

China's Technology Development: From Imitation to Innovation

Notebook and laptop computers are fast becoming commodities with little value-added to the IC cards and components that go into their make up. The Dell model of global sourcing and just-in-time delivery was recognition of this development as the industry moved away from the integrated systems approach of an earlier generation of computer manufacturers.

But the model may be shifting again as large integrated manufacturers such as Lenovo have streamlined their supply chains, reduced costs and are starting to compete not only on low prices but also on after-sales service support. The same is true for telecom vendors such as Huawei and ZTE. As such, 'service to order' is replacing 'build to order' and this would represent a significant innovation for Chinese companies.

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China ICT: From Imitation to Innovation

- Where China was previously known for low cost manufacturing using designs and innovations from other places the past few years has seen a massive emphasis on R&D aimed at securing a position of leadership in the markets China enters.
- Supported by a large network of high quality technically focused Universities many of the traditional State Owned Enterprises (SOEs) have grown large R&D capacity investing substantially higher level than western competitors in the development of new products and technologies.
- This development is strongly supported by the Government with investment in R&D seen as fundamental to China's future plans

There have been – in particular – 3 drivers to this process:

- 1. The creation of *national champions* due to perceived and expected limitations of the domestic market;**
- 2. Rapid product commoditization and eroding profit margins in China's manufacturing base;**
- 3. Standards and the desire to establish and “own” IPRs.**

1. National Champions...

- China's national goal is to be a world-class competitor, owning a leading brand in all domestic and foreign ICT sectors: hardware, software, IT services, telecommunications and semiconductors. To achieve this objective, China will use a combination of education, regulation, government tax policy, trade policy, government investments and market forces to drive ICT market and overall economic development.
- *One area in which China is determined to grow, for example, is in its capacity to produce ever more sophisticated integrated circuits (ICs). In 2005, China represented 21% (approx US\$40 billion) of the world's IC consumption, up from 6% in 2000, making China the world's largest consumer of ICs. The MII's forecast demand for IC chips is US\$124 billion by 2010.*
- The government is selecting a number of ICT firms that will be supported as national and international ICT **industry champions**. Although foreign companies are drawn to China's potentially huge domestic market, China understands the limits on its domestic markets and is attracted by the business opportunities available in more developed economies like the U.S., Europe and Japan, as well as a need to push its large enterprises to be globally competitive.
- **Huawei, ZTE, China Putian, TCL, Lenovo, Founder, Haier**, etc., have all begun to establish themselves as brands in markets outside China.

...as Drivers of Innovation

- In Europe and North America these Champions represent cheap brands rather in the way Japanese goods did a generation or two ago.
 - Some of them acquired brands, such as TCL's acquisition of Thompson's TV interests and Lenovo's acquisition of IBM's PC business.
 - Others are building brands, sometimes in partnerships, such as Huawei with 3Com and Nortel.
 - They can all compete on price, less so on design, and even less so on higher-end products.
- All these factors will change, and in the meantime they are building their client portfolios and market positions in third country markets, especially those of low and middle-income countries.
- The real test for China then will be its ability to move from comparatively low-end value assembly, testing and packaging of items such as PCs and TVs to high-end value design and manufacturing of components, such as microprocessors, digital signal processors and ASICs in which China can file applications for patents.

2. Rapid Commoditization...

- Many of China's ICT markets, such as the making of PCs, mobile phones and consumer electronics (TVs, DVDs), are already mature.
 - Even though China produces around 25% of the world's LCD screens most of these are at the lower end of the market and are not highly competitive with the larger and more advanced screens coming from Korea and Japan.
 - *Right now China simply lacks the R&D and skillsets to compete in this market.*
- Intense market competition in these traditional consumer electronics areas is rapidly decreasing profit margins.
 - Thus, despite healthy revenue growth, the profit margins of the top 100 players have been fading, the average profit margin falling to a five year low of 2.5%.
 - This suggests that much of this growth has been capital intensive rather than productivity-driven and that the level of process innovation (as opposed to product innovation) is still rather low.

... as the driver of Innovation

- However, one of the strengths of China's large companies is their ability to mobilize substantial resources for R&D in line with China's national priorities, as spelt out in the 11th Five Year Plan (2006 – 2010), to focus on innovation, the development of Chinese standards and the registration of Chinese patents.
 - *In 2003 domestic patent applications of all kinds ('invention', 'utility' and 'design') in China (56,767) outnumbered foreign applications (48,549) for the first time since China joined the Patent Cooperation Treaty in 1994.*
 - The top 100 players in 2005 had 93,600 people working on research and development (R&D) activities, accounting for 9.6% of their total employees.
 - The annual R&D spending of the top 100 in 2005 was US\$445 million, accounting for 3.7% of total revenue, compared to the industry average of just over 2%, and a national average of under 2%.
- The markets of 3G handsets, IPTV, DTV, individual video and music terminals and other digital products are expected to be the most important emerging markets of China's consumer electronics over the next several years.

3. Standards...

“Chinese enterprises have paid more than US\$1 billion to compensate their foreign competitors over intellectual property rights disputes since 2001. These IPR battles have involved a wide range of products, including TV sets, MP3 chips, DVDs, motorbikes, digital cameras and telecoms equipment. ... 99 percent of Chinese enterprises did not hold any invention patents, and domestic companies had to pay 20-40% of the price of every mobile phone or computer they produced to overseas patent holders.”

-- Science and Technology Minister Xu Guanhua, April 27, 2006.

