



Study on the Future Opportunities and Challenges of EU-China Trade and Investment Relations

Study 5: ICT Equipment

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EXECUTIVE SUMMARY

China's overall electronic and communications equipment industry is, in terms of output, the third largest in the world after the United States and Japan and worth RMB3.84 trillion (US\$480 billion) in 2005. In 2004, China became the world's leading exporter of high-tech goods such as laptop computers, mobile phones and digital cameras. However in 2003, Foreign Invested Enterprises (FIE) accounted for more than 90% of all computer exports.

China is moving ahead by adopting a macro-economic perspective on the development of ICT equipment that places an emphasis on consolidating its position as a cheap mass producer for world markets, and identifies areas of opportunity aimed at positioning China's leading enterprises at the highest value added points on the supply chain. A contender for the top of the list is China's determination to build wafer fab foundries to reduce dependency upon high-value foreign products and to create the basis for China's own supremacy in the field of chipsets. This would constitute a highly significant advancement in China's capabilities in the ICT equipment sector.

Competitive Strengths and Market Opportunities

The EU ICT manufacturing sector is heavily dependent upon markets driven by domestic demand. This means that the main elements of the sector are industry and services oriented, related to consumer electronics, avionics, telecommunications, computer-related equipment, space and defence, and energy.¹ The high-end and high-value aspect is an important strength of the European ICT industry since there are many industrial sectors that are ready market segments for high-tech ICTs. The use of radio frequency identity tags (RFID) in warehousing and supermarkets is one example of customised industrial applications of ICTs. Therefore, future export competitiveness of European ICT companies should be considered with particular regard to those industries where the EU has an established comparative advantage.

With high investments in R&D, leveraging these investments should be a priority for European ICT companies. The low cost advantages of China can in this regard provide a higher return for companies' investments and also as an opportunity to develop products customised to local standards.

The business-to-business market remains largely underdeveloped in China, and foreign vendors can often compete with better

quality equipment and service-level agreements, especially for companies with international or global operations.

Obstacles to Trade and Investment

European ICT companies are concerned over a number of obstacles hindering their future operations in the Chinese market. These investment obstacles include overregulation, complicated type approvals, unnecessary national standards (overlapping with similar international standards), difficulties in introducing new services, unclear government procurement practices and lack of IP protection.

A quantitative analysis reveals that due non-tariff barriers to trade the European ICT Equipment industry loses up to up to \$1.5 billion per annum due to lost business opportunities

Policy recommendations

- The European Commission should consider programmes to strategise market entry.
- The EC should set up an ICT Office in Beijing and possibly in Shanghai to collect and collate ICT industry, policy and regulatory information on a regular basis.
- Expand lobbying activities to ensure that China signs the WTO Agreement on Government Procurement (GPA)
- Introduce transparent and independent regulations.
- The EC should greatly increase the number of exchange students and researchers between China and the EU.
- The European Patent Office should be granted access to the SIPO Chinese patent office database to improve the transparency of patent administrations and minimise potential barriers to trade.
- The European ICT industry and standards organisations should be encouraged to have direct contact with their Chinese counterparts and vice versa.²
- A constructive approach to the development of new standards in the ICT sector would be to stimulate joint research between the EU and China in developing new standards which can be commonly shared, avoiding the use of standards as trade and market access barriers.

Recommendations for Competitiveness

- Compete on design and innovation rather than commodities.
- Consider using China as a base for selected low-cost investments in R&D which will provide more capital to increase competitiveness.

- Strengthen distribution channels in China, which entails finding reliable and knowledgeable local partners.
- Knowing the market is always the key. Chinese telecom companies do not need over-sophisticated equipment because the markets are not yet there.
- IP should be protected through the use of cautious technology transfer policies.
- Establish a China office with local staff that are committed to a long-term presence
- In third country markets, establish long-term relationships that stress customer care and long-term service level agreements where relevant.
- Walk away from uneconomic deals unless absolutely convinced about their strategic value.

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ABBREVIATIONS

ABS	Academy of Broadcasting Science
ASICs	Application Specific Integrated Circuits
AQSIQ	Administration for Quality Supervision Inspection and Quarantine
ATM	Asymmetric Transfer Mode
ATSC	Advanced TV Systems Committee
AVS	Audio-visual Stands
AVS Working Group	Audio and Video Coding Standard Workgroup of China
BWIPS	Broadband Wireless IP Group Standards
CAD	Computer-Aided Design
CAIA	China Audio Industry Association
CAM	Computer-Aided Manufacturing
CAT	Communications Authority of Thailand
CATR	China Academy of Telecom Research
CCSA	China Communication Standards Association
CESI	China Electronic Standards Institute
CNCAC	China National Certification Accreditation Commission
CPC	Communist Party of China
CRT	Cathode Ray TV
CSIA	China Semiconductor Industry Association
DLNA	Digital Living Network Alliance
DMB	Digital Multimedia Broadcasting
DMB-S	Digital Multimedia Broadcasting Satellite
DMB-T	Digital Multimedia Broadcasting Terrestrial
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
DTVIA	China Digital TV Industry Alliance
DWDM	Dense Wavelength Division Multiplexing
EPC	Electronic Product Code Network
ERI	European Research Institute
EVD	Enhanced Versatile Disk
EV-DO	Evolution Data Only
EWNZ	Econet Wireless New Zealand Limited
EXIM	Export-Import Bank
FIE	Foreign Invested Enterprises
FRAND	Fair, Reasonable and Non-Discriminatory
GAPP	General Administration for Press and Publication
GPA	Agreement of Government Procurement
GPT	General Purpose Technology
HS	Harmonisation System
Html	Hypertext Mark-up Language
ICT	Information and Communication Technology
ICTA	Information & Communications Technology Authority
IGRS	Intelligent Grouping and Resource Sharing
IP	Intellectual Property
IP	Internet Protocol
IPO	Initial Public Offering
IPTV	Internet Protocol TV
ISC	Internet Society of China
ITA	Information Technology Agreement
LCDs	Liquid Crystal Display
MAC	Media Access Control
MII	Ministry of Information and Industry
MMTA	Mobile Multimedia Technology Alliance
MPEG	Moving Pictures Experts Group

MOFCOM	Ministry of Commerce
MOSFETs	Metal Semiconductor Field Effect Transistors Light-emitting diodes
MoU	Memorandum of Understanding
NDRA	National Development and Reform Association
NDRC	National Development and Reform Commission
NET	Net Trade Index
NGN	Next Generation Networks
NPC	National People's Congress
NPL	Non-performing Loans
NTS	Natrindo Telepon Selular
OEM	Original Equipment Manufacturer
OFDM	Orthogonal Frequency Division Multiple Access
RAND	Reasonable and Non-Discriminatory
RCA	Revealed Comparative Advantage
R&D	Research and Development
RFIT	Radio frequency identify tags
RFPs	Request for Proposals
SAC	Standards Authority of China
SAIC	State Administration for Industry and Commerce
SARFT	State Administration for Radio, Film and Television
SDOs	Standards Development Organisations
SDTV	Standard Definition TV
SEZs	Special Economic Zones
SIPO	State Intellectual Property Office
SLT	Sri Lanka Telecom Limited
SMG	Shanghai Media Group
SMIC	Semiconductor Manufacturing International Corp.
SMS	Short Messaging Service
SoC	System-on-Chip
SSID	Service Set Identifier
TDIA	TD-SCDMA Alliance
TMIB	TM International
TMP	Test, Marking and Packaging
TVE	Top Victory Electronics
UMTS	Universal Mobile Telecom System
UOPF	Ubiquitous Open Platform Forum
USITO	US Information Technology Office
VMD	Versatile Multilayer Disk
VPT	Vietnam Power Telecom
WAPI	Wireless Authentication and Privacy Infrastructure
WEP	Wired Equivalent Privacy

1. INTRODUCTION

There are two principal dimensions to any long-term model of industrial development. Firstly, a consideration for the cycles that determine the rhythm of the industry, its investment and growth patterns. These are closely linked with the specifics of the industry and with the peaks and troughs of macro-economic cycles. Second, the secular trends that cause seismic shifts in industry, such as the invention of new so-called 'disruptive' technologies and changes in the spatial economy that bring about a new regional or international division of labour. In the short to medium term, industry restructuring often results in consolidation through mergers and acquisitions and market exits. However, long-term changes in the operating environment can result in industrial fragmentation and the birth of new companies exploiting new markets, shifting to new geographical locations and stimulating economic growth in those regions or countries.³

How cycles and longer term trends affect the ICT sector are particularly important for modern economies because ICTs form part of almost every sector. For example, this makes the demand for semiconductors highly cyclical in line with the cycles of the reliant industries, such as automobiles and consumer electronics. Another reason is that no industry in history has faced such a rapid pace of change. This includes communications technologies such as the Internet and the Web that change the calculus of location (the trade-off between the location of production and the location of markets) resulting in the so-called 'death of distance'⁴. This phenomenon has accelerated the international division of labour and the international networking of supply chains and has benefited China to a huge extent.

The EU and China face very different industrial challenges across all sectors, including ICTs. The EU inherited a prosperous but fragmented regional market, divided between national manufacturers who lacked economies of scale. The challenge has been to create a single regional market by harmonising national policies and reducing national barriers to trade. China, after the Open Door Policy of 1978 inherited a backward economy but one that was under the direction of a strong centralised State that was able to mobilise accumulated surpluses and savings and direct them accordingly, particularly into infrastructure such as communications for strategic as well as economic reasons. Using special economic zones (SEZs) and science and technology parks, China was able to attract FDI on favourable terms while maintaining restrictions on the scope and location of activities.

Cheap labour and land, tax and tariff exemptions, and ultimately the lure of a very large domestic market were sufficient to accelerate the trend towards globalisation of production and, for the first time, seriously challenge the paradigm that had held up to the 1990s: that companies did not relocate their core business technologies, their core intellectual property, or their core R&D (future intellectual property) – to foreign countries. Therefore IPR infringement is one of the biggest challenges foreign companies face when operating in the Chinese market. Many companies in various industries face this problem too, notably in pharmaceuticals and ICT. There are other barriers to entry to China's market which will be discussed in this report but IPR infringements are strategically the most difficult one to negotiate and the results of this process will be key in determining the future of commercial, economic and political relations between China and its major trading partners. China sees this issue as fundamental to its development and to achieving equal status among the industrial countries of the world. Hence it is in the interests of both China and the EU that the emergence of a new global economic order is achieved with the benefits, such as a more efficient allocation of the world's resources, apparent to all⁵.

1.1 The Conceptual Model

The focal point of this report is ICT equipment, but the term 'ICT equipment' needs clarification because it can cover a multitude of products and services that are not included in this report. The boundary of this study is 'equipment' implying hardware of all sorts. This includes parts and components, assembled equipment for use as capital goods, consumer electronics and end-user devices. While software itself is excluded, the fact is that many of the components that drive ICT equipment and govern its functioning are 'hardwired' programmable chip sets⁶. The chipsets that enter mobile phones and allow mobile phones to take pictures, record video, download music and send emails are a good example of this. In addition, modern telecommunications networks are replacing Asymmetric Transfer Mode (ATM) switches, the 1990s digital workhorse switching equipment controlled by independent software programmes, with so-called 'soft switches' programmed into Next Generation Networks (NGN) and all running over Internet Protocol (IP). So for the purposes of this study 'equipment' will refer to any hardware that is programmed or programmable as opposed to independent programmes that run on hardware, such as computer programmes.

1.2 Convergence

It is also difficult to delineate the ICT equipment sector because of convergence issues. Convergence is a widely used term, but here it refers to the coming together of different components of systems to share a common feature. Using the two examples above, several functions converge into mobile phones, such as cameras, music and game consoles, alarm clocks, etc., while Internet Protocol TV (IPTV), telephony and internet access converge through the use of the same fixed telecom broadband lines. Convergence is therefore a technical attribute and should not be confused with the concept of business synergies which determine whether merging two different lines of business will be profitable or not.⁷ Convergence is an aspect of change in the supply chain, whereas business synergies relate to change in the value chain.

Convergence poses two types of problems. These are the agreement on industry definitions and the agreement on industry regulations as the industry restructures. For example, the delineation used by telecom regulators and broadcast regulators to distinguish between the two industries no longer works very well in a world of webcasting and IPTV. If the two sectors are deregulated this will open up new opportunities for equipment vendors, especially foreign companies in previously protected national network markets.

It is also important to add that industries previously not considered being part of the ICT sector, for example health services, the automobile industry, logistics (distribution and warehousing) and retailing, have become major users of ICTs. For example, it is often pointed out that a modern motor vehicle contains far more ICT parts and components than the first Apollo spacecraft to the moon. Now the modern motor vehicle is also networking those parts and components through systems such as GPS and sensors in the vehicle that monitor and gauge dangerously high or low levels of tyre pressure, near empty fuel tanks, erratic patterns of driving and transmit these to a home base station for reception by a PC or a mobile phone. Different applications can then receive and respond in a programmed manner. A similar story is true in just about every major industry. For example, automated supermarket stock control systems that network with the warehouse mean that convergence at the technological level, especially based on Internet Protocol technology, is bringing about a broadening scope of applications. These are the elements of efficiency, of productivity and of innovation

sought by both the market-led economies of the EU and the state-directed economy of China.

From Supply Chain to Value Chain

One of the most important consequences of all these factors is that the many loci of value are shifting. Historically, underlying falling prices, enhancing quality and functionality of electronic products have been brought about by two drivers: Firstly, the development of industry standards that allow for mass production and economies of scale. The second reason is technological advancement described by Moore's law, stating that the number of microprocessors that can be embedded in a single chip of silicon doubles every 18 months.

The result has been the rapid commoditisation of electronic goods as intermediate and end user demand has surged in response to the overall rise in real incomes. Widely recognised industry standards facilitated market entry, falling costs shifted electronics goods from the luxury to the fast-moving goods end of the market. This has meant that profit margins became increasingly dependent upon the rate of market growth. The cost profile of these ICT goods industries changed as a result. Manufacturing costs as a proportion of total costs fell and the costs associated with brand recognition and the marketing of these products grew⁸. Most importantly, the search for the next generation of products, the next wave of ICTs, has become increasingly intense. This involves R&D and has become the real differentiating factor of more successful companies. These company-specific assets in terms of skill sets and scientific and industry knowledge are developed over time and secured as intellectual property (IP).

In the product cycle theory, the cycle becomes ever shorter and ever rising R&D costs have to be recouped over shorter timeframes and thus R&D, successful innovation and IP are key competitive determinants. **Figure 1** illustrates the basic dynamics involved. After an initial period of growth in the use of technology 1, the market becomes commoditised and a margin business. Conceptually there is a switching point where a company can choose to jump to technology 2, where potential profit margins are higher although the product cycle may be shorter than it was for technology 1. Companies choosing to stay with technology 1 need to consolidate their position with good branding and marketing strategies.

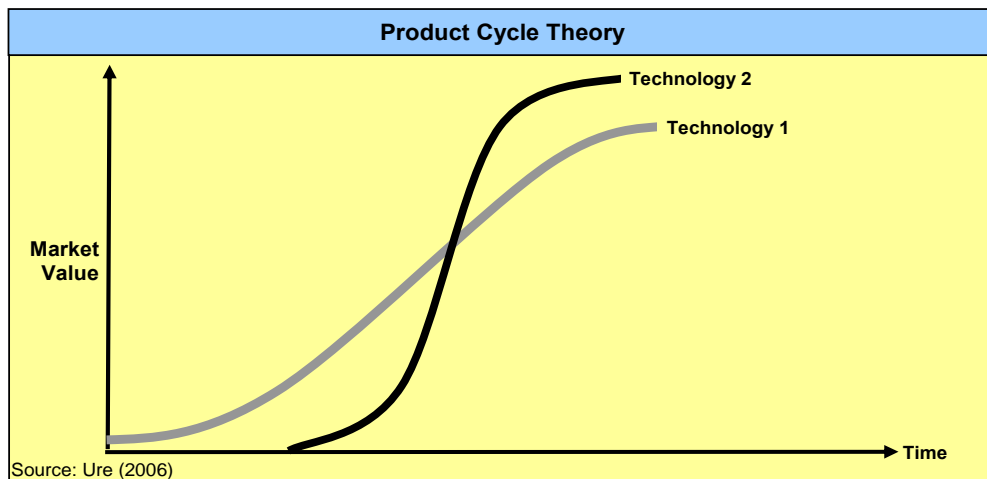


Figure 1: Product cycle theory – shifting value loci

Brand image and a large and efficient marketing organisation can buy valuable time for a company facing the threat of innovation from a competitor, but the stark choice is between being trapped in a commodity market, for example in the manufacture of PCs, which can remain an important source of cash flow for a declining period of time, or moving up the value chain. In some cases this may be from ICT manufacturing into ICT consulting and services, witness IBM. On the other hand, when China's Lenovo (considered a more distinctive brand name than its previous name Legend) bought IBM's PC business in 2005 it bought an entry ticket into many new geographical commodity markets and the use of the IBM brand name for a time.

In some cases moving up the value chain involves shifting gears from manufacturing to applications and services, as in the case of IBM, and in some cases it involves adopting a new technological paradigm. The manufacturers of telecommunications networking equipment, for example Alcatel, Ericsson, Siemens in the EU, Cisco, Juniper, Lucent in the US, Huawei and ZTE in China, are focused upon all-IP NGNs (see above), which will only sell if their clients decide to upgrade from fully functional ATM networks that fulfil present requirements. Accelerated depreciation of presently used technologies is dictated in these markets by the fact that the cost structure of new entrants adopting NGNs is lower from the outset. The scope of products and services NGNs promises to be greater⁹, but there is a far more impressive example of a paradigm shift that predates NGNs and has made their development possible. The invention of Internet Protocol paved the way for the invention of hypertext mark-up language (html) and the World Wide Web. These software developments fundamentally transformed the ICT industry.

1.3 General Purpose Technologies

In economic theory, an invention like Internet Protocol, or more popularly 'the Internet' and the mesh of interconnecting networks using IP that make up its overall concept, is referred to as a General Purpose Technology (GPT) that has profound, downstream effects. Within the product cycle theory, this would involve an entirely new paradigm of invention, and the companies that are most likely to take it up, exploit it, and research and develop it in the early stages are not established ICT manufacturers but entrepreneurial start-ups. This does not mean that the early R&D that gives rise to the invention is the product of small scale entrepreneurial activity. On the contrary, the early R&D history of the Internet and IP is well known as having been funded by the military establishment, like so many other ICT developments such as computers and cellular mobile communications. But once such technologies are allowed to migrate to civil society they are rarely immediately adopted by the established brand name companies, possibly for two reasons. First, these technologies are potentially 'disruptive' to the established technologies and products that embody them. For example, telecommunication companies (the 'Bell heads') were highly dismissive of IP advocates (the 'Net heads') in the 1990s as supporting an inferior technology that could by-pass and disrupt the quality-of-services provided by the telcoms sector and the prices they charged for them. Second, the full potential of new technologies takes time to be demonstrated.¹⁰ Famously, computers were dismissed early on as of little widespread practical use, and the PC was similarly dismissed in the 1980s as a somewhat trivial technology. Disruptive technologies are very often dismissed as trivial, assuming they are even noticed when they first appear.

