ecosystem*, Martin Fransman conceptualizes the ICT ecosystem as a modularized, interconnected layered system consisting of four layers (see diagram overleaf).[6] In Layer 1, *networked element providers* produce items including PCs, smartphones, servers and routers. Some of these elements are utilized by *network operators* in Layer 2, which include telecoms, cable TV and satellite operators, to form converged networks. In Layer 3, *content and application providers* create platforms used by *final consumers*, who occupy Layer 4.
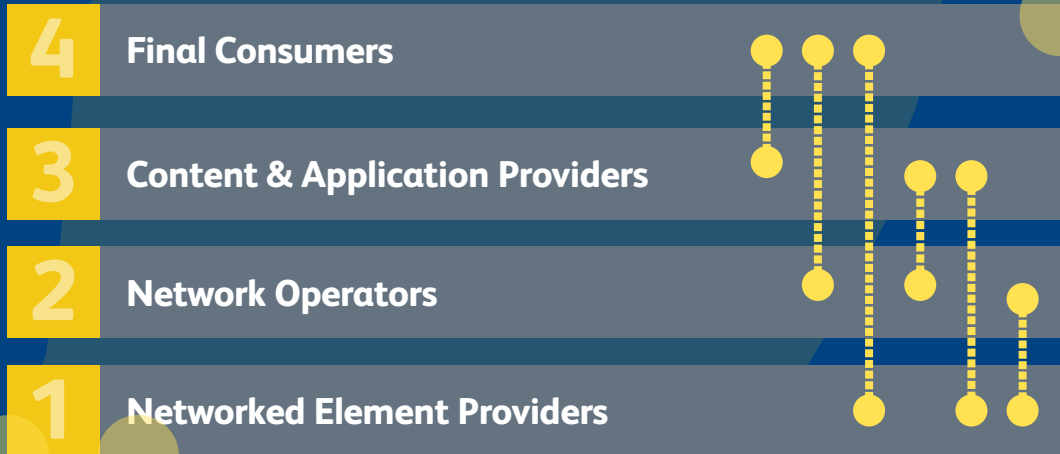
The advent of the Internet has had a profound impact on Layers 3 and 4, which together constitute today's most dynamic innovation platforms for content, applications and services providers such as Amazon, eBay, Facebook and Yahoo!. This is because the Internet is an open-sourced way of information exchange with nearly zero cost of innovation. Network economics also means that Internet companies enjoy dynamic increasing returns with extremely low marginal costs. That the Internet was invented in the US brought first-mover advantages and explains in large part the global dominance of US companies in this layer.

By contrast, although Taiwan's networked element companies contribute much of the vital hardware (notably computers and semiconductors) that constitute Layer 1, they have little to do with the dynamic evolution that is driving the rapid growth of applications and services in Layer 3. The reason is that hardware companies have neither the competencies nor the business focus needed for the development of software-based products like e-commerce platforms and search engines. Furthermore, the weak network position of Taiwanese firms as specialized suppliers to global consumer electronics brands also implies that they are far removed from mass consumer interactions and lack the knowledge to create successful Internet products and services.

That said, Fransman, using insights from Schumpeterian evolutionary economics, tells us that innovation in the ICT ecosystem could emerge from any of the six symbiotic relationships among the four layer players. This is akin to the symbiosis that occurs when different biological species live together in close interaction. Thanks to the Internet, the symbiotic relationship between content and application providers (Layer 3) and final consumers (Layer 4) has been

7 George Wang and Jay Unger, "A Strategy to Move Taiwan's IT Industry From Commodity Hardware Manufacturing to Competitive Cloud Solutions," *IEEE Access*, Vol. 1, May 2013, pp.159-166.
8 Tetsuhiko Endo, "Joi Ito's Trends to Watch in 2013," Think Insights, Google, December 2012. At www.google.com/think/articles/joi-itos-trends-to-watch-in-2013.html

9 Isabella Wu, David Huang, and Chao-yen Lu, "Stan Shih: Where the Prospects Lie," *CommonWealth Magazine*, Jan. 20, 2011.
10 Betsy Masiello and Derek Slater, "Embracing an Innovation Stimulus Package," Social Science Research Network, July 12, 2012. At http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2104350

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4 Final Consumers

3 Content & Application Providers

2 Network Operators

1 Networked Element Providers

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an enduring bright spot of growth and innovation for the past decade. There may be a slim chance that the next Amazon or Facebook will emerge from Taiwan, but networked element providers (Layer 1) are the platforms on which content and application providers serve final consumers (Layers 3 and 4). Due to the presence of so many leading hardware manufacturers, Taiwan is in the unique position of being able to foster industrial innovation from these symbiotic relationships, namely the integration of hardware and software.

One strategy is to enhance the value of commodity hardware by adding software, services and applications to come up with a total solution. For example, the non-profit, non-governmental Institute for Information Industry (III) has devised an initiative called Cloud Appliances For Enterprises (CAFE) to help traditional Taiwanese OEM/ODM vendors transform themselves from primarily commodity hardware providers into profitable, cloud services providers that can reach worldwide markets.[7] III develops software components that can be integrated into partners' hardware to create appliances that deliver cloud infrastructure, resulting in higher value to customers and higher margin for Taiwanese vendors. Key Taiwanese manufacturers that have already adopted the CAFE strategy include Asus, Delta Electronics and GIGABYTE.