- The significance of royalty payments is magnified in China's case by the sheer volume of ICT products involved.
 - In 2004 China (US\$180 billion) overtook the United States (US\$149 billion) as the world's largest exporter of ICT goods, but foreign-invested companies account for a sizeable proportion of these.
 - In 2001, over 50% of all China's exports were by foreign-invested enterprises, and by 2005 'exports by foreign-invested enterprises accounted for 58.5% of China's total foreign trade. In the case of high-tech exports the percentage is even higher.
- As of August 2004, a global accounting firm estimated that a Chinese manufacturer was required to pay US\$15-22 in patent royalties in order to build a DVD player with a retail value as low as US\$60.
 - Another report estimated that a staggering 50-70% of the costs incurred by a Chinese company manufacturing a PC were allocable to IBM and Microsoft royalty payments instead.

... driving Innovation

- The Chinese government is emphasizing that this push for Chinese-set standards is part of its overall effort to promote “Indigenous Innovation” (*zizhuchuangxin*), and an innovation society.
 - This goal forms a primary theme in the country’s 11th Five Year Plan (2006-2010) and the 15-Year Science and Technology Plan (2006-2020), both issued earlier this year.
- It is perhaps not surprising that the promotion of domestic technical standards has become a major focus of the Chinese Government in recent years – the role of standards is assuming a growing policy importance, especially at the intersection of national technology policies and the norms and practices characterizing international trade and investment in the global economy.
 - In China’s rendering – establishing standards not only combats a royalty payment and foreign currency issue, it **creates** a market environment for innovation to emerge.
- In addition to the attention given to prominent standards-related cases such as China’s 3G standards (TD-SCDMA), China’s wireless LAN standard (WAPI), and efforts to develop an alternative to the Windows operating system standard (through the promotion of Linux systems), there are Chinese efforts to develop standards in other areas, including:
 - its own microprocessor (the “Dragon Chip”);
 - its own successor to DVD’s, the “EVD” (Enhanced Versatile Disc) standard;
 - a new digital audio standard (AVS—Audio, Video Coding Standard);
 - a new standard for communicating among digital devices, IGRS;
 - a new Internet protocol (IPV6); and
 - radio frequency identification tagging (RFID).

Innovation: A Top-Down Push in China...

“We need to follow a policy of making independent innovations and “leapfrog” advances in key areas of science and technology and supporting and guiding future development. We need to more quickly turn China into an innovation-oriented country by comprehensively enhancing our capacity to make original innovations, integrate innovations and assimilate foreign technologies and further refine them.”

“The [Plan] calls for launching a number of major scientific and technological projects in strategic industries such as information technology and biotechnology, and projects to address important, pressing problems in energy, resources, the environment and the health of the people, as well as technologies with both military and civilian applications”.

**-- Premier Wen Jiabao, presenting China's 11th Five Year Plan (2006-10)
to the 10th National Party Congress in March.**

1. “Information technology is the key driver for China's economic and social development. Indigenous innovation capability should be regarded as a central aspect of the development of the information industry. China should strengthen the overall planning, organization, and guidance to help establish and improve an enterprise-dominated and market-oriented technological innovation system.”

2. “It is necessary to strengthen the establishment of innovation culture and strengthen the development of the talent pool. Unremitting efforts should be made to further boost the scientific and technological innovation capability in the information industry, thereby creating the basic conditions necessary for building an innovation-based country.”

3. “China's telecom industry should give top priority to indigenous innovations and play a key role in building China into an innovation-based country... pursuit of innovations in the telecom sector should lead to breakthroughs in core technologies, obtaining of intellectual property rights and nurturing of innovation-based enterprises with an international competitive edge.”

-- Vice Premier Huang Ju, addressing China's National ICT Conference on August 29

... allocating resources...

China's 11th FYP identified 6 strategic priorities including:

(2) Accelerating economic restructuring and reducing the social costs of economic growth;

(4) Increasing the capacity for independent innovation.

- As regards No.2, Premier Wen emphasized: “The key to improving technology used in industries lies in comprehensively improving our capacity for independent innovation. We need to promptly develop core technologies and improve systems integration in some important industries and create technologies, products and standards for which we own intellectual property rights....”
- In terms of No.4, 5 main sectors are identified for special attention: IT, biotech, hi-tech materials, energy and aerospace. China's *National Program for Long and Medium Term Scientific and Technological Development* also enumerates various means of financial supporting R&D, including tax incentives, funding for SMEs, government procurement policies and grants for technology applications, etc.
- Given the importance attached to ICTs for every major task set out in the 11th FYP, and especially for the encouragement of innovation in processes, products and services, and management systems, the important question for foreign companies is how far the state will remain the main arbiter of key resource allocations and procurement decisions.
- The emphasis of the Plan is on shifting the non-strategic decisions to the enterprise sector, yet even in this sector state support is vital for permissions and permits, access to finance and lines of credit, procurement contracts, R&D funding, and so forth.
 - The principal economic and industrial tasks of the Plan are to ensure that China fully benefits from her entry into the global market place, in particular in relation to high value innovative technologies, technology standards and IPRs and it is important that China witnesses the benefits of doing so through an open and competitive economy approach.

... and identifying priorities

Given the State's focus, the areas which have been identified for focus include:

- Next generation (all-IP) network development;
- 3G cellular (especially TD-SCDMA);
- IPv6 applications (including super fast Internet);
- Broadband access, services, content and applications;
- Digital TV, HDTV, IPTV and associated home and/or personal electronic (audio-visual) networks, services, content and applications;
- RFID and near field communications (NFC) and ultra-wideband (UWB) communications and their applications in industry.

Each of these areas involves substantial innovations in equipment, but each also requires services and applications to drive the demand for them and establish the business case for them. This will inevitably be an international learning experience, with standards requiring inter-operability to make good commercial sense, and therefore the opportunities for experienced international companies should be considerable.