All GPT technologies are disruptive, but not all disruptive technologies are GPTs. The short messaging service (SMS) is a good example. SMS are text messages carried over

the signalling band of a cellular telephone system. They use very little bandwidth and were introduced as a means of network administration. The industry was caught unawares when consumers took to SMS in droves. This seemingly trivial technology has proved to be a major non-trivial source of revenue (at virtually no cost) to mobile phone service providers, and handset manufacturers have responded accordingly. But SMS is not a disruptive technology; it is rather an incremental technology.¹¹

1.4 Business Strategies and the Product Cycle

Given the speed of ICT developments taking place, what emerges from the above is a view of the dynamics that especially characterise the ICT equipment sector. It is important to keep this view in mind when making an assessment of the ability of the European ICT equipment manufacturers to compete in China's domestic market and against China's ICT equipment export sector. The projection for the ICT sector is not in principle different from other industrial sectors insofar as product cycle theory typically identifies periods of incubation, initial growth, take-off, mass markets, saturated markets and decline. Companies who want to remain highly profitable and competitive need to choose their strategy between coming to dominate a mass market with a bankable brand and marketing machine, or becoming or remaining a leading cutting edge technology company. The first is a margin business; the second is a high-risk high-gain business built upon a portfolio of IP, generated either by R&D or through mergers and acquisitions. In most cases, the commodity business is an unlikely strategy for European companies when the competition comes from a low-cost China, except insofar as most of the ICT commodity products being exported from China are owned by foreign-invested companies (up to 88 per cent for ICTs according to the Ministry of Commerce)¹². In this case, investment in China is a direct substitute for trade with China. Instead of selling to China, foreign companies manufacture in China for the local market and sell from China. However, even this strategy looks provisional at best as China's own manufacturers are rapidly targeting this market, as the case of Lenovo demonstrates.

1.5 Barriers to Trade

The problem with the second strategy with respect to China's market is barriers to trade. These are examined in more detail below, but they fall into two types. First, barriers of various kinds erected against foreign ICT products. These include issues of standards,

IPR, customs treatment, government procurement and government policies implemented by state enterprises. Notably since January 2005 tariffs do not constitute a significant obstacle to trade due to China signing up to the WTO Information Technology Agreement (ITA). Second are 'natural' barriers that reflect underdevelopment in China's domestic market. For example, China's banking system remains chronically inefficient with limited use of ICTs despite state-sponsored projects such as the Golden Card and Golden Finance designed to support debit cards and inter-bank clearing. Another example would be the traditional reluctance of China's organisations to place value on intangible assets such as software, and although this report excludes software from its consideration, it signals a weakness in China's enterprise system, that while stand alone ICT equipment is often purchased, the networking of this equipment within and across state and non-state bodies has been seriously under-valued. In part, this also reflects the vertical hierarchy of management and State and Party systems, a legacy of central planning that will take time to revise despite the emphasis of the 11th 5 year programme on enterprise-led growth and innovation. It also holds back the widespread adoption of top-end ICT equipment and systems that could help China's enterprise sector reach higher levels of efficiency, productivity and innovation in work methods.¹³ In conclusion, it needs to be pointed out that China is entering the ICT equipment market to compete on a global scale when the Internet Protocol (IP) era has become the new paradigm.

China has taken this very much to heart. For example it is pioneering, in collaboration with Japan and South Korea, IPv6 (IP version 6) addresses and is constructing a national high-speed research Internet 2. These are signals from the national level to the enterprise sector that innovations in ICT equipment utilising the cutting edge of IP research are expected of them, along with the IPR that add or secure value. China is moving ahead by adopting a macro-economic perspective on ICT equipment development that on the one hand consolidates its position as a cheap mass producer for world markets, and on the other hand identifies areas of opportunity to position China's leading enterprises at points along the supply chain where value is greatest. Top of the list is probably China's determination to build wafer fab foundries to reduce dependency upon high-value foreign products and to create the basis for China's own supremacy in the field of chipsets. This is the equivalent of building the engines that power automobiles and if successful will represent a very significant stride forward in China's capability in ICT equipment production.

1.6 Patents and IP issues

IP theft, ineffective IP protection enforcement, and in some cases an official blind eye towards, or even policy favouring of the non-payment of royalty fees is a problem faced by those doing business and are investing in China. Chinese companies developing a portfolio of patents, copyright and trademarks (brands) are seen as concomitant to the objectives of the 11th five year programme and the *Plan for National Informatisation Development 2006-2020* announced on 12th May 2006 jointly by the General Office of the Central Committee of the Communist Party of China (CPC) and the General Office of the State Council:

*"The ultimate objective is to elevate China from a position of learning and using foreign technologies to one that creates."*¹⁴

Paying billions of dollars in royalties and a sense of dependency on foreign technologies is a state China wishes to move beyond, at least to the point where China can participate on more equal terms in the world market for high technology products. But China is also trying to persuade the world that it is a good citizen. The State Council published a nine chapter White Paper on 21 April 2005 entitled "New Progress in China's Protection of Intellectual Property Rights" along with a short Foreword 'in order for the international community to have a better understanding of the real situation regarding China's IPR protection'.¹⁵ China finds that laws and regulations regarding IPRs need to find the right balance 'for its own national situation [between] the interests among intellectual property creators, users and the general public [to ensure a] benign circle for the creation and use of intellectual property.'¹⁶

Annex 1 provides a background to the current IP protection regime in China.

2. SECTOR DEVELOPMENT: ICTS AND THE EU

Overall, the EU is under-represented in the ICT sector. According to data from the European Commission, the EU falls behind Japan, Korea, Taiwan and the US in terms of the value added by ICTs to the manufacturing sector, in terms of employment in the ICT sector as a percentage of manufacturing employment and in terms of revealed comparative advantage (RCA) for the ICT manufacturing sector compared with China, Hong Kong, Indonesia, Japan, Korea, the US, Singapore and Malaysia¹⁷. According to the OECD, besides the US, Japan and Chinese Taipei (Taiwan) no other country has ten or more registered headquarters of the world's leading 250 ICT companies¹⁸.

By 2004, the EU was importing almost the same value of ICT goods as the US, US\$226

billion for the EU and US\$235 billion for the US, but exporting only US\$139 billion (less than China which has now overtaken the US to become the world's top exporter of ICT goods). In terms of ICT manufacturing sectors, the EU is heavily dependent upon domestic demand driven markets. This has led researchers to break the main components of the sector into consumer electronics, computer-related equipment, avionics, telecommunications, space and defence, energy, industry and services¹⁹. What is interesting about this breakdown is how it reflects the blurring of the boundaries between ICT core industries that supply the chip sets, parts and components, equipment and devices and the industries that use them and who need to work closely with, for example, chip set designers and component manufacturers, to ensure they get the right technology which will solve their problems, integrate with their systems and will offer them a competitive edge to win customers.

This highlights an important strength of the EU: there are many industrial sectors that are ready market segments for ICTs at the high-tech end of the market. Examples could be extended, including the widespread use of CAD-CAM (Computer-Aided Design and Computer-Aided Manufacturing). In addition, there is the growing use of new communications technologies such as RFID (radio frequency identify tags) and NFR (near field radio) and UWB (ultra wideband) sensors for industrial applications in warehousing and supermarkets and in the extraction and exploration industries and so on. Following this line of reasoning, the future export competitiveness of European ICT companies should be considered in terms of their contribution to the exports of the industries they serve where the EU does seem to have comparative advantages. This is highlighted by the fact that the EU currently manufactures just under 20 per cent of the world's chip sets, but like China imports far more than this, which indicates the strong growth of domestic demand. Therefore, future opportunities for European companies exist in collaboration across sectors, which require customised hi-tech and high-value applications of ICTs.

2.1 European Revealed Comparative Advantage in ICTs

To estimate the European revealed comparative advantage in ICTs with respect to China trade, first the European top ten HS categories of ICT exports to China for 2003 were identified²⁰. Then the world exports of each of these HS categories for China, Hong Kong (China), the EU, Japan, Korea and the US were measured against the total world exports of each of these countries²¹.

Table 1: EU Revealed Comparative Advantage in ICTs

HS No.	Name of Category	US\$ Exports	RCA
8542	Electronic integrated circuits & micro-assemblies	1,056,794,878	0.4
8529	Parts suitable for use with the apparatus of headings 85.25 to 85.28	772,728,512	0.5
8537	Boards, panels, consoles, desks, cabinets and other bases	454,915,191	1.5
8536	Electrical apparatus for switching or protecting electrical circuits, or for making connections...	412,186,429	0.9
8473	Parts and accessories for use with machines of heading 84.69 to 84.72	354,886,692	0.4
8525	Transmission apparatus for radio-telephony, radio-broadcasting	319,849,458	0.7
8535	Electrical apparatus for switching or protecting electrical circuits	235,060,046	1.25
8471	Automatic data processing machines and units thereof	227,467,555	0.4
8543	Electrical machines and apparatus, having individual functions	187,093,648	0.8
8541	Diodes, transistors and similar semiconductor devices	183,175,949	0.4

The RCA categories are therefore calculated as shown in the following example: Leading ICT exports from Euro zone countries to China were 'electronic integrated circuits and micro-assemblies'. The Euro zone countries total world exports of these was 1.6% of Europe's total world exports of all goods. The comparable figures for China, Hong Kong (China), Japan, Korea and the US were 1.5 per cent, 7.1 per cent, 5.5 per cent, 8 per cent and 5.8 per cent respectively.²² The average for this group of countries as a whole was 4 per cent. The EU's revealed comparative advantage (RCA) therefore is estimated by expressing 1.6 per cent as a proportion of 4 per cent, i.e. 0.4. RCA > 1 indicates comparative advantage. As **Table 1** shows, the EU appears to have comparative advantage in only two of its top ten ICT export categories to China, which are third highest export, 'Boards, panels, consoles, desks, cabinets and other bases' (HS 8537) and seventh highest export, 'Electrical apparatus for switching or protecting electrical circuits' (HS 8535). This suggests a major weakness on the hardware side of the European ICT industry, although it must be borne in mind that in areas where the EU has been strong in recent years, for example in the design and manufacture of fixed line telecommunications and mobile cellular network equipment and handsets, most of the manufacturing is done overseas and

much of it in China. For example, Alcatel of France has its major manufacturing base in Shanghai.

But growing competition from Asian, including Chinese, manufacturers is beginning to take its toll even in this sector. For example, in 2001 Ericsson of Sweden placed its handset business into a joint venture with Sony of Japan, in 2005 Siemens sold its handset business to the BenQ Group of Taiwan, and in an apparently defensive move in 2006 Nokia of Finland and Siemens of Germany announced the merger of their carrier and network operations businesses. In another prominent deal, in 2003 Thompson of France placed its TV sets and DVD players business into a joint venture with TCL of China. These are bell-weather companies and they are doing what they have to do to remain successful.

3. SECTOR DEVELOPMENT: ICTS AND CHINA

3.1 Overview

According to OECD statistics, China is now the world's leading exporter of high-tech goods like laptop computers, mobile phones and digital cameras. China exported US\$180 billion worth of ICT (information and communication technology) goods in 2004, compared with U.S. exports of US\$149 billion.

Table 2: 2005 Electronic Communications Industry

Commodity	Revenue (million RMB) - Year ended		% change	Profit (million RMB) - Year ended		% change
	2005	2004		2005	2004	
Computers	1,064,400	874,900	21.7	20,900	15,900	31.7
Radio communications equipment	613,200	47,270	29.7	24,400	28,800	-15.4
Electronic components	573,500	409,200	40.2	30,900	23,200	32.7
Home entertainment equipment	376,200	343,300	9.6	6,400	1,400	361.7
Broadcasting and TV equipment	30,700	15,800	94.9	1,100	400	140.7

Source: Ministry of Information Industry http://www.mii.gov.cn/art/2006/02/28/art_941_7107.html

China's electronics and IT market was worth RMB3.84 trillion (US\$480 billion) in 2005 with the revenue of the top 100 Chinese manufacturers reaching RMB964.3 billion (US\$120.5 billion) – representing a year-on-year increase of 18.2 per cent. Deputy Minister of the Ministry of Information Industries, Lou Qanjian forecasts the market will hit RMB7 trillion (US\$870 billion) by 2010. The leading five companies in terms of revenues were: (i) Legend Holdings (parent of the Lenovo Group); (ii) Haier Group (consumer 'white goods' manufacturer); (iii) BOE Technology (LCD panel maker); (iv) TCL Group (TV and mobile phone maker); (v) Huawei Technologies (telecommunications equipment). Despite healthy revenue growth, the profit margins of the top 100 players have been decreasing with the average profit margin falling to a five year low of 2.5 %. This reflects the fact that many of China's ICT companies are operating in commodity markets where price competition is fierce, but some such as Huawei, Datang, ZTE are managing to develop their own patented technologies as they attempt to reach higher value-added ground.

One of the strengths of China's larger companies is their ability to mobilise substantial resources for R&D to focus on innovation in line with China's national priorities, laid out in the 11th 5 year programme. The top 100 players in 2005 had 93,600 people working on research and development (R&D) activities, accounting for 9.6 per cent of their total employees. The annual R&D spending of the top 100 in 2005 was RMB3.56 billion (US\$445 million), accounting for 3.7 per cent of total revenue, compared for the industry average of just over 2 per cent and a national average of under 2 per cent.

3.2 IT office equipment, components and semi-conductors

3.2.1 Computers

The leading companies are Lenovo, who recently acquired IBM's PC business and holds nearly 38 % share of the market, Founder with 14 %, and Tongfang with just under 10 %. US companies Dell and HP hold just over 12 per cent of the market between them. TCL and Great Wall share another 4.5 per cent of the market, which is typically price competitive and fast moving.

3.2.2 Electronic Components – Consumer Electronics

The market for traditional consumer electronics products such as CRT (cathode ray TV) colour television, mobile phones and DVDs is mature. Intense market competition is gradually decreasing profit margins. 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 coming years. China's main DVD manufacturers include Konka, Better Life, Shinco, Malata, Desay, Amoi, SVA, Nintaus, and Skyworth. The China Audio Industry Association represents 60-70 DVD manufacturers in China and along with the China Chamber of Commerce for Import and Export of Machinery and Electronic Products has been negotiating with MPEG LA over DVD IPR royalties. However, collecting the money (roughly US\$2.50 per player) may be difficult²³. At the same time, China is developing its own standard. These moves on standards are part of a wider initiative by China to develop an array of standards and IPRs directed at the growth of the home networking and entertainment industry. While companies like Huawei and ZTE, TCL and Konka have joined the industry's international Digital Living Network Alliance (previously known as the Digital Home Networking Group) that also includes companies such as Sony, Intel, Microsoft, Philips and HP. They are also members of the Intelligent Grouping and Resource Sharing (IGRS) industry body for the development of local 3C-convergence standards. This body comes under the Science and Technology Department of the MII and includes over 20 local companies. Office and home networking is also an area included in the China-Japan-Korea ICT cooperation scheme and the International Cooperation Working Group agreed between these countries to collaborate on research and development of ICTs, including liaison with Japan's Ubiquitous Open Platform Forum.

3.2.3 Electronic Components – LCD Flat Screen Panels

China accounts for around 25 per cent of the world's production of Liquid Crystal Display (LCDs) screens, but 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. Leading companies include Hisense, China's number one by revenue, Shanghai-based SVA Group (NEC of Japan is a partner), the BOE Technology Group (Hynix Semiconductor of Korea is a partner), Konka (Thompson of France is a partner) and TCL (partners include Thomson and Alcatel (mobile phone handsets) of France) and Top Victory Electronics (TPV).

3.2.4 Semiconductors and Integrated Circuits

Producing semiconductors and chip sets is all about producing the engines that drive ICT equipment. The design of chip sets, for example, determines what functions the most

cutting edge consumer devices can perform. Therefore chip sets occupy a pivotal point along the supply chain and represent a strategic point within the value chain. But China's production is mostly concentrated at the low-end of semiconductors, such as diodes, discretes and analogue chips. Chinese manufacturers lack the intellectual property (IP) to build high-end semiconductors such as microprocessors, digital signal processors and ASICs (application specific integrated circuits).²⁴ While electronic products are increasingly utilising single-chip components, a significant part of electronic circuitry still favours discrete semiconductors, such as diodes and MOSFETs.²⁵ The transistor and diode industry in mainland China and Taiwan, including discrete semiconductor is currently made up by 130 manufacturers. Galaxy Semi-conductor Holdings is a leading Chinese maker of diodes.

In 2005, China represented 21 per cent – approximately US\$40 billion – of the world's US\$192.4 billion in integrated IC consumption (up from 6 per cent in 2000) making China the world's largest consumer of ICs²⁶. According to CCID Consulting, an affiliate of the MII, China's demand for IC chips is forecast to reach US\$124 billion by 2010, with 3G handsets and digital TV being the strongest drivers of demand. Production is expected to grow at an annual rate of 36 per cent to US\$ 12.1 billion by 2010, still only 10 per cent of forecasted demand. In terms of value, demand for computers is largest, accounting for around 40 per cent of the market. However, by volume, 30 per cent of chips go into ID cards, 17 per cent into telecommunication goods and only 11 per cent into laptop and notebook computers²⁷.

3.2.5 Outlook

Looking forward to 2010, according to the MII, the market share of domestic players will leap to 30 per cent while revenue will hit RMB 300 billion. The chip design sector will move upwards of RMB 60 billion and made-to-order chip manufacturing upwards of RMB 80 billion. Assembly and testing will move to upwards of RMB 160 billion or just over 50 per cent of the total compared with over 70

per cent today²⁸. These figures highlight the State's push for a move towards higher value activities despite the continuing dominance of low-end work. China's strengths lie in the demand arising from computers and consumer electronics. China's weakness is that it lacks a strong demand from home manufacturing and services industries for high-end components, equipment and systems. Consequently, almost all manufacturing equipment is imported. Overall, imports make up about 80 per cent of the chips used in products made in China.

Boosting semiconductor manufacturing and design is a number one priority for the Chinese government. The China Semiconductor Industry Association (CSIA) estimates that China will make an investment of as much as RMB300 billion in the IC industry for development from 2006 to 2010. This will allow for home grown IC makers to double their market share. Under the 11th 5 year programme (2006-2010), China will establish a fund of at least RMB150 million each year to support the home grown IC industry's research and development, offering more favourable tax policies and founding a national technical support centre. China will also build 10 more 8-inch wafer plants and five 12-inch wafer plants. According to the MII, the capital for the work can be raised from government, the public and overseas investors, including venture capital companies, government-backed funds and foreign direct investment.²⁹

Chip design may be the highest value end of the semiconductor business, but before China can sustain that level, the big push is to develop the foundry manufacture of semiconductors, a highly expensive and risky business given the dominance of Korean, Japanese and US companies. It started with 'Project 909' in 1995 with state funds of US\$250 million (see **Box 1** on next page) and between 2000 and 2004 state-supported investment in the semiconductor business amounted to US\$14 billion. **Table 3** shows the fruits of Project 909 to date where four of the top eight integrated circuit producers in China are joint ventures.

Table 3: Top Chinese IC producers

Company	Sales US\$ million		Products
	2004	2005	
1. SMIC	975	1,160	Foundry
2. Hua Hong/NEC	324	375	ICs, ASICs
3. He-Jian	230	250	Foundry
4. ASMC/Philips	175	200	Foundry
5 Shougang/NEC	140	160	Standard ICs, Foundry
6 Grace	145	100	Foundry
7 CSMC	80	70	Foundry
8. Shanghai Belling/Alcatel	65	70	Consumer ICs

Source: 'Industry in Infancy', *Purchasing*, May 18, 2006

Box 1: State Assistance for Semiconductors

The Case of Vimicro

The National Guideline on Medium- and Long-term Programme for Science and Technology Development (2006-2020) issued by the State Council in early February is aimed at reducing the country's reliance on key foreign technologies from more than 50 percent to 30 percent by 2020. Vimicro is one of a number of Chinese companies benefiting from this strategy. The government is applying preferential policies and directing investment to promising companies to foster domestically developed but internationally competitive technologies. 'We've wanted to develop world leading technologies and target the global market since our very first day of operation,' says Tom Zhang, vice-president and one of the founders of Vimicro.