The opportunity to innovate in the age of connectivity does not stop here. In what's commonly called the Internet of Things, physical objects are embedded with sensors linked to the Internet. The resulting information networks promise to stimulate new business models. The widespread adoption of the Internet of Things will take time, but wearable computers such as Google Glass offer a glimpse of what is possible. In Silicon Valley, startups that combine hardware and software are proclaimed the next big thing. Joi Ito, Director of the MIT Media Lab, has identified the rise

of the hardware startups as a key trend to watch.[8] What makes them special is that they conjoin the Internet with the real world of hardware. When everyday objects are hooked up to the Internet, it will open up entirely new worlds. This viewpoint is echoed by Stan Shih, founder of Acer, who asserted in an interview with Taiwan's *CommonWealth* Magazine that new Taiwanese high-tech startups must ride on the strengths of the island's hardware industry if they are to create a unique Internet-based "Taiwanese phenomenon."[9]

By applying the core characteristics of the Internet, the Taiwanese hardware industry can innovate across a range of physical objects and infrastructure through the facilitation of real-time information sharing and analysis at network endpoints. They will empower users to contribute back to the system, enabling the infrastructure to become more efficient and productive, so that people can make well-informed decisions. For example, vehicles that are built to include sensors for collecting and sharing data about transport use will enable drivers to make informed decisions that, in aggregate, will optimize use of the network as a whole. Smart electricity meters will allow consumers to monitor and manage their energy use in real-time, leading to savings in energy costs.[10]

THE CHALLENGES
The Internet could become a significant force to revive Taiwan's hardware-focused ICT industry, yet business, policy and legal challenges must be tackled before the opportunity can be seized. Taiwan's software ecosystem has long lagged behind its well-established hardware industry. The above-mentioned ITRI, set up to support the hardware capabilities of Taiwanese firms, is a success story. By contrast, III, a similar subsidiary set up through the joint efforts of the public and private sectors in 1979 to enhance Taiwan's software

11 "Good to grow? The environment for Asia's Internet businesses," Economist Intelligence Unit, July 2013.

capabilities, has been less successful. According to the Market Intelligence Center (MIC) of III, the production value of Taiwan's software industry was NT$162.3 billion (US$5.5 billion) in 2012. The corresponding figure for the hardware industry was much greater at NT$4.6 trillion.

Silicon Valley's fertile tech ecosystem is built upon industry collaboration — the forming of alliances and partnerships to gain access to technical expertise and markets, and the sharing of ideas among industry peers. In Taiwan, we can envision a similarly vibrant ecosystem based on the large complementarities between the hardware and software sectors. However, a culture of collaboration still needs to be fostered.

In the hardware industry, Taiwanese manufacturers have long been ideal partners for foreign brands largely because of their obsession with secrecy, so customers have confidence that design blueprints will not be leaked. This quality makes it hard for them to share new ideas with peers. On the other hand, in the software industry, the competitive mindset of early online ventures resulted in limited collaboration. But as the landscape has matured and become more regulated, Internet companies have seen the mutual benefits of working closely together, most notably with the formation of the Taiwan Internet and E-Commerce Association (TIEA) to advocate for a more friendly regulatory environment.

It remains to be seen if such nascent collaboration could lead to deeper strategic partnerships and alliances, not only within each respective sector, but also between them. The integration of hardware and software resources to create systems and devices suitable for the age of the Internet would be a huge opportunity for Taiwan, but it will not happen if the two sectors work in silos. In Taiwan, most Internet and software start-ups lack the resources, in terms of financial or management strength, to scale globally. The well-established hardware manufacturers' resources and international connections would be the ideal platform from which the software industry could catch up, while their hardware products could in return be enriched with applications and services. The concept of collaboration could even be taken internationally. For example, India's strengths in software development and Taiwan's hardware capabilities can be combined in joint ventures.

Another challenge facing Taiwan is a lack of software talent. This is a problem of quantity and of quality. On one hand, many companies report difficulties in hiring software developers. On the other, there are complaints that the education system is failing to prepare engineers with up-to-date skills. Exacerbating the talent shortage is the conservative attitude among Taiwanese graduates, who prefer stable employment in the more established hardware industry with companies like HTC and Asus. The built-to-specification mindset that engineers develop in these big companies is vastly different from that required in Internet companies — to pivot and innovate quickly. To alleviate the talent problem, shifting the focus of the education system to software skills and creativity and attracting more global talent, as well as encouraging youngsters to come out of their comfort zone by making Internet-related businesses a strategic priority are some policy measures that the government should consider.

Last but not least, with respect to governance and regulation, the Taiwanese government is still finding the right balance suited to the fast-moving Internet industry.[11] In some areas, outdated rules and mindsets hamper Internet businesses. For example, because of government restrictions on third-party payment mechanisms, such as Paypal, the online payment environment in Taiwan shows much room for development. The government is also conservative on consumer protection, mandating a seven-day trial period and return policy, made before the Internet age, to apply to digital products. This can be impractical in the context of e-commerce, when a buyer has finished consuming a song or a game seven days after download. This does not mean that legislation is not needed on the Internet, but unnecessary regulatory burdens will suppress the emergence of innovative online business models.

In less than half a century, Taiwan's government and its entrepreneurs built the "Taiwan Miracle" by looking outward to world markets and adjusting constantly to new technologies and demands, transforming the nation into a high-tech manufacturing superpower. Today, Taiwan is at a crossroads. Decades of success for its hardware industry has created a serious deviation from the new global ICT trend fueled by Internet-driven innovation. It is time for Taiwan to muster the ambition and determination of the previous generation who laid its industrial foundations. The extent to which Taiwan's ICT industry can reinvent itself will depend on a number of critical factors, namely cross-sectoral collaboration, the availability of talent and regulatory reforms. These will determine whether Taiwan can create its next economic miracle in the Internet age. It has done so before, and it can do so again.

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