Vimicro was founded in 1999, with the Ministry of Information Industry (MII) investing about 10 million RMB (US\$1.25 million) as a 'seed fund.' 'The government played a big role in the early development of Vimicro,' says Zhang. The MII was managing 100 million RMB (US\$12.5 million) at the time, a fund allocated by the Ministry of Finance to support Chinese high-tech companies. The MII registered a venture capital company overseas to manage the fund, a dramatic departure from how it had previously supported domestic high-tech companies. 'Government support is crucial to Vimicro. But the government does not intervene in our daily operations,' says Zhang. Vimicro later managed to absorb several rounds of venture capital from a number of foreign companies, which diluted MII's stake to 10.9 percent. Vimicro became the first Chinese semiconductor companies to trade shares on the NASDAQ when it went public on 15 November 2005. It raised US\$87 million and the MII sold its 10 percent stake.

'The government is changing the way it helps the high-tech sector,' says Mr. Zhang. The Chinese Government launched 'Project 909' in 1995 to develop the semiconductor industry, which saw it as the lifeblood of the high-tech sector. It contributed registered capital of 4 billion RMB (US\$250 million). The State Council and Shanghai municipal government later injected an additional US\$100 million and launched foundry enterprise Huahong in 1996. At that time, 85 percent of chips used in China were imported. The country's IC manufacturing technologies were three generations behind foreign technologies. The 10-year development of 'Project 909' unearthed a number of tough lessons. When introducing some production lines, for example, the government focused too much on closing technical gaps with advanced global technologies, but did not address customer demands effectively enough. That underscored the importance of establishing space between the government and company operations. Business-savvy executives needed to be educated to lead market-driven companies.

Spending on research and development in 2004 stood at 196.63 billion RMB (US\$24.3 billion), accounting for 1.23 percent of the country's GDP (gross domestic product). The government planned to expand this figure to 360 billion RMB (US\$44.4 billion) by 2010, accounting for 2 percent of the GDP. The government might set up a fund valued at 500 million RMB (US\$61.7 million) in the coming years to accelerate the development of the chip design industry. Yet some observers are calling for the government to help improve the ability of design companies to raise capital through means other than direct allocation of funds. Statistics have shown that between 2000 and 2004, investment in China's semiconductor industry amounted to US\$14 billion, four times the total in the past 20 years. Only a small portion of this was associated with chip design companies, however.

Chip design is the highest value-added business in the semiconductor industry, accounting for 40 percent of the value chain. Compared to manufacturing, assembling and testing, chip design also requires smaller investments and costs. By 2004, there were 421 chip design companies throughout the country, with total annual revenue of 8.15 billion RMB (US\$1 billion). Vimicro's NASDAQ-listing was followed by an initial public offering (IPO) by Actions Semiconductor Co, another Chinese chip design company. Both IPOs fell below expectations highlighting that it will likely take time for investors to understand the profitability of Chinese chip design enterprises.

This trend is set to continue. STMicroelectronics (ST of France and Italy), the world's No 5 chip maker, announced in 2006 the building of a US\$500 million wholly foreign owned test, marking and packaging (TMP) chip assembly facility in Shenzhen. ST already has a joint-venture TMP factory, STS Microelectronics, with Shenzhen Saige High-tech Investment Company in Shenzhen and is due to start a joint venture fab plant in Wuxi with Hynix (Korea) to build flash memory and DRAM chips. ST forecasts that Greater China, which accounts for 25 per cent of ST's global sales, will soon overtake Europe, which accounts for 30 per cent.³⁰ Also in 2006, Infineon (Germany) announced that it would transfer its 90-nanometer standard memory chip technology and 300-

millimeter silicon wafer production know-how to Semiconductor Manufacturing International Corp. (SMIC). Technology transfer in the Chinese market at this level is a significant development considering the risk of IP theft, for example stealing and copying designs, is a major problem in the minds of foreign companies.³¹

3.3 Sector Development: Telecom Equipment and China

3.3.1 Overview

The telecoms equipment market typically breaks down into three major sectors, network and operational equipment like switches, routers, cables, wireless base stations, monitoring equipment, etc.,

consumer devices such as handsets and modems, and enterprise equipment, such as switchboard equipment, internet protocol telephony systems, data traffic management systems for wide area networks, and so on. European companies are well represented in all these markets globally, but in China there are obstacles.

There are three state-owned fixed line operators, China Telecom (southern China) and China Netcom (northern China) which, in theory, compete, and China Unicom, a weak third player nationally. There are two state-owned mobile operators, China Mobile and China Unicom. In addition, there are the state-owned China Railcom and China Satcom which provide interconnection and data services, the '5+1 model'. Being state-owned, these operating companies tend to follow Government policies towards buying local, and Huawei and ZTE typically account for 60-70 per cent or more of network equipment sales within China, and other local companies, many of them located in Shenzhen and Dongguan **in Guangdong province**, a further 10 per cent³². The close relations between these companies, the operators, the MII as both policy maker and regulator, and local governments pose a major barrier to entry for foreign vendors despite the enormous size of the market. There are currently over 330 million fixed line subscribers in China and revenues are over US\$20 billion, mobile subscribers number 400 million and revenues over US\$40 billion. Network equipment sales in China for 2005, came to just under US\$4 billion³³.

With these sorts of numbers, companies like Huawei and ZTE have been able to finance their strategic climb up the value-added ladder. For example, figures from the State Intellectual Property Office (SIPO) show that by the end of 2005 Huawei had applied for more than 10,000 patents, and 90 per cent of these were so-called 'invention patents'. Besides the benefits of a protected local market, Huawei and ZTE are also able to underbid foreign vendors, often by substantial amounts and especially in overseas markets which are priority targets for these companies. Initial bids are often 20-30 per cent less than foreign competitors, and in a recent case in Thailand a case of 60 per cent less was recorded. Whatever the true cost structure of Huawei, ZTE and other companies from China, bids at these levels suggest strategic pricing to gain market entry.

But foreign companies have made an impact in China. For example, in the network market, Alcatel Shanghai Bell operates a highly successful joint venture. Ericsson is an interesting case because the company

withdrew from the equipment sales market in favour of selling professional services connected to network design, planning and optimisation. Internationally, Ericsson now offers network management outsourcing services, for example in Hong Kong the company manages Hutchison's mobile network. In this sense, Ericsson is IBM's counterpart in the telecoms market. Ericsson also transferred its mobile handset business into a joint venture with Sony (Japan), while Siemens sold its mobile handset business to BenQ (Taiwan) and Nokia and Siemens have merged their network equipment businesses – see earlier. Despite these transfers of ownership, it remains the case that while China manufactures nearly 40 per cent of the world's mobile phones, foreign invested companies account for 94 per cent of exports of mobile phones from China, and Nokia and Motorola dominate China's domestic market for handsets with around 30 per cent and 10 per cent of the market. The value-added part of a handset, apart from the brand name that instantly adds to its price, is the chip set. China's manufacturers cannot yet match the technical knowledge and skills of foreign companies in the design of chip sets³⁴.

The business-to-business market remains largely underdeveloped in China, and foreign vendors can often compete with better quality equipment and service-level agreements, especially for companies with international or global operations. Equipment vendors working closely with systems integrators, IT consulting companies and international carriers are more likely to attract top tier enterprise clients, but the second tier enterprise sector in China may well remain attracted to cheaper local integrators and vendors for the foreseeable future. As discussed above, traditional business thinking and organisation in China do present a market barrier.

3.3.2 Telecom equipment and the Issue of Standards

A further barrier is the issue of local or national standards. One example is China's insistence on introducing its own TD-SCDMA standard for 3G mobile phones, in spite of the original standard being jointly developed by Siemens and the Datang Corporation (which comes under the MII) and has been recognised by the ITU. At the time of writing, it is not yet known when and how many TD-SCDMA licenses will be issued, but it is known that the operators prefer, for straightforward commercial reasons, to adopt the European W-CDMA standard. It is thought likely that three standards will be licensed, including CDMA-2000. China Mobile also operates a business model for content providers somewhat similar to Japan's

DoCoMo model, offering wide access on standard terms to content providers which has stimulated that market, in turn stimulating the market for handsets and chip sets to support those applications.

The large scale of the network equipment market and high IPR royalties to foreign companies are two of the reasons why China wants its own standard. The experience gained through the research and development process will also give China a place at the international table for post-3G broadband wireless developments, standards and IPRs and for what has been called 4G network development³⁵. In the 1990s, most of the capital expenditure on building China's national mobile telephone networks went to foreign companies, a situation China is not willing to repeat with the deployment of 3G networks and services. Estimates, forecasts and predictions of the 3G equipment market in China vary enormously, for example, estimates of annual investment in 3G networks cited below range from RMB20 billion to RMB36 billion and even as high as RMB60 billion.

European companies are exceptionally well placed to gain from 3G deployment in China, partly because the 2G GSM standard and 3G W-CDMA standards are the most popular among China's operators. This is partly because European companies are already gearing up to provide support for the TD-SCDMA standard and partly because they are already well positioned in China's market. One example is the RMB900 million joint venture formed in June 2006 between Nokia and China Putian to manufacture and market telecoms equipment such as base stations, based on the 3G standards TD-SCDMA and WCDMA. China Putian will have a 51 per cent stake, with Nokia owning 49 per cent.³⁶

The dispute over the WAPI standard for WiFi access is another case in point as outlined in **Box 2**. Much of the interest in WiFi has been driven by fixed mobile convergence and the idea of 3G-WiFi handsets such as the BluePhone introduced by BT in the UK in 2005. As early as March 23, 2005 China Telecom signed a strategic agreement with China Mobile. Even though the terms of the agreement were not disclosed, it was suggested at the time that fixed-line phone operators should pay more attention to terminals such as WLAN mobile phone for commercial use, which have huge profit potential³⁷. WiMax, WiFi's big brother, is also exciting interest. The MII is drafting standards regarding WiMAX, which will accelerate the technology's commercialisation process in China. The Wimax Forum has among its members several Chinese technology companies, including ZTE, Huawei, Shenzhen Powercom, and the China Academy of Telecom Research (CATR). In China, the Wimax Forum is exploring further collaboration with the TD-SCDMA Forum. For European companies, the main interest in WiMax in China, as elsewhere, will be on the radio access network equipment side, for example, directional antenna where European companies have considerable technical expertise.

3.3.3 Digital TV (DTV) and Internet Protocol TV (IPTV)

To illustrate the issue of standards as a potential barrier, China, which has an estimated 370 million TV sets, is also developing its own DTV standard (see **Table 4** on next page) and is experimenting with IPTV. Hong Kong's two free-to-air TV stations (lobbed by the Hong Kong, SAR Government) delayed the introduction of DTV using the European DVB standard for several years in anticipation of China announcing its own standard.

Box 2: A Separate WAPI Standard?

The question mark hanging over WiFi or WLAN is whether or not China will, by mandate or otherwise, insist upon the use of its own WAPI (Wireless Authentication and Privacy Infrastructure) standard. WAPI was developed by IWNCOMM Ltd, a spin-off from Xidan University, and the company holds the IPRs on WAPI which it claims has better encryption algorithms and security features than the IEEE's 802.11i WiFi standard. The WAPI standard was approved by China's Broadband Wireless IP Group Standards (BWIPS) with the blessing of the Standards Authority of China (SAC), the MII and various other state agencies, possibly including the military who are thought to have close links with the research group from Xidan University.

In 2004, China declared WAPI a mandatory national standard and announced that foreign companies, such as Intel, wishing to market WLAN products in China would need to partner with selected licensed Chinese companies. China then reversed the decision under pressure from the US Government (under pressure from Intel) as a technical barrier to trade under WTO rules. China has twice failed in 2005 and 2006 to get IEEE standards approval and is appealing. In 2006, over 20 Chinese vendors and service providers formed the WAPI Industry Alliance suggesting that China may still insist upon WAPI. This leaves the market uncertain, and has been one of the factors slowing down the growth of WLAN.

Since China has also developed a high definition audio-visual standard (AVS) of its own, it remains unclear whether or not China will adopt AVS for HDTV. If it does so it will disadvantage foreign, including European TV manufacturers in the China market, unless like Thompson they have a joint venture with a domestic manufacturer, but conversely it will disadvantage China's own producers in the export market. The IPTV market in China faces another problem. The distance of

telephone lines from the exchanges to customer premises are often lengthy and their quality insufficient to support DSL (digital subscriber line) services. To upgrade them, or replace them with fibre in the local loop, will be a very costly investment. For example, Li Ruigang, president of Shanghai Media Group (SMG)³⁸, estimates it would require RMB50-60 billion to make IPTV available to up to 30 million subscribers.³⁹

Table 4: Selected ICT Standards

Technology	International	China	Notes
Video Disk	Digital Versatile Disk (DVD). MPEG-1 used for CD (VCD); MPEG-2 for DVD; MPEG-4 for web video and 3G streaming	Enhanced Versatile Disk (EVD) based on MPEG-2; approved by MII and SAC	Chinese manufacturers produce 70-80% of the world's DVD players, but can pay royalties of 40% or more of production costs; ⁴⁰ EVD format licences are pegged at 1 RMB per device (US\$0.12) compared with US\$2.50 agreed with the MPEG (Moving Picture Experts Group) Licensing Authority (pooled agreement April 2006). ⁴¹ EVD is being further enhanced by Versatile Multilayer Disk (VMD) tech based upon red laser optical storage of up to 40GB, potentially 100GB being developed in China by JV between NME and Beijing E-World Technology
High Definition Audio-Visual Compression	HD-DVD (Toshiba-led consortium, includes Microsoft) ⁴² vs Blue-Ray (Sony-led consortium, with Philips); based on blue laser ISO/IEC JTC1 MPEG-4 and ITU H.264 video and G.7 audio standards	Audio-Visual Standards (AVS) codec designed to replace MPEG-2 and offer an alternative to MPEG-4 and H.264 standards	MPEG-4 and H.264 standards products which are suitable for HDTV and IPTV charge royalties on equipment (US\$0.20 per unit above 100,000 units falling to US\$0.10 per unit above 5 million units) and content (US\$0.02 per title); ⁴³ AVS charges royalties only on equipment (thought to be US\$0.12); ⁴⁴ AVS standards are widely used in DVDs, TV sets, TV station equipment, online and satellite broadcasting
DTV, HDTV, IPTV, MTV	USA: Advanced TV Systems Committee (ATSC); Europe: MPEG2/Digital Video Broadcast (DVB)-T (terrestrial) or -C (cable) or -S (satellite) or -M (mobile); Standard Definition TV (SDTV)	For DTV in 2005 CCTV announced adoption of MPEG-2/DVB not AVS; 49 DTV trials ordered by SARFT to shift to DTV by June 2006; for China developing Digital Multimedia Broadcasting Terrestrial (DMB-T) HDTV	In 2005, AVS was not yet an established national standard. Its adoption for DTV, HDTV and IPTV will be crucial for its success, but China is also experimenting with Digital Multimedia Broadcasting (DMB) based on MPEG-4 which can transmit by terrestrial (DMB-T) or satellite (DMB-S) and can be accessed by mobile phone. DVB-T royalties on receiver products range from €0.50 to €0.75 (US\$0.60 to US\$1) ⁴⁵
Home Wireless Networking	Digital Living Network Alliance (DLNA), includes Sony, Intel, Microsoft, Philips and HP Ubiquitous Open Platform Forum (UOPF) in Japan	Intelligent Grouping and Resource Sharing (IGRS) 3C-Convergence Standard	IGRS under the Science & Technology Dept of MII with over 20 local companies and several foreign companies such Intel, Microsoft, Sony, Samsung. But several Chinese companies, e.g. Huawei, ZTE, TCL and Konka, have also joined the DLNA (previously the Digital Home Working Group) ⁴⁶
3G Mobile Telephony	Wideband-Code Division Multiple Access W-CDMA (Europe) and Code Division Multiple Access CDMA-2000 (USA)	W-CDMA (tba); CDMA-2000 (tba); Time Division-Synchronous TD-SCDMA (tba). Postponed 3G licensing announcements suggest TD-SCDMA trials found problems.	TD-SCDMA became a recognised ITU (IMT-2000) 3G standard for Universal Mobile Telecom System (UMTS). Developed by Datang Telecom Technology Company (the China Academy of Telecom Technology under MII is the parent) in collaboration with Siemens. Qualcomm and Nokia hold many of the CDMA patents. ⁴⁷

			Chinese vendors are prepared to produce dual-band handsets, but service providers face an uncertain business case for TD-SCDMA
Wireless Local Area Networks (WLANS) – uses ‘contention’ method MAC (media access control)	802.11 security standards: Service Set Identifier (SSID); Media Access Control (MAC); Wired Equivalent Privacy (WEP) for WiFi (Wireless Fidelity) networks	Wireless LAN Authentication and Privacy Infrastructure (WAPI)	Xidian University National Key Lab and its company IWNCOMM developed the WAPI encryption algorithm. From 2001, ChinaBWIPS working group steered it, ⁴⁸ and in 2003 SEMC and SAC declared it the national standard. ⁴⁹ It was declared mandatory as a security issue in 2004 and foreign companies required to partner with licensed Chinese companies, ⁵⁰ but China relented after international protest from the WiFi industry and US Government. China has been battling for the IEEE to accept the standard
Worldwide Interoperability for Microwave Access or Wireless MAN (WiMax) – uses scheduled method MAC (media access control)	IEEE 802.16 fixed led by Intel, Nokia and Motorola; Korea agreed to harmonise its WiBro standard with WiMax in the 802.16e mobile version using modulation Orthogonal Frequency Division Multiple Access (OFDM) ⁵¹	CCSA submitted 802.1d interface, equipment and testing standards	CCSA’s 2006 submission suggests China is developing patentable technologies within the IEEE international standards framework. Companies involved include the MII Telecom Research Institute, ZTE, Alcatel Shanghai Bell, Huawei, CAS Institute of Computing, and the Shanghai Centre for Wireless Communications.
Radio Frequency Identification (RFID) tags	Electronic Product Code (EPC) Network	MOST and 14 other ministries issued White Papers in June 2006 declaring that China would develop its own standard; both EPC and local standards would be in use	China has established a working group to develop its own RFID standard, but many WOFEs such as Walmart already use the EPC standard; RFID is also part of the China-Japan-Korea ICT research agenda. RFID is used for ID cards, pioneered by the ‘Golden Card Project’ of the early 1990s. The most successful industry application is the MOR’s Automatic Train Information System begun mid-1990s ⁵² .

Source: Compiled from various sources by John Ure, TRP, University of Hong Kong

3.4 ICTs and China’s 11th 5 Year Programme

China’s 11th 5 year programme, presented by Premier Wen Jiabao to the 10th NPC in March 2006, was for the first time officially referred to as a ‘Programme’ and as such represents a departure from previous Plans that set mandatory targets, often not achieved. This time the targets are divided into two categories, anticipated and obligatory, with economic targets being recognised as aims to be achieved through a ‘social market economy’ mechanism rather than through administrative instruction. The role of ICTs is prominent within the Programme and referred to throughout. For example, the following extract from Premier Wen Jiabao’s speech mentions a number of priority issues identified in the Programme, all of which have implications for ICT applications.

“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 Outline (draft) 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.”

The six strategic priorities of the Programme are: (1) building a new socialist countryside, (2) accelerating economic restructuring and reducing the social costs of economic growth, (3) promoting development among the regions, (4) increasing the capacity for independent innovation, (5) deepening market reforms and opening to the global economy, (6) building a harmonious society. The underlying understanding of the authorities in China is that legitimacy springs from achieving economic and social development while maintaining social

harmony. In one way or another each of these six key tasks is aimed at this goal. The role of ICTs is recognised as cutting across each of these tasks. For example, (1) the MII aims to connect every rural village to the telecommunications network by 2010 and to bridge the digital divide by providing ubiquitous Internet access. This in turn is helping the Ministry of Education to provide Web-based distance learning. E-Government has been a priority for China since the late 1990s, and the first e-Health experiment with patient's records is due to begin shortly between a hospital in Guangzhou and Hong Kong.

The restructuring of industries (2) is a high priority along with the conservation of resources, such as energy, forests and fresh water supplies, and with improving the environment.⁵³ In each of these areas ICTs have applications, and, as Premier Wen emphasises:

"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... We need to strongly promote upgrading of equipment and technology, focusing on energy saving and decreasing consumption of materials and more quickly eliminate production processes, technologies and equipment products that waste energy, water and raw materials."

The improvement of management and management information systems is also referred to at this stage in the Work Report as part of this process. This corresponds with the long standing focus of the authorities in China on e-Government, for example through the more than twenty Golden projects.⁵⁴ The Golden projects include placing the bank clearing system online, real-time customs and excise data, taxation returns, agricultural price and product data, and so forth. But since the 10th 5 year programme the emphasis shifted from state-driven to enterprise-driven adoption of ICT systems, a drive for efficiency and waste reduction, a focus reinforced by the 11th 5 year programme.

The contribution of ICTs to more balanced growth between the regions, task (3) is posed in terms of the continuing role of technology and special economic zones, although the eastern region will continue 'to lead the country in development', especially the SEZs in Guangdong, the Pudong New Area in Shanghai the Binhai New Area in Tianjin, the coastal city of Beijing. The most important emphasis on ICTs comes under

task (4) where Premier Wen refers to the Outline of the National Programme for Long and Medium Term Scientific and Technological Development released at a conference attended by President Hu Jintao in January 2006 by the National Development and Reform Commission (NDRC), the Ministry of Finance, the Ministry of Science & Technology, and the China Academy of Science. The Outline Programme identifies five main sectors for special attention: information technology, biotechnology, hi-tech materials, energy and aerospace. The Outline Programme also enumerates various means of financial support to R&D.⁵⁵ This includes tax incentives, funding for SMEs, government procurement policies and grants for technology applications, etc. This is all part of the effort, in Premier Wen's words, 'to strengthen the national innovation system'.⁵⁶

Deepening reforms and opening to the international economy (5) became a cornerstone of China's government policy the moment China entered the WTO. The important point to note here is the determination of China to promote the overseas expansion of trade and investment in high-technology areas by encouraging Chinese manufacturing and service enterprises to 'go global' including investing overseas in R&D, manufacturing and service networks.

"We will support the export of service products and high value-added products with Chinese intellectual property rights and trademarks...We will further open the services sector to foreign competition. We will support qualified enterprises going global, making overseas investments, conduction [of] international business in conformance with general international practices, and establishing processing centres, marketing and service networks and R&D centres in other countries."

There is also an interesting reference to making 'the mechanism for dealing with trade disputes more efficient', to 'handle trade frictions properly' and to 'play a constructive role in the new round of WTO talks.' Finally, the role for ICTs in building a harmonious society (6) arises at two very different levels. ICTs will play an important role in advancing the availability of health care, education, access to e-Government, and so forth. ICTs are also mentioned in terms of strengthening the military to 'raise the army's overall ability to fight a defensive war fought using IT' and to 'improve defence-related research and development of new and high-tech weapons and equipment.'

Given the importance attached to ICTs, for every major task set out in the 11th 5 year programme, and especially for the encouragement of innovation in processes,

products, 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 Programme 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 Programme 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

4. CHINA'S REVEALED COMPARATIVE ADVANTAGE IN ICTS

4.1 Overview and analysis

Since China ushered in the Open Door policy after 1978, a new world economy has emerged. The industrial processes (extractive, processing, manufacturing, assembly, etc.) and business services (ICT systems integration, warehousing, transportation, distribution, retail, marketing, financial, legal, etc.) that make up the many supply or value chains in the gross national products of different countries have undergone major transformation. They have become globally redistributed between companies and globally relocated between countries. Accompanying this restructuring of value chains on an international basis, referred to as a new international division of labour, an international fragmentation of production, delocalisation, etc., have been new theories of international trade and investment exploring the relationship between trade and investment on the one hand and national economic and industrial development on the other.

These theories hypothesise a correlation between trade volumes and productivity. Trade first tends to stimulate imitation (and later innovation), on the export side to maintain competitiveness and on the domestic side as a result of spill over effects, demonstration effects and technology and productivity catch-up. The effects of intra-industry trade and investment associated with particular value-chains tend to focus these productivity benefits on particular sectors, such as those that make up ICTs, rather than their economy-wide usage. This results in the emergence of a different set of comparative advantages in trade. For example, within ICTs according to evidence

analysed by Amighini (2005) of UNCTAD⁵⁷ China has become especially competitive in sectors such as audio-visual equipment and telecommunications equipment (see below). A third trend identified by theoretical and empirical research is that technology transfer (including knowledge and skills) is closely associated with trade in intermediate goods. According to Amighini, 'Cheung and Lin (2004), using provincial data for 1995-2000, it can be shown that there have been spill over effects of foreign direct investment on innovation activity via several channels, such as reverse engineering, skill-labour turnover from foreign-investment-related companies to local companies, demonstration effects and supplier-customer relationships.'⁵⁸

A key factor indicating that China is developing an ICT production capacity beyond low value-added activities such as assembly, testing and packaging is the growth of a domestic intermediate goods and services sector, in particular the 'parts and components' categories of the SITC 5-digit industrial index. In undertaking an assessment of China's progress, Amighini (2005) makes use of the net trade index (NET), which measures the shift from import-dependency towards sectors that are export led⁵⁹. Amighini concludes 'the dramatic surge in exports of high-technology goods has been accompanied over time by a switch from China being a net importer to it being a net exporter of parts and components for ICT products. This suggests that the core of ICT production has progressively moved to China through foreign direct investment by leading manufacturers.' Amighini finds significant gains in the IT (SITC 752) and telecom equipment (SITC 764) categories, including parts and components. The office machines (SITC 751) category shows selective gains, for example in photocopying equipment, while the semiconductors (SITC 772) category shows little change with China remaining a major net importer of electrical circuits and parts and components.

A second measure of China's increasingly competitive trade position in ICT products is revealed comparative advantage. This is indicated by a country devoting a greater share of its total exports to a particular product or sector than the proportion of world trade represented by trade in that product or sector. Amighini identifies the following 5 digit SITC categories in China's ICT sector where between 1991 and 2001 China displays a revealed comparative advantage in trade. In **Table 5** the higher the value above 1 the greater the comparative advantage.⁶⁰

Table 5 China Revealed Comparative Advantage 1991-2001

SITC	Description	1991	2001
751	Office machines		
75121	Electronic without external source of power	7.46	6.70
75122	Other calculating machines	5.75	2.43
75132	Electrostatic photocopy, apparatus, indirect process	0.02	2.11
75199	Office machines, n.e.s.	0.80	2.05
7591	Parts, accessories of the apparatus of heading 7513	0.02	1.25
75995	Parts, accessories of the machines of sub-group 7512		
764	Telecom products		
76411	Telephone sets	6.90	7.07
76419	Other telephonic or telegraphic apparatus	0.30	1.15
76421	Microphones and stands therefore	1.36	2.23
76422	Loudspeakers, mounted in their enclosures	0.37	4.91
76423	Loudspeakers, not mounted in their enclosures	0.99	4.60
76424	Headphones, earphones & combined microphone/speaker	5.02	10.05
76425	Audio-frequency electric amplifiers	0.80	1.41
76426	Electric sound amplifier sets	0.45	1.89
76431	Transmission apparatus	0.30	1.00
76432	Transmission apparatus with reception apparatus	2.38	4.27
76491	Parts and accessories for apparatus of heading 7641	0.12	1.68
76492	Parts and accessories for apparatus of heading 7642	0.44	2.03
76493	Parts and accessories of 761, 762, 7643, 7648	0.39	2.11
76499	Parts and accessories for apparatus of heading 763	1.18	3.66
752	IT products		
7526	Input or output units, whether or not with storage	0.23	3.56
7527	Storage units, with the rest of the system or not	0.01	1.54
75997	Parts, accessories of the machine of group 752	0.14	2.06
772	Semiconductors		
7722	Printed circuits	0.11	1.20
77253	Other apparatus for protecting electrical circuits	0.87	4.18
77257	Lampholders, voltage < 1000 volts	2.20	1.56
77258	Plugs & sockets, voltage < 1000 volts	0.85	2.18
77259	Other apparatus for electrical circuits < 1000 volts	0.31	0.98
77629	Parts of the tubes, valves of the sub-groups 7761, 7762	0.05	1.22
77631	Diodes, not photosensitive nor light emitting diodes	0.08	1.01
77632	Transistors, dissipation rate < 1 w	0.18	1.24
77681	Piezo-electric crystals, mounted	0.15	3.38

Source: Amighini (2005) Table 3.

4.2 Building Comparative Advantage in Trade and the Role of IPRs

Establishing comparative advantage is clearly beneficial to a country but to remain effective over the longer term it requires the development of a capacity to innovate and move up the value chain as competing countries offer locations with even lower land and labour costs.⁶¹ Certain conditions must apply if this shift is to be successful. They include first, retaining a growing portion of the value-added in-country for reinvestment, and second, access to the technologies, skills and know-how required to make the transition happen. The issue of retaining 'value-added' is related among other things to the proportion of trade and investment that remains in foreign hands, and of that, the proportion of the value-added that is extracted from the accounts of companies in China through intra-industry transfer pricing.⁶² The issue of technology transfer and technology diffusion in China is

influenced by who owns the IPRs and how much they charge for them. IPRs influence both issues, as many original equipment manufacturers (OEMs) in China, for example those producing mobile handset components for export to the rest of the world, are bound by the IPRs owned by their clients and these are reflected in the payments they make for intermediate imports.

Although neither of these issues is the subject of Amighini's study, the implication of that study is that China is moving up the value chain. But according to China's Ministry of Commerce, 'During the first 10 months of 2005, imports of hi-tech products by foreign investment enterprises amounted to USD125.59 billion, up by 24.2% and accounting for 79.7% of total imports of such products. Exports were USD150.38 billion, up by 34.2% and accounting for 87.8% of total exports of hi-tech products.'⁶³ For this reason, caution must be used when interpreting the evidence of revealed comparative advantage

enjoyed by Chinese exporters in ICT products. For this reason also, China naturally puts great emphasis upon the need for a fair, reasonable and non-discriminatory (FRAND) regime of IPRs as they enter the standards setting process for the ICT sector. China has also shown a tendency to look for home-grown technologies or at least domestic variants of foreign technologies to achieve two key objectives. The first is to reduce dependency upon foreign IPRs and to reduce the costs of technology diffusion. Second, to extract similar IPR benefits from the development of home grown standards through 'independent innovation', or to improve the bargaining power of Chinese companies, for example in reaching cross-licensing deals, and thereby retain more value within China for reinvestment.

4.3 Building Intellectual Property

A fair and consistent IP protection regime which is regularly enforced is a prerequisite for technology transfer to take place on any significant scale. Better protection will allow foreign companies to be more confident that IP theft and counterfeits of their products will not result from any technology transfer to Chinese partners. Furthermore, Chinese companies will benefit from direct access to new technologies increasing their ability to move up the value chain among competitors. Otherwise the effects of FDI in intermediate goods manufacturing is likely to be confined to foreign-owned companies, foreign-invested companies (joint ventures with local companies) and/or OEM activity, with IPRs preventing the application of the technology to domestic producers⁶⁴. In China, foreign-invested companies, that is where foreign investors are in partnership with a domestic producer, are the most likely channels for technology transfer in the ICT sectors. However, as noted above, trade in ICT products remains dominated by foreign-invested companies and China's OEMs who are really just customers of foreign companies who hold the IPRs.

The development of Chinese 'home' innovations and intellectual property has seen a marked increase in the past few years. According to Science and Technology Minister Xu Guanhua, 99% of Chinese companies may not own any invention patents,⁶⁵ However according to the State Intellectual Property Office (SIPO) 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. Actual patents issued to domestic applicants (11,404) fell short of those issued to foreign applicants (25,750).⁶⁶ Most recently, it has been

reported by the World Intellectual Property Organisation (WIPO) that in 2004 China overtook Europe to become the 4th largest country for patent applications after Japan, the US, and Korea⁶⁷. In 2004, invention patents for electronic digital processing ranked second behind medical and pharmaceutical patents, and in a close third came digital transmission patents, a category in which for the first time Chinese patents represented just over 50 per cent of the total. Included for the first time as a sub-category was China's home-grown IGRS digital equipment networking industry standard. 'The patent applications were mainly filed by several large corporations such as the Huawei Tech Co. Ltd., ZTE Communication Co. Ltd. Shenzhen, LG Electronics Tianjin Electric Appliances, Beijing Harbour Network Co. Ltd., Lenovo Beijing Co. Ltd., etc., and some universities, research institutions such as Shanghai Jiaotong University, Beijing University of Posts & Telecom, Beijing Aeronautics & Astronautics University, Tsinghua University, the Chinese Academy of Sciences, etc.'⁶⁸ This indicates a catching up process in China, at least in the ICT sector and has enabled some of China's leading ICT companies to enter licensing and cross-licensing agreements with leading foreign multinationals as **Annex 2** Patents and Licensing Agreements illustrates.

4.4 Cost Advantages

Cost advantages arising from low land and labour prices are attractive in the short-term for foreign competitors. This has driven foreign investment in locations designated by China's authorities, and these direct investments have become substitutes for exports to China. China has become the low-cost base for exports to the rest of the world, but these cost advantages are diminishing for three reasons. First, land and labour prices are rising in China in response to rapid industrialisation and economic growth. Second, as China's leading enterprises climb the value chain their R&D expenditures rise, the price of quality control rises and as a more knowledgeable and skilled workforce is required, the cost of wages and salaries also rises. Third, foreign competitors reduce their costs by relocating production, by refocusing on core business, outsourcing or exiting lower value activities and streamlining their supply chains. Still, China's leading companies retain many cost advantages, which reflect two factors. First, many have not yet reached the higher value ground and their products may be high quality (a crucial first step improvement for reputation and brand image) but their functionality, design and level of sophistication is not on a par with foreign brands. The case of mobile phone handsets was given previously as one example. The

same seems to be true of other areas of telecom equipment.

Many of China's enterprises receive various forms of State support. Direct funding from ministries is one way. The following passage from the news service INTERFAX provides a good illustration:

"China's Ministry of Information Industry (MII) said in a circular issued Wednesday that it would encourage large-scale Chinese IT companies to do more business overseas by offering preferential tax, foreign exchange, and credit loan policies [...] The ministry will provide tax help by enlarging the number of export products that are eligible for government tax rebates, as well as increasing the number of export products eligible for more flexible foreign exchange regulations.

*The ministry will also encourage companies to raise funds overseas. At the same time, the MII will provide more national credit loans for Chinese IT companies that participate in assistance projects initiated by the Chinese government in developing countries. These loans will be available to electronics manufacturers, telecom operators, TV, and entertainment companies. In addition, the MII's IT Fund, a national endowment for China's IT industry, will increase its capacity as a source of venture capital this year. One of the fund's focuses will be to attract ethnic Chinese living abroad to start new businesses in China. The ministry also said it would step up support for Chinese software outsourcing companies by providing export credit and employee training services, among other forms of support. In addition, MII said it would increase investment in R&D activities for software, integrated circuits and key component, and further support development projects such as next generation communication networks and digital TV. Development of terminal products with high added value will be bolstered as well, including high-performance computers and 3G mobile communication equipment."*⁶⁹

Box 1 cited the example of the MII's subsidies to Vimicro. In 2006, Vimicro, a leading IC manufacturer, and Ningbo Bird, a top mobile handset maker, received funding of up to RMB60 million from the MII to develop a chip design and handset to support China's 3G standard. Many similar examples could be cited. Another important source of funding comes from lines of credit from China's banks even though they are seriously over-extended with NPLs (non-performing loans). These lines of credit are generally not possible to get without the support of one or another government agency, such as a ministry or a provincial government. China's industrial structure has for decades been vertically organised and administered under different ministries and although enterprise market reforms are breaking up this hierarchical structure the relationships remain close. Because the issuing of licenses and permits is not transparent in China's bureaucracy, despite for example the requirement for China to have transparent regulations governing the telecom sector under the WTO Basic Agreement on

Telecoms, business planning and the costs of doing business in China are far higher than they should be.

Government Procurement

One other area in which the State plays a very important role is in procurement, not least because of several national priority Golden Projects that involve ICTs and a major e-Government development programme. China is not yet a signatory to the WTO Agreement of Government Procurement (GPA) and access to the important public procurement market in China remains an issue of concern for foreign companies, especially as it affects the market for software products. Just how important becomes evident from these WTO figures: 'in most countries, procurement represents, on average, 12-15% of GDP.'⁷⁰ In China, central government procurement accounted for 1.4% of GDP in 2003. This figure excludes state-owned enterprises, public utilities and defence-related organisations. Data provided to the WTO suggests local government authorities in China purchase 14 times as much as central government.⁷¹

China's Law on Government Procurement (2003) links government purchases to the achievement of the government's economic and social goals and applies to State organs, public institutions and social organisations. However, it does not apply to state-owned enterprises.⁷² 'It also appears there is a preference for state purchases of "domestic goods, construction and services", which are not defined by the law.'⁷³

5. BARRIERS TO TRADE AND INVESTMENT

Table 6: Overview of Market Access Obstacles

Section	Topic
5.1	Certification and Standards Issues
5.2	IPR Licensing and Infringement

In this report, two categories of barriers to trade are identified. First, what might be termed 'unnatural' barriers, those that are imposed through policy or regulation, and second 'natural' barriers, those that relate to market factors such as costs and culture. The following sections list these barriers, and provide a brief qualitative description derived both from desk research, and the results of the industry survey. **Annex 7** provides a visual summary of both the market driven competitive forces as well as those derived from 'unnatural barriers.

In the ICT sector, since China signed the International Technology Agreement (ITA) of the WTO, tariff barriers have not been an issue, however customs issues remain. Chief among these are issues of certification.

5.1 Certification and Standards Issues

In 2001 and 2002, the National People's Congress (NPC) revised the PRC Import and Export Commodity Inspection Law and the PRC Product Quality Law. AQSIQ (Administration for Quality Supervision Inspection and Quarantine) and SAC (Standards Administration of China) issued codes of practice governing the adoption of international and mandatory standards. Included in the changes was the introduction of a unified certification 'CCC' mark to replace the 'Great Wall' mark for domestic products and the 'CCIB' mark for imported products. By February 2003, the CNCA reported that 37,000 products from 25,000 domestic and foreign companies had been issued with the 'CCC' mark, but as a Weeks and Chen report (2003) stated, there remain problems for products that do not require certificates but share the same custom's harmonisation system (HS) code as products that do. While the CNCA has been pro-active in launching a capacity-building programme with the PRC General Administration of Customs to rectify the situation and to issue temporary certificates or exemption documents where necessary, Weeks and Chen acknowledge that the problems are diminishing. They also cite anecdotal evidence to suggest that delays at ports of entry have not yet been entirely eliminated⁷⁴.

Certificates relate to products meeting certain mandatory standards, but industry standards set by standards development organisations (SDOs) are generally a greater problem because a standard should be mandatory or heavily promoted only if it is reasonable to do so, for example on grounds of health and safety or national security. In the case of the former, then compliance should be just a matter of making the appropriate adjustments that should involve one-off costs, and applying for the required certificates, where the cost is usually a time issue. In the case of a national security issue, the market is probably closed to foreign companies. The reason why the previously cited WAPI case became heated as a non-tariff barrier to trade issue was because a national security argument was being applied to civilian markets. The standard would have been mandatory for foreign companies, and foreign companies would have been forced to enter into trading agreements with a limited number of locally licensed partner companies. But most ICT standards issues in China concern industry standards, with the major examples listed in **Table 4**. **Box 3** lists the major standards development bodies related to ICTs in China.

The standards setting process in China is in a state of flux. On the one hand, it is seen as serving the interests of national development,

so technologies such as TD-SCDMA, AVS, WAPI and the equipment networking standards. These are being generated by the IGRS Working Group and are regarded as strengthening China's national drive to innovate, create its own portfolio of IP and enhance its ability to participate in the high value end of global trade in next generation ICTs. On the other hand, there is a tendency to shift the process towards the enterprise sector and for government agencies to play a less direct role. In this regard, China's most innovative enterprises have an interest in staying connected to standards that will allow them to sell and produce in overseas markets. This is evidenced by the participation of China's leading companies like Huawei, ZTE, TCL and others in international SDOs such as the Digital Living Network Alliance (DLNA) as well as domestic bodies.

For foreign companies trading or investing in China the standards setting process essentially raises two problems: First, local standards fragment the global market and undermine the efficiencies of economies of scale many foreign multinationals can otherwise achieve. An interview, conducted for this report, with a leading European-based ICT company provides an interesting insight into the problem:

"The current situation is 'wild west' atmosphere where every one has to survive as best they can. On the one hand you are required to have local R&D in order to respond to local requirements (standards), but on the other hand there is no long term planning and development possibilities for your R&D investments in China. Thus business planning is very difficult and leaves one's role as a follower rather than a leader." (Interview)

When asked whether this posed a major problem for their investment in China, the response below in effect says that while it does not deter investment it holds back the business. This implies that the level of investment is lower than it otherwise would be:

"Yes and No. The business would prospect much better if [it] used global standards as such. However, as a big company, we are capable of responding even to unreasonable requests. The biggest problem is the degree of difficulties in business planning when the standards and technologies to be used in China are unknown, and the business advantage provided to Chinese companies by [us] having less visibility than they do."

Second, the process is often not at all transparent and foreign companies can face difficulties in participating and influencing the outcomes. Again the interview provided an experience of this:

"The documents are available for review only with very short notice, there is no fixed schedule for the meetings, no appropriate agenda thus limiting

preparation possibilities. The standard drafts are modified arbitrarily between meetings and meeting comments do not have effect with regard to the content, etc. There is no influence into the content of standards as they are dictated by the drafting people and the meetings are used to rubber stamp the proposals with no possibility for meaningful discussion."

It should be emphasised that this experience is not universal, and clearly some of the standards setting bodies are more transparent than others. In an interview with another European-based ICT company, again active in China, there were no complaints about the workings of the IGRS Working Group or voting

rights and according to an official of that SDO any foreign company was permitted to stand for election to the governing body.⁷⁵

Therefore, it can be clearly seen that the adoption of local standards in the Chinese market would have a negative effect on the growth of both foreign and Chinese companies - the former in the Chinese market and the latter in the overseas market. This is clearly an area in which a European-China dialogue would be beneficial to establishing guiding principles for the future.

Box 3: Telecom standards working groups

China Communications Standards Association (CSSA) comes under the remit of the MII and coordinates the work of many telecom standards working groups, such as:

* *China Broadband Wireless IP Standard Working Group (ChinaBWIPS)* – established in 2001 with MII approval. The founding members are CESI, Xidan University, Beijing Institute of Post and Telecommunications, Jiaotong University, Xi'an Institute of Post and Telecommunications, Hanwang Technologies, Guilin University of Electronic Technology Research, Centre for Commercial Key of China, National Radio Monitoring Centre and China IWNCOMM Co. (Group Leader)

* *Mobile Multimedia Technology Alliance (MMTA)* – founded by China Academy of Telecommunication Research (CATR) of the MII, CM, CNC, CT, CU, China Putian (Potevio), Huawei, ZTE and Vimicro to promote 3G applications

* *Future Mobile Communications Forum (Shanghai)* – founded by 26 companies in 2006 to boost development beyond 3G, including 9 multinationals (Siemens, Nokia, Ericsson, Philips, Shanghai Bell-Alcatel, Motorola, Samsung, France Telecom and NTT DoCoMo), China Telecom, China Mobile, China Netcom and China Unicom, and domestic equipment manufacturers including Huawei, ZTE and Datang Telecom.

* *TD-SCDMA Alliance (TDIA)* – formed in 2002 by Datang Telecom and seven local vendors.

* *Internet Society of China (ISC)* – founded in 2001 under the MII with more than 70 sponsors, the current chair Mdm. Hu Qiheng, the Vice-Chair of CAST (China Association for Science and Technology) and the academician of Chinese Academy of Engineering.

China Electronics Standards Institute (CESI) comes under the MII and coordinates the work of many electronic standards working groups, such as:

* *China Digital TV Industry Alliance(DTVIA)* – established 1998 with more than 20 members: Konka, TCL, SkyWorth, Xocec, Fujian Hitachi, SVA, Panda, ZhenJiang Com. Co., Soya, Hisen, Peony, C&W, BBEF, GreatWall (Tian Jin), NTC, Tong Fang, AutoSoft, Wall Investment, Guang Yu, ZhongXing, Academy of Broadcasting Science (SARFT) and Research Institute of TV & Electro-Acoustics (MII).

* *China Audio Industry Association (CAIA)* – represents 60-70 DVD manufacturers in China.

* *Intelligent Grouping and Resource Sharing (IGRS)* – home networking group (MII) founded in 2003 with 22 local companies to support its emerging standard, including Lenovo Group, Great Wall Computer Co., consumer electronics and communications makers such as TCL Group, Konka Group, and Hisense Group.

* *Audio and Video Coding Standard Workgroup of China (AVS Working Group)* – set up under the SCIENCE AND TECHNOLOGY DEPARTMENT OF THE MII IN JUNE, 2002.⁷⁶

* *WAPI Industry Alliance* – founded in 2006 by 22 companies, including China Telecom, China Mobile, China Unicom and China Netcom, computer makers Lenovo and Founder, chip designers China IWNCOMM Co and Beijing LHWT Microelectronics Inc.

* *China IPv6 Alliance* – 'industrial bodies, research institutes, Universities, individual experts, etc, are welcome to join the council not only domestically but also internationally.'

- *China Software Industry Association(CSIA)* – founded in 1984 and assigned responsibilities for promoting the aims of the State Council's Document 18 issued June 2000 'Encouraging the Development of the Software Industry and IC Industry' including intellectual property.

5.2 IPR Licensing and Infringement

In order to justify substantial investments into R&D, companies need to be able to be sure they can recover their costs. However, in China, the authorities often seem to impede the engagement of patent holders in licensing negotiations with Chinese companies. This allows Chinese companies to take advantage of their already considerable comparative cost advantages discussed above to export to the EU and third markets at the expense of competitors.

In addition to the above licensing concerns, the wider, horizontal, problems relating to IPR found in other sectors apply to ICT as well. For a more general discussion of this problem please refer to **Annex 1** of this study.

5.3 Market Access Obstacles: Survey Results

The following market access obstacles are based on the industry survey conducted by the consortium in May 2006. The main obstacle currently perceived as preventing further expansion in the Chinese Market is government intervention (40% of times mentioned, see **Figure 2**).

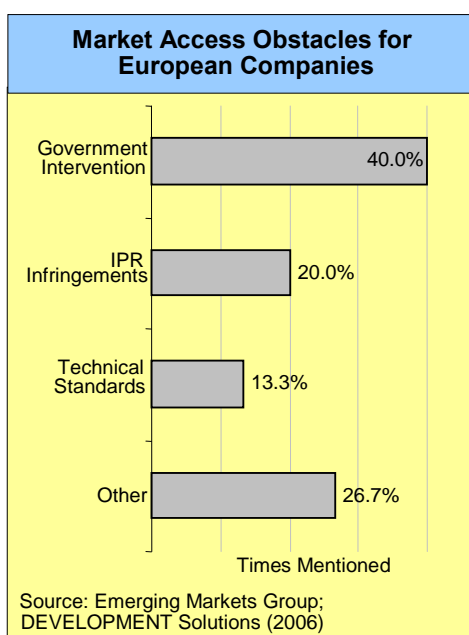


Figure 2: Market Access Obstacles for European Companies

Government intervention as described by respondents include: preventing market access by excessive regulatory controls, discriminatory practices in applying laws and

regulations, and other forms of local protectionism. The lack of IPR protection is also of significant concern (20% of times mentioned) acting as a disincentive for the transfer of higher-end technologies. Of further concern is the adoption of indigenous technical standards (13.3% of times mentioned) which are increasingly seen as a technical barrier to trade. The European companies surveyed also mentioned a host of other obstacles, including price competition, geographical challenges and difficulties with access to financial services (26.7%).

5.3 Quantification of Market Access Obstacles

To establish the quantitative impact of market access obstacles on EU-China trade, a partial equilibrium (PE) model was applied by the study's quantitative analysis experts (for further details please refer to the separate **Technical Appendix**). Inputs for the model were based on assumptions derived from the qualitative analysis discussed above, with estimates for the impact of non-tariff barriers to trade (NTBs) and regulatory restrictions calculated in consultation with trade experts and industry representatives, and compared to existing datasets on *ad valorem* NTBs from the World Bank. The PE model was then used to make several sets of calculations, each assuming a different outlook scenario. Finally, the quantitative impact of these market obstacles was then derived by comparing the current situation with the liberalised trade scenario.⁷⁷

The key quantification results from the model for the ICT Equipment sector are outlined in **Table 7**. The model compared current conditions with a scenario where tariffs and NTBs were eliminated. Under the liberal trading regime overall economic welfare increased by 15% whereas local production would almost not be affected, decreasing by only 0.87%. In addition, the European-based ICT industry exports to China increased by \$3.7 billion. The cost in lost business opportunities resulting from NTBs alone amounted to \$1.5 billion.

Additional comments on the quantitative costs resulting from market access obstacles, based on the industry survey as conducted by the consortium in May 2006, are outlined out in **Table 8**. The costs or impacts resulting from the aforementioned obstacles for some companies equate to as much as 50% in terms of revenue growth constraints.

Table 7: Quantification of Market Access Obstacles

Chemicals (HS 28 &-29)⁽¹⁾		
Current Conditions	China Imports from EU-25 ⁽²⁾	\$5.6 billion
	Domestic Production Output ⁽²⁾	\$282.7 billion
Conditions Under a Liberalised Trading Regime ⁽³⁾	Welfare Improvements ⁽⁴⁾	15.11% increase
	Change in Domestic Output	0.87% decrease
Cost of Lost Business Opportunities of EU Companies Exporting to China.	Estimated Total Cost	\$3.7 billion
	Cost of NTBs Alone	\$1.5 billion
Notes: ⁽¹⁾ HS codes for ICT Equipment were based on the categorisation proposed by the UN/OECD ⁽²⁾ China imports from the EU-25 and production data uses 2004 figures ⁽³⁾ A "liberalised" regime here denotes a 100% cut in tariffs and non-tariff barriers across sectors covered in the partial equilibrium model and which is applied equally to all major trading partners. ⁽⁴⁾ Economic welfare is measured by changes in absorption (total consumption) by sector Source: UN Comtrade; World Bank; China Industry Annual (Various Years); Author's own calculations		

Table 8: Quantitative Impact of Market Access Obstacles – Industry Survey Results

Where respondents made specific calculations:			
Comment		Sub-Sector	
		Serv	Eqp
Financial Commitments	"50% of revenue loss due to outstanding payments/Account Receivable."	•	•
Where respondents made estimates:			
Comment		Sub-Sector	
		Serv	Eqp
"20%-30% of the revenue" – Note: ICT Services include Technology Transformation Service; Workspace Management Service; Application Service; Communication Service and Security Service."		•	
"Around 40% of the turnover" - Other ICT Equipment include: Flight Simulators, Urban Traffic Control Systems, Railway High Speed Control Systems.			•
"The growth constraint is -40%" – Broad Band Access			•
"Revenue loss is around 10%-15%" – Telecom Equipment, Office Equipment and other Equipment for the Aviation Industry.			•
"Revenue loss probably 30%-50%" - Software for mobile and embedded devices		•	•
Where respondents found it difficult to quantify market access obstacles:			
Comment		Sub-Sector	
		Serv	Eqp
"There are no big obstacles that are identified. Therefore, future higher costs are not expected."			•
"The unnecessary local product modifications and lost of new business opportunities are significant however we cannot quantify them."			•

6. OVERSEAS EXPANSION OF CHINA'S ICT COMPANIES

The culture of business in China is being stretched between the pull of the market, including the international market, the workings of 'guanxi' or influential friends and local interests, and the requirements of the State. The push towards the international market is now high on the State agenda. Chapter 9 of the Foreign Trade Law provides for China supporting exports using export credits and credit insurance through the Export-Import Bank (EXIM). According to the WTO, EXIM in 2003 'granted US\$59 billion in export credits, an increase of 37.8 per cent over the previous year. Of this, 65.9 per cent was for mechanical and electronic exports, 38.8 per cent for high and new tech

exports.'⁷⁸ In the same year, it provided US\$270 million of credits to buyers in overseas markets, including for telecommunications equipment. These initiatives have been closely associated with overseas tours by President Hu Jintao to developing counties in Central Asia and Africa. In 2005, the EXIM Bank provided Huawei and ZTE with US\$600 million and US\$500 million respectively for export credit financing over three years, and MII Minister Wang Xudong announced plans for additional preferential policies, including bank loans and credit insurance, to support the international expansion of local telecom vendors.'⁷⁹

The cost advantages that companies like Huawei and ZTE can offer for all the above reasons are very appealing to operators and

Governments of low-income countries, but less so to operators in high-income countries who require not just the highest quality of equipment but also long term service agreements. As will be seen below, this does not prevent Huawei and ZTE from winning contracts in the EU and the US, but the general trend to date has been to focus on developing countries to build a large base of users and an impressive portfolio of contracts and where the demands are less sophisticated. Also these markets have been traditionally overlooked or neglected by western vendors as they focused their efforts elsewhere. A strong selling point has also been the suggestion that Huawei and, ZTE and other China companies are more familiar with the requirements of geographically large low-income markets because China's own Western provinces are low-income.

6.1 China's ICT Vendors Expansion in the US and the EU

United States

In cracking the North American market the Chinese ICT companies face new challenges: (1) raising their credibility or visibility by building up a strong brand that will erase the stigma that Chinese companies manufacture cheaply priced products of low-quality and durability; (2) building up their after-sales service and support systems outside China to ensure delivery times to large carrier and enterprise clients so as not to jeopardise rollout plans⁸⁰; (3) political opposition to Chinese companies gaining control of important companies in key industries⁸¹; and (4) dealing with the recent mergers in the industry which could put a squeeze on Chinese vendors at home and abroad⁸². However, to abet efforts to expand overseas, Chinese banks have given generous loans to Chinese ICT companies. Huawei has been the recipient of a US\$10 billion line of credit from the China Development Bank and an additional US\$600 million from China's EXIM bank.⁸³

So far Huawei in the U.S. has failed to replicate the moderate success it has had in Europe (see section 6.2).⁸⁴ Huawei opened up a North American office in March 2001 in Plano, Texas, but when Cisco sued Huawei in 2003 alleging IP theft the negative publicity apparently killed a 'significant deal with WorldCom (now known as MCI).⁸⁵ Subsequently Huawei entered into a joint-venture partnership with 3Com, one of Cisco's main rivals, to sell Layer 3 switches. In February 2006, Huawei was involved in a JV with Nortel to sell broadband access equipment. To date, in the North American market Huawei has won a handful of deals with small operators.

ZTE has been actively setting up R&D centres in New Jersey, Dallas, and San Diego. ZTE's ZiMAX Technologies subsidiary has struck a key deal with Intel to develop WiMAX gear. It is thought by some that being a listed company on the HK Stock Exchange might give ZTE an advantage over privately owned Huawei in winning American contracts. Unlike Huawei and ZTE, Haier has been successful in the U.S. market, particularly in selling mini fridges to college students housed in campus dormitories. Part of its success has been due to establishing its own fridge factory in South Carolina in 2000. However, in July 2005 Haier pulled out of a bid to acquire the U.S. companies Maytag, the third largest appliance maker in the U.S.⁸⁶

Lenovo has caused the greatest stir with its US\$1.75 billion acquisition of IBM's PC business in 2004. In May 2006, the U.S. State Department announced that the thousands of Lenovo PCs it had purchased would be limited to non-classified work for fear of spying.⁸⁷ Lenovo has stepped up worldwide promotion and marketing activities to create an image of itself as a global company and not just a Chinese company and has moved its executive offices to New York. It spent US\$16million on sponsorship of the Winter Olympic Games held in Italy in February 2006 and in Europe is running an ad campaign featuring Barcelona star Ronaldinho as a 'brand ambassador'.

Despite having a 5 year right to use the IBM trademark and the ThinkPad brand name, Lenovo has moved rapidly to establish its own Lenovo brand and sever connections to IBM while integrating the two businesses and tightening its supply chains. In the U.S., Lenovo has signed distribution deals with Office Depot and Best Buy and in April 2006 American Airlines cut a deal with Lenovo to provide computers for the airline's Admiral's Clubs worldwide.. Still it is far behind Dell and HP, the top 2 PC makers in the world. Coinciding with the visit to the US by President Hu Jintao in 2006, Lenovo was one of several Chinese PC manufacturers to commit to buying US\$1.2 billion worth of Microsoft software to pre-install on its PCs in a bid to defuse tensions of the level of pirated software in China.

Europe

In Europe, Huawei is well on its way to becoming a fully credible European supplier. Its first big breakthrough came in late 2004 when Huawei was selected to build the 3G mobile network for Dutch carrier Telfort, in a deal valued at 200-400 million euros.⁸⁸ In the first half of 2006, Huawei signed deals to be a preferred telecoms equipment supplier to BT and a supplier of 3G mobile phones to

Vodafone.⁸⁹ In February 2006, Huawei signed a Memorandum of Understanding (MoU) with KPN to work together on constructing a nationwide 3G network. In May 2006 Opal Telecom, a subsidiary of The Carphone Warehouse Group, signed an installation and support contract with Huawei for an MSAN solution for 500 sites in the first year. Huawei is also supplying soft switches to EEscape, 49% owned by BT. One noticeable setback for Huawei in Europe was its failed bid to purchase Marconi in August 2005.⁹⁰

Within Europe, Spain and Portugal show a special attraction for Chinese ICT companies; driven by the interest the Chinese have in understanding Latin American markets, where Portuguese and Spanish companies have historical ties.⁹¹ In November 2005, a visit by Chinese president Hu Jintao to Madrid paved the way for Telefonica to raise its stake in China Netcom to 9.9%. In April 2006, Huawei said it planned to set up a training centre in Portugal by the year's end where it has been cooperating with Optimus and Novis. In 2005, ZTE signed an R&D agreement with Portugal Telecom to jointly bring to market new products and services.

Eastern Europe has also represented an important portal for Chinese ICT companies to set up regional operations. In April 2006, Huawei signed a contract with Vodafone to build a UMTS network in the Czech Republic.⁹² Hungary, which opened up its doors to Chinese refugees after the Tiananmen crackdown in 1989, has the biggest Chinese community in Eastern Europe. The 200,000 square-metre China Brand Trade Centre, the first such one in Europe, is being built there and will serve as a springboard for Chinese goods into Europe. Hisense has an agreement with Flextronics to make Hisense TVs in Hungary for sale in Europe. In October 2005, Huawei opened a US\$1.5 million training centre at the Budapest computer-services company Synergon to build and service hardware. Changhong has decided to open up a TV plant in the Czech Republic with an investment of US\$100 million. In April 2006, Lenovo set up a centre in Bratislava to process orders from the EMEA region, providing technical support, financial management and after-sales services in 28 European languages. Lenovo also outsources some manufacturing to a partner in Hungary.

Like Huawei, ZTE became in 2005 one of the eight preferred suppliers for BT's US\$20 billion 21st Century Network (21CN). ZTE supplied the DSL network for the Athens Olympics and this led to a further contract with Greek

operator OTE. ZTE has also supplied France Telecom with ADSL equipment.

Conclusion

In Europe and North America it is expected that Chinese ICT companies will follow the same learning curve and investment pattern as Japan and South Korea did before them. This goes beyond trade to investment in production facilities in Europe and the US and to the acquisition of and partnering with local companies. These investments are and will be part of a global supply chain, with Chinese ICT companies increasingly positioning themselves at the most valuable points along it. Given these patterns of investment, which are typical of all major industrialised countries, it will become more difficult and less meaningful to distinguish between countries of origin and less relevant to use tariff and non-tariff barriers to trade to resolve commercial disputes.

6.2 EU and China in ASEAN ICT Markets

In 2004, ASEAN 6 imports of the two-digit category HS 85 ('Electrical Machinery, Equipment and Parts; Sound Equipment; TV Equipment') coming from the EU and from China were about equal at around US\$14 billion, representing 27 per cent and 33 per cent respectively of ASEAN's total imports coming from the EU and China. But in 2001 the respective figures were US\$12 billion imports from the EU, US\$5 billion imports from China, and while the share slipped from 30 per cent in the EU's case, it rose from 29 per cent in China's case. The figures for HS 84 – everything from nuclear reactors to ball bearings and including office machinery – were around US\$10 billion for both the EU and China, up from US\$9 billion and US\$3 billion respectively. The share of the EU's total dropped slightly from just over to just under 20 per cent, while the share of the imports from China rose from 22 per cent to 25 per cent. The figures indicate very clearly the rise in China's overseas competitiveness in these sectors. **Table 9** shows a breakdown to the SITC three-digit level of imports to the ASEAN 6 from the EU and China from a list of the top twenty imports from either country. The numbers column indicates where, in the top twenty, each product category comes.

For example, by value SITC 776 ('Transistors, semiconductors, devices, valves, etc'), is the number one import from both the EU and from China, whereas SITC 772 ('Electrical switcher relays, circuits, NES'), is the number 5 import from the EU and the number 8 import from China.

Table 9: Percentage of ASEAN 6 Top Twenty Imports from the EU and China, 2004 (in Order of Value)

ASEAN 6 High-Tech Imports from EU			ASEAN 6 High-Tech Imports from China		
No.	SITC Category	%	No.	SITC Category	%
1	776 - Transistors, semiconductors, devices, valves, etc	9.3	1	759 - Parts & accessories for office machines and automatic data processing	21.1
2	764 - Telecoms equipment, NES & parts	14.5	2	764 - Telecoms equipment, NES & parts	28.5
3	792 - Aircraft, equipment & parts	30.6	3	776 - Transistors, semiconductors, devices, valves, etc	4.4
5	772 - Electrical switcher relays, circuits, NES	10.7	4	752 - Automatic data processing machines	32.8
6	874 - Measuring/ Analysis/ Controlling Instruments and Apparatus	16.8	5	772 - Electrical switcher relays, circuits, NES	12.4
8	759 - Parts & accessories for office machines and automatic data processing	3.7	6	778 - Electrical Machinery & apparatus, NES	14.7
13	778 - Electrical Machinery & apparatus, NES	8.3	17	763 - Sound and TV image recorders and reproducers	20.5

Table 9 reveals that where imports from the EU and China compete, imports from the EU lead those from China as a percentage of ASEAN 6 imports in one category only, in SITC 776 ('Transistors, semiconductors, etc'), while imports from China lead in 764 ('Telecoms equipment'), 772 ('Electrical switcher relays, circuits, NES'), 759 ('Parts & accessories for office machines and automatic data processing') and 778 ('Electrical Machinery & apparatus, NES').

Besides 'transistors, semiconductors, devices, valves, etc.', the European competitive advantages in high-tech exports are seen to lie in 'aircraft, equipment and parts', which are included here because they include instrumentation that relies heavily upon ICT equipment, and in 'measuring, analysis and control instruments and apparatus' which are high-end precision tools usually involving sophisticated ICT components. By contrast, China's competitive advantage lies in the areas mentioned above, plus 'automatic data processing machines' for which read 'computers', which include the exports of the US, Taiwanese and other companies manufacturing in China, and 'sound and TV image recorders and reproducers' for which the same story holds true. A more detailed outline of the expansion of Chinese ICT companies in each of the six ASEAN member countries is provided in **Annex 4**.

This data supports the conclusion that in general European companies occupy the high-end of the value chain, while in many

cases using China as part of their supply chain. China on the other hand shows a mix of low-end commodity trade and more middle-to-high-end 'parts and accessories' and semiconductors, but it is likely given the data cited earlier in this report that a large proportion of the latter is from foreign-invested companies in China, for example from Taiwan. With further investment in the manufacturing of high-end ICT products in China by European companies, it can be expected that European companies will also consider using China as a more cost effective R&D base. This would free up resources to invest in strengthening other aspects of their business such as distribution networks and marketing.

7. COMPETITIVENESS OF EUROPEAN AND CHINESE VENDORS COMPARED

The following SWOT overview is based upon two sets of inputs. First, the data and analysis cited in this report. Second, returns of the questionnaires as distributed by the consortium in May 2006 to European companies doing business in China. Answers to this questionnaire reflect the perceptions of the respondents as to their own strengths and weaknesses, and the opportunities and threats, in China's domestic market and in third country markets in potential or actual competition with Chinese vendors. This information is supplemented with the views expressed by two additional vendors interviewed in Shanghai by the author 26th-28th June 2006.

Table 10: SWOT Review for EU and China

EU	China
<p><i>Strength</i></p> <ul style="list-style-type: none"> - High-end value chain and design capabilities - High quality and quality control - Good after sales service and customer care - Strong global brands - Good on innovative products 	<p><i>Strength</i></p> <ul style="list-style-type: none"> - Low costs - State-supported industrial policy, R&D, lines of credit, and national technologies. - Close relationship with China's carriers and cultural insiders
<p><i>Weaknesses</i></p> <ul style="list-style-type: none"> - Lack 'guanxi' within China - Lack understanding of China's markets - Lack good local partners, distribution channels and direct access to customers - Language problems 	<p><i>Weaknesses</i></p> <ul style="list-style-type: none"> - Low-end value chain and design capabilities - Low quality and quality control - Poor after sales service and customer care - Lack of global brands - Poor on innovative products
<p><i>Opportunities</i></p> <ul style="list-style-type: none"> - High-end value chain and design capabilities - High quality and quality control - Good after sales service and customer care - Strong global brands - Good on innovative products 	<p><i>Opportunities</i></p> <ul style="list-style-type: none"> - Low costs - State-supported industrial policy, R&D, lines of credit, and national technologies. - Close relationship with China's carriers and cultural insiders - Lax regulations
<p><i>Threats</i></p> <ul style="list-style-type: none"> - China companies moving up the value chain - 11th 5 year programme calls for the development of indigenous and mandatory Chinese standards that require expensive local adaptation costs. - Undue State support for China's companies in overseas markets - Regulatory risk in China's new media and telecom sectors - No level playing field for European companies in China: Uneven application of laws and regulations 	<p><i>Threats</i></p> <ul style="list-style-type: none"> - Rising costs and low margins - Revaluation of the RMB - Overseas policy and regulatory opposition to State-owned or heavily State-influenced companies - Lack of international standards - Litigation over IPRs - Limitation of rules discriminating against foreign competitors - Prices for production factors (e.g. wages, land) rise fast in China, making imports from the EU relatively cheaper

The industry survey conducted by the consortium revealed that the advantages expressed by the industry representatives are predominantly concerned with R&D and technology development (30.8% of times mentioned, see **Figure 3**). It is noted that while Chinese products are cheaper, quality is lower and innovation is less prevalent. This reflects the increasing emphasis being placed on R&D.

Related to this, European companies say they will increase the quality of their products and engage in innovation facilitating the provision of goods and services that cannot be offered by local companies (23.1%). In addition, respondents emphasise the importance of lobbying the Chinese government (23.1%) in order to achieve better market protection.

Localisation and further price reduction (15.4%) and other measures (7.7%), such as increasing capital strength are also mentioned.

However, the anticipated competitive threat of local companies to European companies operating in the Chinese market is perceived as significant. This is mainly due to local companies' efforts to upgrade their capabilities (66.7% of times mentioned see **Figure 4**) particularly through greater investment in domestic R&D. Local companies grow also in terms of skills, experience and "know-how", partly helped by continued government support received by at a local and national level. (11.1%). The advantage of a lower cost base (22.2%) was also identified as a significant advantage for

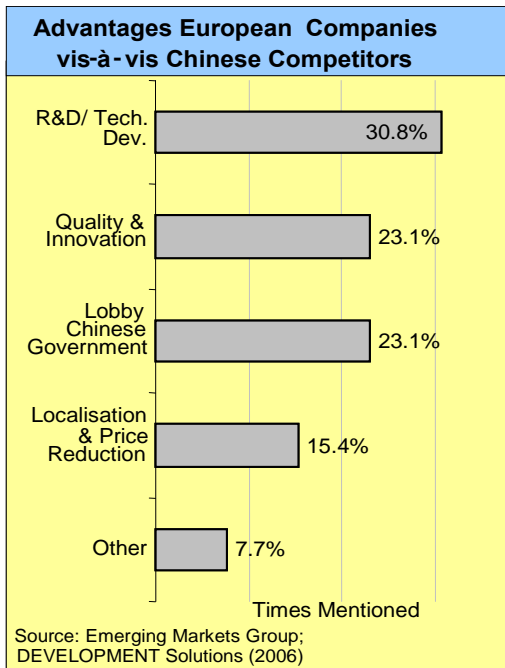


Figure 3: Advantages EU companies vis-à-vis Chinese Competitors

Chinese competitors, although it is hoped that the extent of this advantage would erode under new safety and pollution guidelines outlined in the 11th 5 year programme. **Box 4** provides selected comments from some of the companies who participated in the survey.

7.1 Future Development Scenarios

In the previous chapters, the Chinese ICT industry market was described and opportunities and advantages of European ICT companies were outlined. Moreover the current threats and obstacles have been identified. Based on current trends in the ICT sector, two different scenarios can be formed.

7.1.1 Scenario 1: Baseline

Assumption: China redoubles its efforts to develop its own national standards and to subsidise the overseas expansion of its vendors. Government policy in the area of IP protection remains skewed towards the rapid proliferation of (foreign) technology at the expense of creating an environment in which local companies can develop ownership over their own technologies based on long-term investment in R&D:

- Market access obstacles remain, including significant support given to local companies by the Chinese government in pursuing market strategies.
- Partnerships with European and North American companies will be exceptions rather than the rule and of a very limited nature unless the foreign partners are willing to

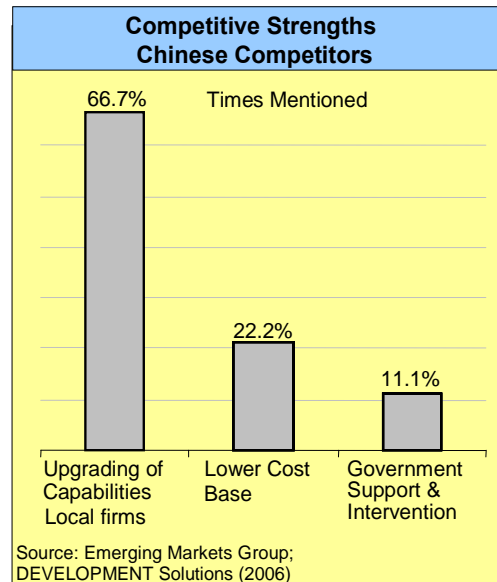


Figure 4: Advantages Chinese Competitors vs European Companies

adopt Chinese standards. Consequently, foreign participation within the Chinese market remains low. Market share of European companies at best remains constant at 15% by 2010.

- Local competitors such as Huawei, ZTE and others will continue their push into each others' business areas regardless of their core competencies with the focus on the short term market share gain. This will result in a lack of demand-driven investment into viable R&D projects and may continue the current trend of copying competitor's products and entering these markets at a discount. This will lead to continued low industry profitability and innovation, thereby stymieing the development of a globally competitive Chinese ICT equipment industry.

Low profitability at home drives Chinese ICT equipment companies abroad in search of more profitable markets. However, overseas expansion will be limited to third country low-income markets due to the low quality of Chinese products and lack of integration into the global supply chains of advanced country multinationals. The inroads of Chinese producers will be further restrained due to the lack of environmental and safety standards demanded in advanced markets.

- China will emphasise reciprocity with ASEAN nations, Central Asia, and possibly with sub-Saharan Africa and South America. This will be a resource-led and technology-standards led policy. These regional strategies could involve Japan and Korea but is unlikely to involve European and North American economies making this approach ultimately unsustainable.

Box 4: Quotations from the industry survey

The following are a selection of quotations from the returned questionnaires:

What impact do restrictions on operating in China have upon your business?

"20-30%, and the competition grows faster than the market grows" - ICT Services company

"40%" - Traffic control systems

"10-15%" - Aviation components

What are the problems of doing business in China?

"Chinese competitors follow other rules and have local privileges due to their relationship with local government."
(Manufacturer of cables)

"Overregulation, complicated type approvals, unnecessary national standards, difficulties in introducing new services..." -Tele Equip Mfg

Strengths

"Quality and time to market" -Electronic switch mfg

"Understanding of the international market, business model, product innovation, brand" -Tele Equip. Mfg

"Offer high technology, higher than the Chinese can offer" -Traffic control systems

Threats

"Fast learning, promotion by Government of Chinese technology companies" – Railway Control Systems

"EU needs to work with government to establish respect for IPRs, payments, etc." -Software vendor

Opportunities

"Invest in R&D and in alliances" -Tel Equip Mfg; "Lowering R&D costs for China, acquire companies and competences later when needed" -Software vendor

- In an attempt to compensate for this, China will place national resources behind R&D and training in an attempt to improve Chinese companies' position on the value chain and increase their competitiveness vis-à-vis foreign competitors.

Conclusion: Under this baseline scenario, the MII estimate predicts the total revenue of the ICT equipment sector to grow at a rate of 12.65% per annum reaching RMB 7 trillion, or USD 870bn by 2010 is accepted. We also apply an estimated current EU market share of 15% (Although the market share of European companies in the telecom equipment sub-sector is currently estimated at 30%, the overall sector share is estimated to be much lower.⁹³).

Foreign companies will not be able to make significant inroads into the Chinese market due to the development of China-specific technical standards in which Chinese producers have a natural competitive advantage. Consequently, the market share of European companies is predicted to remain at its current level, resulting in a quantifiable market share of USD 130.5bn in terms of revenue by 2010. It must be emphasised that the extent to which Chinese ICT equipment companies will benefit from a relatively larger market share will be minimal. Government investment-driven R&D and production facilities will result in overcapacity in some areas and shortages in other. This will mean the current unfavourable industry structure is sustained in which most Chinese companies remain only narrowly profitable. In addition, despite a higher domestic market share, under the conditions of the baseline scenario the expansion of Chinese companies in

overseas markets (barring low-income fringe markets) will also be hindered. Without the adoption of global standards, cooperation with foreign players and a lack of IP protection this means ultimately that a large amount of this investment is unsustainable and will create little added value in the long run.

7.1.2 Scenario 2: Optimistic

Assumption: China liberalises its currency regime, increases IP protection and allows its ICT companies to pursue their own interests without excessive state guidance, promoting R&D and training mainly through incentives to the non-state sector.

- Market access obstacles such as complex regulatory systems and discriminatory practices significantly reduce, allowing foreign companies better opportunities to compete against, but also cooperate with local companies.
- Increased high-level competition and cooperation with foreign multinationals results in industry consolidation, raising the competitiveness of local companies and increasing overall industry profitability.
- China adopts global standards across the ICT equipment sector rather than developing China-specific standards.
- Consequently, the share of European companies in China across the ICT equipment sector would increase by 10 percentage points by 2010 to 25%. Again, although the market share of Chinese companies diminishes, overall industry profitability should rise creating benefits for local companies as well.

- Better industry profitability and IP protection means the returns accruing from investment into R&D increase thereby shifting competition away from unsustainable price-wars towards competition based on indigenous innovation and quality. Local companies will seek more cross-licensing agreements and will focus more on the quality and less on the quantity of patents registered.
- Chinese vendors seek investments and partnerships overseas. For strategic reasons, they may favour third country local company partnerships, but to reinforce brand image they will also seek more partnerships and cross-licensing agreements with European and North American companies. With the opening up of the Chinese market to foreign participation, some of these partnerships will build on previous cooperation within the Chinese market.
- Local Chinese companies' cost base will increase due to more even-handed application of new regulations on safety and environmental standards under the 11th 5 year programme. This would allow European companies in particular to compete on a more level-playing field with local companies. Despite this, improved environmental and labour standards increases the incentive for local companies to improve innovation and quality in the long-term and, perhaps most importantly, at the same time opens up new markets abroad due to compliance with foreign standards and directives.

Under this optimistic scenario, European companies would benefit from a fairer and more open market and would be well-placed to compete across the sector. The overall market is expected to grow at the same pace as under the 'baseline scenario' based on MII estimates⁹⁴. Based on the more optimistic data received in the industry survey, the market share is predicted to grow 10 percentage points up to 25%⁹⁵. Thus, the market potential for European companies would then stand at around USD 217.5bn under this optimistic scenario. On the Chinese side, industry would see a large number of incentives to compete on indigenous innovation rather than on price-cutting. In the longer term, this would mean that any (unprofitable) market share lost in the domestic market to foreign players would be more than compensated by higher industry profitability. Furthermore, due to integration into global supply and knowledge chains Chinese companies will achieve better access to advanced markets.

8. CONCLUSION AND RECOMMENDATIONS

What are the key lessons from the SWOT analysis (see **Table 10**) First, that European companies have highly developed marketplace strengths placing them at the high end of the value chain or value networks. These strengths are based upon a combination of company-specific technical, design and managerial capabilities that have been acquired over years of experience of competing in open and global markets. Second, Chinese vendors have the determination, most of the resources and the political support of the China's Government to move up the value chain and compete globally in markets. This is especially true for those markets where buyers place more emphasis upon the cost of acquisition and less upon the quality of long-term customer care, after-sales service levels and the long run total cost of ownership. Third, that European companies are at a disadvantage in various ways competing in China's domestic market. This is partly due to local market characteristics and partly due to the difficulties and costs of doing business in China, including both non-technical barriers to trade and in some notable cases technical (standards) barriers to trade. Finally, the strengths of European companies should be leveraged as far as possible to create win-win partnering opportunities with Chinese customers and Chinese vendors. Great caution and good business sense needs to be adopted in these efforts, and the best way to achieve this is for European companies to have a credible presence in China. This entails local 'ears and eyes' to develop a good understanding of the market, of potential partners and of business methods in China.

This raises the all important questions for European companies. What can they do to maximise opportunities in markets where Chinese companies are strong? What can they do to minimise regulatory and commercial risk in China itself? And with regard to the EU, are there measures the EU can take to assist European companies in developing their presence in China?

8.1 Recommendations on Competitiveness

European manufacturers and vendors cannot beat their Chinese competitors on price or on commodity items. On design and new and advanced features however they are at an advantage.

1. China has already attracted many ICT companies as a low-cost production base for manufacturing. In this regard, China is also an attractive investment

destination for selected low-cost investments in R&D, providing European companies with more capital to increase their competitiveness.

2. European ICT industry and standards organisations should be encouraged to have direct contact with their MII (CESI for electronics and CSSA for telecoms) counterparts. Chambers of commerce, industry and trade associations should likewise be facilitated to engage with their counterparts in China.
3. A constructive approach to the development of new standards in the ICT sector would be to stimulate joint research between the EU and China in this area. Such research should seek to upgrade and develop new standards which can be commonly shared, avoiding the use of standards as trade and market access barriers. Although views on this issue diverge, it is clear that interoperability of standards should be the minimum requirement in order to reduce barriers to market entry.
4. Excellent distribution channels are required in China to compete, and that means reliable and knowledgeable local partners, which is worth spending time and money on to find out. The alternative is costly mistakes.
5. Knowing the market is always the key. Markets are cultural and so are ways of doing business. Chinese telecom companies do not need over-sophisticated equipment because the markets are not mature enough yet. This is tempered, however, by the fact that many poor rural customers of mobile networks will buy expensive handsets as opposed to cheap ones.
6. If it can be copied, it will be copied. Without management control of an enterprise in China, protect IP with cautious technology transfer policies. To protect all aspects of the business it is necessary to establish very good working relationships with all relevant authorities. This is an unavoidable part of the cost of doing business in China.
7. Establish a China office with staff that can speak Chinese and commit to a long-term presence so the company can build up a memory bank and staff can establish the long-term relationships necessary for doing business in China.
8. In third country markets, look to establish long term relationships that stress customer care and long term service level agreements where relevant.

Most European companies will have a competitive advantage here.

9. Walk away from uneconomic deals unless absolutely convinced about their strategic value.

8.2 Recommendations on Policy:

It appears that the EU is less active than the US in promoting and facilitating its companies and research institutes coming to China, although the European Chamber of Commerce clearly is active in this regard. Nevertheless, there is a perception among a number of European companies that more could be done at the EU level. Also, to assist European ICT companies to be more successful in China, the EC should encourage dialogue around issues of standards and IPRs that involve European companies and EU standards organisations and their counterparts. The EU should not confine these issues to official contacts between state officials.

1. To assist European companies to be more successful in China, the EC should consider programmes to strategise market entry. For example, European companies could work more closely together to offer synergies, to share information, and they could share training facilities for staff being posted to China.
2. The EC should set up an ICT Office in Beijing and possibly in Shanghai to collect and collate ICT industry, and policy and regulatory information on a regular basis in the same way as the privately funded USITO (US Information Technology Office) in Beijing does. This could be a public-private initiative and an enormously helpful resource, especially for European companies not very familiar with China.
3. A measure which can be taken to facilitate this process is to increase the exchange of students and researchers between China and Europe. The future lies not in protecting European companies and markets, but in stimulating R&D and innovation in new technologies, products and services, in ways of marketing and in ways of doing business. The latter will inevitably involve greater partnering and cross-investment between European and Chinese companies, and personal contacts, research and business networks are indispensable to achieve commonly shared standards
4. Expand lobby activities to ensure that China signs the WTO Agreement of Government Procurement (GPA)
5. Introduce transparent and independent regulations that e.g. ensure the reduction

of the degree of complexity in patent registration, patent searches, patent fee structures, and patent disputes resolution.

6. Future Chinese standards and legislation need to be monitored closely throughout their drafting stages. For the upcoming "China RoHS" legislation for example, the Commission needs to continue to encourage the China's authorities to show transparency on this issue to avoid unnecessary incompatibilities of the existing European RoHS and standards which might constitute a technical barrier to trade.
7. It is important that patents are not used as barriers to trade or as a means to limit or pre-empt access to markets. One fairly straight-forward measure that can be

taken to increase the transparency, of the Chinese patent office SIPO, would be to give reciprocal rights for foreign patent offices to access the Chinese patent database. The database of the European Patent Office is already accessible to their Chinese counterparts but not vice-versa. The European, Japanese and US patent offices all currently follow the practice of granting access to each other's database. This exchange of information should be encouraged to improve transparency and ensure effective administration of patents between international patent offices. It would also allow European and Chinese companies greater collaboration and partnership on common strategies in the local market.

ANNEX 1: PATENTS AND IPR PROTECTION ISSUES

IP theft, ineffective IP protection enforcement, and in some cases an official blind eye towards, or even policy favouring of the non-payment of royalty fees is a problem faced by those doing business and are investing in China. Chinese companies developing a portfolio of patents, copyright and trademarks (brands) are seen as concomitant to the objectives of the *11th five year programme* and the *Plan for National Informatisation Development 2006-2020* announced on 12th May 2006 jointly by the General Office of the Central Committee of the Communist Party of China (CPC) and the General Office of the State Council:

"The ultimate objective is to elevate China from a position of learning and using foreign technologies to one that creates."⁹⁶

Paying billions of dollars in royalties and a sense of dependency on foreign technologies is a state China wishes to move beyond, at least to the point where China can participate on more equal terms in the world market for high technology products. But China is also trying to persuade the world that it is a good citizen. The State Council published a nine chapter white paper on 21 April 2005 entitled "New Progress in China's Protection of Intellectual Property Rights" along with a short Foreword 'in order for the international community to have a better understanding of the real situation regarding China's IPR protection [...]'⁹⁷ China sees laws and regulations regarding IPRs as needing to find the right balance 'appropriate for its own national situation [between] the interests among intellectual property creators, users and the general public [to ensure a] benign circle for the creation and use of intellectual property.'⁹⁸

The main laws directly relevant to ICT intellectual property rights are:

The Patent Law (2000)⁹⁹

The Trademark Law (2001)¹⁰⁰

The Copyright Law (2001)¹⁰¹

In addition, there are Judicial Interpretations as well as several other laws such as the Criminal Code, Civil Procedure Code et al. The most relevant regulations are:

- The Protection of Computer Software (2001)
- The Protection of Layout Designs of Integrated Circuits (2001)
- The Collective Management of Copyright (2004)

- The Management of Audio-Visual Products
- The Protection of IPRs by Customs

Accompanying these laws and regulations are rules on implementation. 'In its practice of IPR protection, a two-way parallel system, namely administrative and judicial protection, has emerged in China.' The foreword to the white paper goes on to list the major state bodies responsible for implementing IPR protection, and there are many bodies responsible for approving and monitoring national and industry standards. These include essential local IPRs and foreign-owned IPRs associated with international standards, foreign-invested enterprises, local joint ventures, Chinese companies involved in OEM production and China enterprises with IPR licensing agreements. The following lists some of the main bodies and it becomes immediately apparent just how complex the picture can become for foreign companies trying to do business and trying to conform to all the requirements:

- National Development and Reform Commission (NDRC)
- State Intellectual Property Office (SIPO)
- State Administration for Industry and Commerce (SAIC)
- General Administration for Press and Publication (GAPP) – includes the State Copyright Bureau
- Ministry of Information Industries (MII) + Communications Standards Research Institute of China Academy of Telecommunication Research
- State Administration for Radio, Film and Television (SARFT)
- Ministry of Culture
- Ministry of Commerce (MOFCOM)
- Ministry of Public Security
- General Administration of Customs
- Supreme People's Court
- Supreme People's Procuratorate
- Administration for Quality Supervision Inspection & Quarantine (AQSIQ)
- Standardisation Administration of China (SAC)
- China National Certification Accreditation Commission (CNCAC)
- China Electronics Standards Institute (CESI)
- China Communications Standards Association (CCSA)

Some of these bodies are industry-level standards setting organisations, such as the CCSA set up with authorisation from the MII, the SAC and the Ministry of Civil Affairs. The scope of activities nevertheless include, according to Article 7 (1) of Chapter 2 of the

By Laws, 'to promulgate the state laws, regulations and policies on standardisation.'¹⁰² The myriad of ministries, administrations and industry bodies involved poses a problem of knowing exactly which body is responsible for what. This is especially true for foreign companies unfamiliar with the structure of China's IPR and standards implementation, enforcement procedures and mechanisms. It also poses a problem of clarification and coordination between the administrative and the judicial bodies and their respective roles.

This was recognised as early as October 2000 when 'the relevant departments jointly issued the "Notice on Strengthening Cooperation and Coordination in the Work Investigating and Dealing with Criminal Cases that Infringe IPRs." This was followed in July 2001 'when the State Council promulgated the "Regulations on the Transfer of Suspected Criminal Cases by Administrative Law Enforcement Organs" which includes clear provisions on how administrative law enforcement organs should transfer suspected criminal cases to public security organs in a timely fashion.' This was followed in March 2005 when the relevant departments jointly issued the "Opinions on Increasing Work Contacts between Administrative Law Enforcement Organs and Public Security Organs and People's Procuratorates." A work mechanism involving the coordination of administrative law enforcement and criminal law enforcement has been established, creating a joint power

to deal with IPR infringements.'¹⁰³ The reality seems to be that to a large extent China uses administrative rather than criminal law against IPR violations,¹⁰⁴ and while this may be a more cost-effective means of investigation and enforcement there are problems of consistency of practice across such a vast country. This therefore raises transparency issues. The independence of local judicial authorities can be questioned and the lack of specialist training to handle the more complex cases exacerbates this problem. These are clearly ongoing problems that can only be solved over time with incremental improvement and support in terms of human resources.

IPR issues are clearly a barrier to trade and investment that need to be resolved. They involve issues of patents registration, especially issues of the quality of those patents and issues of disclosure of patents held or pending in the standards setting process. They further include issues of how the structure and level of patent fees are arrived at and whether or not these should be subject to policy decisions. For example, as China has argued, whether there should be capping arrangements, or if they should be left entirely to the market and to litigation and if there should be dispute resolution procedures, etc.. The issues are complex, and the aim should be to facilitate business by reducing wherever possible, the degree of complexity in patent registration, patent searches, patent fee structures, and patent dispute resolution.

ANNEX 2: PATENTS AND LICENSING AGREEMENTS

Patents & Licensing Agreements	Partnerships	Notes
China Vendor – Huawei		
WCDMA, cross licensing (Shanghai Daily, 25 April, 2006)	Nokia	In 2005, Huawei had filed 249 PCT (Property Cooperation Treaty) international patent applications, ranking 37 among the global applicants and exceeding Cisco Systems' 212 applications. Huawei owns 5 per cent of the global wideband code division multiple access patents
WCDMA, cross licensing (Ericsson, 22 Aug, 2002)	Ericsson	
cdmaOne and CDMA2000 1X equipment, royalty-bearing licensing agreement (Qualcomm, 1 Nov, 2001)	Qualcomm	
LAN switches and routers, formed a JV called 3Com-Huawei (Business Week Online, 22 Dec, 2003)	3Com	But in Dec. 2005, 3Com announced it would assume majority ownership of the JV (BusinessWeek Online, February 2, 2006)
Broadband network technologies, JV (Business Week Online, 2 Feb, 2006)	Nortel	But the JV was dissolved in June 2006
TDSCDMA, formed a JV called TD Tech Ltd (Internet News, 29 Aug, 2003)	Siemens	
WCDMA platform (3GNewsroom, 16 Sept, 2003)	Infineon	Huawei and Infineon opened a joint R&D lab in 2002
Operations support systems (OSS), research partnership (Light Reading, 2 March, 2006)	HP	Jointly establish an OSS laboratory in Shenzhen
China Vendor – ZTE		
Granted a license to develop, manufacture and sell cdmaOne and CDMA2000 1X equipment, royalty-bearing licensing agreement (Qualcomm, 2 July, 2001)	Qualcomm	
Wireless broadband chip, 'Rosedale', based on the IEEE 802.16 specification (WiMaxxed, 13 Jan, 2005)	Intel	
TDSCDMA, OEM (NE Asia Online, 23 May, 2005)	Ericsson	Ericsson will integrate ZTE's TD-SCDMA Node B into its radio access network
3G equipment and NGN, partnership (Business Week Online, 23 Nov, 2005)	Cisco	
China Vendor – Datang		
TD-SCDMA, partnership (eeTimes Online, 16 Jan, 2003)	Siemens	Parent company is the China Academy of Telecommunications Technology of the MII
TD-SCDMA chipset and protocol stack, form a JV in Feb, 2002 called Commit, (eeTimes Online, 16 Jan, 2003)	Nokia, TI, LG, Putian (now Potevio), DBTel	
Core TD-SCDMA chipsets and reference designs for mobile terminals, formed a JV called T3G in Dec, 2002 (eeTimes Online, 16 Jan, 2003)	Philips and Samsung	
Key applications such as the micro-browser, messaging client and Java virtual machine, partnership (Peoples Daily, 6 July, 2004)	Access, Internet access technologies provider in Japan	
ARM Technologies for wireless applications, licensing agreement (ARM, 25 Jan, 2005)	ARM	
eZiText™ technology, five-year licensing agreement (Zi Corporation, 16 Oct, 2001)	Zi Corporation	
ZSP540 digital signal processor (DSP) for 3G wireless applications, licensing agreement (3G Newsroom, 30 Nov, 2004)	LSI Logic Corporation	
TD-SCDMA, partnership agreement (TelecomAsia, 12 Nov, 2004)	Alcatel	
Foreign Companies		
Alcatel - CDMA radio access solutions, OEM (ZTE, Partnership Breakthroughs In 2005)	ZTE	ZTE's CDMA radio access portfolio integrated into Alcatel's end-to-end CDMA solutions.
France Telecom - Linux operating system for 3G handsets, research partnership (8 Dec, 2005)	ZTE	
Nokia - WCDMA and TD-SCDMA, JV (<i>China Daily</i> , October 14, 2005)	Putian (now Potevio)	
STMicroelectronics - TD-SCDMA System-on-Chip (SoC) products, licensing agreement (eeTimes Online, 16 Jan, 2003)	Datang	

ANNEX 3: OVERSEAS PROJECTS OF HUAWEI AND ZTE

Overseas projects		
Huawei	Huawei's products have been deployed by over 300 operators in over 90 countries regions.	Annual Report 2004
ASEAN	Huawei's programmes in ASEAN are expected to reach US\$600 million in 2005 and US\$1.2 billion in 2008. The company provides mobile network, next generation network (NGN), broadband and intelligence network to ASEAN telecom operators. Its market share for broadband and NGN in ASEAN would reach more than 50 percent this year and the mobile products over 30 percent in 2005. Its share in the whole telecom equipment market in ASEAN would reach 20 percent in 2005. It expects to employ over 800 people in ASEAN countries by end of 2005.	http://english.people.com.cn/200505/20/eng20050520_185899.html
Philippines	Huawei is negotiating with Smart Communications, Inc., Globe Telecom, Inc. and Digitel Mobile Communications, Inc. for possible supply contracts	http://www.tdscdma-forum.org/EN/news/see.asp?id=1339
Indonesia (2006)	Huawei has won the WCDMA contract of Indonesia's mobile operator Natrindo Telepon Selular ("NTS") and selected as their preferred & sole vendor to construct NTS' unified 3G/2G softswitch core networks, intelligent service platforms and IP backbone networks in Indonesia.	http://www.3gnewsroom.com/3g_news/jan_06/news_6618.shtml
	Huawei Technologies completed a 450 MHz CDMA2000 1X network for Mobisel in Indonesia . As part of the upgrade, Huawei Technologies provided a complete end-to-end CDMA450 solution including the base station, switching system and user terminals allowing Mobisel to migrate their NMT450, analog network directly to 3G.	http://www.3gnewsroom.com/3g_news/jan_04/news_4135.shtml
Thailand (2005)	The Communications Authority of Thailand (CAT) in Thailand has awarded Huawei Technologies its nationwide CDMA2000 3G expansion network bid. Huawei will provide CDMA2000 1x & 1x EV-DO products and solutions in 51 of the 76 provinces in Thailand. Within the turn-key project, Huawei will also provide products in the areas of transmission, service & software and data communications. Huawei obtained the contract with a winning bid of 7.2 billion baht - six billion baht below the price quoted in an earlier failed bid. The company denied claims of using a price-dumping strategy to bid for contracts	http://www.3g.co.uk/PR/Feb2005/9030.htm
Singapore (2004)	Huawei Technologies and NCS Communications Engineering have been awarded a multi-million-dollar contract from SingTel in July 2004 for the supply of Digital Subscriber Line Access Multiplexer (DSLAM) equipment	http://www.ncs.com.sg/media/pr.asp?PressReleaseID=160
Malaysia (2003)	Huawei partnered with Telekom Malaysia, has made a soft launch of its pre-commercial WCDMA network in Malaysia	http://www.3g.co.uk/PR/Oct2003/5981.htm
Europe		
Czech Republic (2006)	Huawei has signed a contract for the construction of a UMTS network for Vodafone Czech Republic	http://www.tdscdma-forum.org/EN/news/see.asp?id=2840
Germany, Italy, Ireland (2005)	Huawei won the bid for construction of data core networks by Vodafone in Germany, Italy and Ireland	http://www.tdscdma-forum.org/EN/news/see.asp?id=2778
Italy (2005)	Italian ISP Tiscali SpA has selected Huawei to provide equipment for its U.K. broadband rollout	http://www.tdscdma-forum.org/EN/news/see.asp?id=1665
UK (2005)	Huawei, signed an agreement with British telecoms group Marconi to market each other's products	http://www.sinomedia.net/eurobiz/v200503/briefs0503.html
UK (2005)	BT Group announced that Huawei became a preferred supplier for its 21st Century Network project (21st CN), which will likely involve investment of GBP 10 billion (or USD 19 billion).	http://www.tdscdma-forum.org/EN/news/see.asp?id=1571
Netherlands (2005)	Huawei signed a contract with Telfort in the Netherlands to supply a 3G network	http://www.tdscdma-forum.org/EN/news/see.asp?id=1713

North America		
U.S.	Huawei's SONET solution was selected by First Avenue Networks for its core network applications	http://www.tdscdma-forum.org/EN/news/see.asp?id=2938
	Huawei Technologies released its new-generation UMTS Base Station Solution for AWS Band (1.7GHz/2.1GHz)	http://www.tdscdma-forum.org/EN/news/see.asp?id=2911
	Huawei Technologies and Intel will cooperate in building carrier-grade wireless broadband networks supporting the new WiMAX / IEEE 802.16 standards and specifications	http://www.intel.com/pressroom/archive/releases/20050419comp.htm
Others		
Tajikistan (2006)	Huawei to build mobile network in Tajikistan	http://www.telegeography.com/cu/index.php?day=03&month=05&year=2006
Libya (2006)	GPTC of Libya awarded Huawei a contract to install 500,000 mobile lines	http://www.telegeography.com/cu/article.php?article_id=12894
Bangladesh (2006)	Huawei has signed a \$100 million GSM network expansion contract with Bangladeshi mobile operator TM International (TMIB)	http://www.tdscdma-forum.org/EN/news/see.asp?id=2969
Russia (2006)	Huawei has won a contract to construct a CDMA2000 network for Skylink, the largest CDMA operator in Russia	http://www.tdscdma-forum.org/EN/news/see.asp?id=2944
Congo (2006)	Huawei has signed a US\$100 million contract with mobile telecom operator Oasis Sprl to build a GSM network engineering project in the Democratic Republic of Congo	http://www.tdscdma-forum.org/EN/news/see.asp?id=2937
Brazil (2006)	Huawei deployed 1 million ADSL lines in Brazil.	http://www.tdscdma-forum.org/EN/news/see.asp?id=2924
India (2006)	Huawei has introduced the latest range of CDMA mobile phone handsets in India	http://www.tdscdma-forum.org/EN/news/see.asp?id=2792
India (2005)	Huawei signed a \$70-million contract with the Delhi-based HFCL Infotel to supply telecom products and solutions. The company is in the process of setting up a manufacturing plant in India with an investment of \$60 million	http://www.tdscdma-forum.org/EN/news/see.asp?id=1483 http://www.tdscdma-forum.org/EN/news/see.asp?id=2213
Nigeria (2005)	Huawei signed a deal to provide Nigeria with US\$200 million worth of telecommunications equipment to set up a nationwide mobile phone service using CDMA technology	http://www.tdscdma-forum.org/EN/news/see.asp?id=1510
Argentina (2005)	Huawei launched a 3G CDMA network in Argentina, the CDMA2000 system will be used by customers of local operator Cooperative Telefonica de Calafate Ltda (CoTeCal). Huawei's Argentine operations, which have been in place since 2001, accounted for US\$14mn in revenues in 2004 and has overtaken competitors Alcatel and Siemens in this country.	http://www.tdscdma-forum.org/EN/news/see.asp?id=1713
Uruguay (2005)	Huawei has built a pilot 3G network for ANTEL, one of the leading telecom operators in Uruguay	http://www.tdscdma-forum.org/EN/news/see.asp?id=1910
New Zealand (2005)	Huawei was recognised by New Zealand Econet Wireless New Zealand Limited ("EWNZ") as their strategic partner for WCDMA networks deployment. Huawei will start the first deployment phase in Auckland and target to complete the nationwide networks within the next 3 years	http://www.tdscdma-forum.org/EN/news/see.asp?id=2383
ZTE	ZTE has already deployed 20 million lines of CDMA equipment for more than 50 operators in more than 40 countries including Turkey, Saudi Arabia, Ukraine, Egypt, Indonesia, Algeria, Nigeria, Kenya, India, Indonesia and Vietnam. (2005) ZTE started its overseas efforts in 1999. In 2004, ZTE's overseas sales reached US\$1.64 billion, accounting for 40 percent of the companies's total revenue	http://www.tdscdma-forum.org/EN/news/see.asp?id=2206
ASEAN		
Myanmar (2006)	Myanmar Posts and Telecommunications and ZTE signed a supply contract (phase-1) for Myanmar National Telecommunication Network	http://myanmargeneva.org/NLM2006/eng/2feb/n060219.pdf

	Construction Project	
Vietnam (2005)	ZTE has won several network infrastructure contracts in Vietnam. Including a deal to provide 450MHz CDMA2000-1X EV-DO (Evolution Data Only) equipment to Vietnam Power Telecom (VPT) as well as a contract with Vietnamese railway company to build communication network	http://english.people.com.cn/200505/20/eng20050520_185899.html http://www.tdscdma-forum.org/EN/news/see.asp?id=1792
Laos (2005)	Operator Sky Telecom in Laos signed a contract with ZTE Corporation to deploy a national CDMA 2000 1X EV-DO network	http://skyscrapercity.com/archive/index.php/t-145301.html
North America		
US (2005)	ZTE announced the opening of a new U.S. headquarters in Dallas, expected to employ nearly 100 people by 2005.	http://www.tdscdma-forum.org/EN/news/see.asp?id=1721
	ZTE's ZIMAX Technologies subsidiary, based in San Diego, struck a key deal with Intel to develop WiMAX gear	http://www.tdscdma-forum.org/EN/news/see.asp?id=2040
Europe		
Europe	Given its overall size, the on-going enlargement of the European single market, and the considerable potential for expansion in Central and Eastern countries in the region, Europe is a particular focus of ZTE's overseas activities. The group has established offices in 15 European countries - Cyprus, the Czech Republic, Bulgaria, France, Germany, Greece, Hungary, Italy, Poland, Portugal, Romania, Spain, Sweden, Turkey and the UK. ZTE has also set up the European Research Institute (ERI) in Sweden.	http://www.tdscdma-forum.org/EN/news/see.asp?id=1776
France (2005)	ZTE jointly develops new mobile telecom systems with Alcatel	http://www.tdscdma-forum.org/EN/news/see.asp?id=1195
France	ZTE becomes a global supplier of ADSL equipment to France Telecom	http://www.tdscdma-forum.org/EN/news/see.asp?id=1292
Norway (2005)	ZTE builds Europe's first CDMA digital trunking network for Nordisk Mobiltelefon AB in Norway	http://www.tdscdma-forum.org/EN/news/see.asp?id=1695 http://www.tdscdma-forum.org/EN/news/see.asp?id=1664
Greece (2005)	OTE, Greece's largest fixed-line operator, has ordered an expansion of the ADSL network in Athens that ZTE built for them in 2004.	http://www.tdscdma-forum.org/EN/news/see.asp?id=1695
Portugal (2005)	ZTE and Portugal Telecom signed an R&D and new technologies MoU to work together to develop products and services for new markets. It also allowed the company to access markets where Portugal Telecom is operating	http://www.tdscdma-forum.org/EN/news/see.asp?id=1776
Germany (2005)	ZTE, which opened an office in Munich in April 2005 has offered test equipment for fixed-line and wireless networks to potential clients in Germany including Deutsche Telekom	http://www.tdscdma-forum.org/EN/news/see.asp?id=1817
Others		
Russia (2005)	ZTE was contracted to supply a CDMA450 network to the port of Murmansk. This followed a contract win with Skylink that will see ZTE provide a CDMA2000 1X system to cover all of Murmansk, and an earlier CDMA450 contract placed by KCC, one of Russia's largest wireless operators.	http://www.tdscdma-forum.org/EN/news/see.asp?id=1776
Bulgaria (2005)	ZTE signed a dense wavelength division multiplexing (DWDM) backbone contract with Cabletel	http://www.tdscdma-forum.org/EN/news/see.asp?id=1776
Australia (2005)	ZTE has founded a branch in Melbourne and planned to enter the Australia market, in hope of winning more orders to compete with strong rivals like Cisco, Nortel Networks, and Lucent.	http://www.tdscdma-forum.org/EN/news/see.asp?id=1588
Brazil (2005)	ZTE established operations in Brazil in 2002.	http://www.tdscdma-

	ZTE won an order for 500,000 mobile telecommunication devices from Vivo, the largest mobile telecom operator in Brazil.	forum.org/EN/news/see.asp?id=1786
Mexico (2005)	Mexican wireless access services provider SAI has signed ZTE to implement a wireless CDMA network	http://www.tdscdma-forum.org/EN/news/see.asp?id=2145
Angola (2005)	ZTE won a national broadband telephone network project in Angola, competing with global giants including Siemens, Ericsson and Alcatel	http://www.china.org.cn/english/BAT/136508.htm
Mongolia (2005)	Mongolia's Information & Communications Technology Authority (ICTA) has launched the country's first commercial international NGN gateway, provided by ZTE	http://www.zte.com.cn/English/02news/detail.jsp?CateName=news&ID=4885
India (2005)	ZTE secured orders for about one million CDMA handsets from India-based Tata Group	http://www.tdscdma-forum.org/EN/news/see.asp?id=2011
Pakistan (2005)	ZTE has been given next generation networking contracts in Pakistan	http://www.tdscdma-forum.org/EN/news/see.asp?id=1935
Nepal (2005)	ZTE will provide 10,000 lines of GPRS data services, offering customers in Nepal continuous high-speed wireless connection to the Internet. ZTE will also supply Nepal Telecom with one million lines of GSM equipment to build a state-of-the-art network to cover the Kathmandu valley	http://www.telephonyworld.com/cgi-bin/news/viewnews.cgi?category=all&id=1114470587
Sri Lanka (2005)	ZTE will supply Sri Lanka Telecom Limited (SLT) with its end-to-end ALL IP CDMA2000 solution which consists of soft switch-based ALL- IP 3G core network and a full series of ALL-IP base stations that will cover the country's major areas	http://www.tdscdma-forum.org/EN/news/see.asp?id=2166 http://www.tdscdma-forum.org/EN/news/see.asp?id=2271

ANNEX 4: CHINA AND ASEAN

China's relationship with ASEAN is of growing significance at all levels. This is important in light of the initial fears among ASEAN member states that the rise of China as an economic power would result in foreign investment, trade and manufacturing relocating to the Mainland, thereby 'sucking' out resources from developing countries in the region. The evidence below suggests in the area of ICTs this has not happened, or at least such a picture would constitute a gross simplification of a growing reciprocity between China and ASEAN countries.¹⁰⁵

ASEAN Member States:



ICTs were one of five key areas¹⁰⁶ identified for cooperation between ASEAN and China at the 5th China-ASEAN Summit held in Bandar Seri Begawan, the capital of Brunei, in 2001, where it was also agreed to work towards an ASEAN-China Free Trade Area (ACFTA) within ten years.¹⁰⁷ An 'Early Harvest' agreement was reached to abolish tariffs between China and ASEAN countries for 8 and 9 digital level items of HS Chapters 1-8 (viz. animal, agriculture, fishery and forestry products) with notified exemptions that came into effect from 2005, as a step towards the FTA for ASEAN-6 by 2010 and newer ASEAN member states by 2015.¹⁰⁸ A *Framework Agreement on Comprehensive Economic Cooperation between ASEAN and the People's Republic of China (2002)* was signed at the first GSM (Greater Mekong Sub-region) Summit of Heads of State in Phnom Penh in November 2002.¹⁰⁹ This was followed by the signing in October 2003 of an *ASEAN-China Memorandum of Understanding on Cooperation in Information and Communications Technology*. 'Among the areas agreed include China's commitment to utilise its domestic training bases to provide training for personnel of ASEAN Member Countries. ASEAN and China have agreed to cooperate in developing MRAs (Mutual

Recognition Arrangements) for ICT Skills Certification. Furthermore, China will assist in the construction and development of information infrastructure such as fixed/mobile communications networks, multimedia applications and Internet in ASEAN Member Countries.' (ASEAN)¹¹⁰

The Beijing Declaration

In May 2005, the *Beijing Declaration on China-ASEAN ICT Cooperative Partnership for Common Development* was issued following the inaugural ASEAN-China ICT Ministerial Forum. The principal theme of the declaration was a call for the strengthening of exchanges between ASEAN and China in promoting technology suitable for rural and remote areas. China also proposed to train 500 middle and high-level telecom managers and technicians in ASEAN countries over the next five years. The conference was attended by representatives of numerous private companies, including Huawei. The Huawei chairman was quoted as saying, 'We are making every effort to become a local company in all ASEAN countries, adapting ourselves into the social lives of ASEAN countries, and making the necessary contribution to ASEAN countries.'¹¹¹ The Beijing Declaration went on to state that '[China and ASEAN] should strengthen cooperation among countries in e-commerce, e-Governance and promote mutual recognition arrangements for ICT expertise certification and telecom equipment certification. China and ASEAN member countries should foster exchanges of ICT development strategy and policy, and explore effective market regulation models.'¹¹²

The second GSM Summit was held in Kunming, capital of China's southwest Yunnan province in July 2005, where Premier Wen Jiabao emphasised the importance of providing telecommunication services in the rural areas of GSM countries.¹¹³ The Chinese government planned to offer incentives, including government-backed soft loans, to Chinese companies to invest in member countries of the GSM, particularly in the telecommunications sector.¹¹⁴ In July 2005, the GSM member countries came out with the GSM Information Superhighway blueprint, backed by an investment of US\$66.21 million.

In April 2006, the 2nd ASEAN-China ICT Ministerial Forum was held in Malaysia.¹¹⁵ It was agreed to explore the possibility of expanding the Greater Mekong Subregion (GMS) Information Superhighway to cover all ASEAN countries and establish an ASEAN-China Information Superhighway. Following up on the Beijing Declaration's emphasis on tackling the digital divide, it was agreed to consider the implementation of pilot projects

in selected rural areas. Another agreement dealt with facilitating intra-regional trade, investment and logistics, and called for studies to be conducted on e-commerce and e-Government and on regional standards and mutual recognition agreements for telecommunication equipment and ICT expertise certifications. It was also agreed to develop an ASEAN-China Coordination Framework for Network and Information Security Emergency Responses to crack down on spam and negative content like pornography. Other agreements include the organising of a symposium on RFID later in 2006¹¹⁶ and exploring the possibility of developing a common position on issues to be raised at the Internet Governance Forum to be held in Greece in October 2006, and it was agreed a follow-up mechanism was needed to implement and refine the proposals emanating from the ASEAN-China ICT Ministerial Forum. The contribution of public-private sector collaboration was also recognised and welcomed.

*"We are satisfied with the active participation of our private sectors in the ASEAN-China ICT Business Forum held on 18-19th April 2006. They express their support and willingness to participate in ASEAN-China cooperation activities in ICT including, among others, in establishing the ASEAN-China Information Superhighway, universal services, digital content development, RFID, training, standards and MRAs."*¹¹⁷

Zero-Sum Game Fears Wrong?

Chinese investors have become the major engine of growth for ASEAN countries, displacing to some extent the American consumer. In 2003, ASEAN economies captured a disproportionate share of the US\$413 billion of goods China imported, for example Malaysia, Thailand, Singapore and the Philippines all saw exports to China rise by more than 50 per cent.¹¹⁸ This has changed the perception of China from threat to a land of opportunity.¹¹⁹ That is not to say that some ASEAN countries have not seen high-tech factories close shop and move to China. But it means that the early view of, say, Malaysia's semiconductor industry moving *en masse* to China has proven to be inaccurate and a more nuanced interpretation is called for. After a period of adjustment, ASEAN countries seem to be experiencing a new dynamic in their relationship with China, one that encompasses benefits as well as risks.¹²⁰

Greater Mekong Subregion (GMS)

'In November last year, the six GMS nations signed an agreement to build the Information Superhighway together. China Telecom organised the first meeting on project

implementation in January 2005 and developed the preliminary plan.'¹²¹

Since 1992 the Asian Development Bank (ADB), in collaboration with a number of multilateral agencies, has been financially supporting a series of initiatives to aid the low-income developing countries of Indo-China reduce poverty and develop intra-regional infrastructures. One aspect is a harmonisation of their development policies and industry regulations as a way to attract more of the world's trade and investment. One infrastructure proposal has been an Information Superhighway linking Yunnan province in China with Burma (Myanmar), Vietnam, Laos, Cambodia and Thailand. Prior to 1995, regional telecommunications links were mostly by satellite, but the GMS project was, under Phase One, to construct three major optical fibre cables (East, North and West) and under Phase Two build fibre rings around these to serve various cities and towns, and by Phase Three to promote services, such as e-Commerce, e-Health, e-Government, etc.

China is playing an active role in the GMS initiative. For example, at the 6th STCF (Sub-region Telecommunications Forum) meeting in Hanoi in 2004, Mr Zhang Tao, Network Manager of China Telecommunications Corporation, 'presented China Telecom's proposal based on the ADB's earlier TA study, as follows: (i) transmission construction for Phase I 2005-2006, and Phase II in 2007-2008; (ii) transmission network covering major cities in each country, with four loops to form target network; (iii) combined existing international cable system; and (iv) sub-regional international exchange centre to contribute capacity to all countries.' Mr. Zhang goes on to outline the steps China is taking to establish cross-border implementation of the system with Laos and Myanmar and speaks of opportunities for service cooperation in 'international voice, international bandwidth, international IP, and e-commerce, e-Government and e-society applications.'¹²² Training is another major contribution China is offering and this is clearly an important opportunity for China to extend the influence of its ICT products and services, including those that conform to its own standards and which embed its own patents, such as RFID (see above).

Singapore

Singapore's market size is relatively small. Nonetheless there have been two major drivers behind Chinese ICT firms establishing a presence in Singapore.

First, Singapore has become a springboard to reach out to India and South Asia, and Singaporean firms have earned a reputation for being reliable, efficient, and trustworthy partners. In January 2006, Shinco entered into a tie-up with Future Techno Design of Singapore to market its high-end portable DVD players in India.¹²³ In November 2005, Chinese online gaming firm SeaSky NetJoy decided to use Singapore as a base to spearhead its international expansion. The SeaSky chairman was quoted as saying, 'Singapore is a leading business hub in Asia, and a bridge to South-east Asia, China and Europe. She will make an excellent test-bed for new games before rolling out to other markets.' It launched, in collaboration with Sun Microsystems and Pacific Internet, a multi-player suite of casual games called Dream-i, which allows gamers using personal computers and mobile phones to play together at the same time.¹²⁴

The second major driver for a number of the Chinese ICT firms is the chance to seek a listing on the Singapore Stock Exchange (SGX). According to the Economic Development Board (EDB) of Singapore, in 2005 88 Chinese enterprises raised funds for their expansion and growth through initial public offerings (IPOs) on the SGX, compared with only 18 at the end of 2001.¹²⁵ Chinese companies now account for more than 10% of the SGX listings.¹²⁶ In December 2005, China-based foundry HeJian Technology (Suzhou) Co Ltd decided to make its initial public offering in Singapore.¹²⁷ In September 2005, China-based Memory Devices Ltd - which makes memory modules used in computers, consumer and industrial electronics, and communications equipment - sought to list on the main board. It wanted to raise more funds to expand its R&D, develop new products, boost production capacities and expand its sales network in China and overseas.¹²⁸

Singapore-China Trade and Investment

In June 2005, TCL announced plans to set up regional headquarters in Singapore to better focus on and develop its business in the Southeast and South Asia region.¹²⁹ In May 2005, Lenovo was applying the final touch on a soon-to-open regional headquarters in Singapore, in order to promote its business in Southeast and South Asia¹³⁰ and in April 2005 ZTE officially opened its Asia-Pacific headquarters in Singapore.

Finally, Singapore and Singaporean-based companies have targeted the China market in partnership with Chinese counterparts. This trend was officially encouraged by the Singaporean government in the 1990s as part of Singapore's efforts to expand its economy regionally. Although the achievements of Singapore's collaboration with China have not run as smoothly as first hoped, over recent years collaboration seems to be picking up.¹³¹ For example, in April 2006 Chongqing University of Posts and Telecommunications (CQUPT) joined hands with Singapore-based Nanyang Technological University in launching the Fourth Generation Mobile Telecom (4G) United Research Center in Chongqing.¹³² In April 2005, Singapore-based United Test and Assembly Center Ltd. (UTAC) formed a strategic alliance with nine Chinese integrated circuit (IC) design companies, under which UTAC will become their preferred provider of packaging and testing services in both Singapore and Shanghai.¹³³ And China is included in the global network of factories of Singapore-based Flextronics, a leader in the electronics manufacturing outsourcing movement.

Malaysia

After Singapore, Malaysia is ASEAN's largest ICT market in consumption and production. For example, as of November 2003 Malaysia was 'one of the largest manufacturers of disk drives in the world, the largest auto parts manufacturer and assembler in Southeast Asia, and a sizable electrical and OEM components assembler in the region.'¹³⁴ Malaysia's growing ICT market is attractive to Chinese firms. At the end of September 2005, Malaysia had 17.5 million cellphone subscribers, or two-thirds of the country's 25 million people. About 600,000 households had high-speed Internet access, and the government aimed to boost that to 1.3 million homes -- or a penetration rate of roughly 25% -- by 2006.¹³⁵

The Chinese government has been just as aggressive as Chinese companies in exploring new deals in ASEAN that increase Chinese political and economic influence in the region. In December 2005, during Chinese Premier Wen Jiabao's visit to Malaysia for the 9th Summit of ASEAN Plus China, Japan and South Korea (10+3), China and Malaysia signed several economic cooperation agreements on projects involving a total value of over USD 1 billion.¹³⁶

ASEAN countries are increasingly looking at China and seeking to learn from it. In September 2005, Malaysia's Deputy Prime Minister Datuk Seri Najib Tun Razak toured Huawei's R&D labs in the Haidian district of Beijing.¹³⁷ In some instances, the Chinese

are replacing the Japanese who had been encouraged by the previous Prime Minister Mahathir Mohamad to relocate some of their ICT plants to Malaysia through the granting of favourable treatment. Japanese electronics makers, as early as the 1970s, turned Malaysia into their production centre in the ASEAN region. But ironically as the Japanese are shifting consumer electronics production to China and Thailand, Chinese are filling the vacuum.¹³⁸ Malaysia's own effort to promote ICTs took on the 'large project' approach during the 1990s, the most spectacular being the Multimedia Super Corridor (MSC) south of the capital Kuala Lumpur, and it may be noted that in September 2004 Malaysia unveiled a plan to open up offices in Saudi Arabia (Jeddah) and China (Dalian) to promote the MSC.¹³⁹

Telecoms Network Equipment

On the wireless side, this is one area where Chinese vendors continue to make a big splash. Time dotCom (TdC), Maxis Communications and Celcom (Telekom Malaysia's cellular arm) were awarded 3G spectrum. Huawei and Alcatel are assisting TdC in an HSDPA pilot trial scheduled to last for 3 months in and around Kuala Lumpur.¹⁴⁰

European vendors have made their presence felt as well. Alcatel and Ericsson have opened R&D facilities in Malaysia. In May 2004, Alcatel said it would invest USD 53 million in Malaysia, over the next 4 years to tap growth in 3G services. Alcatel's Asia-Pacific president Christian Reinaudo was quoted as saying that Alcatel is helping state-owned Telekom Malaysia to develop and introduce 3G services in the country by 2005.¹⁴¹ In March 2004, Siemens established its Information and Communications Networks (ICN) Asia-Pacific regional headquarters in Kuala Lumpur at a cost of RM20 million.¹⁴²

In November 2004, Telekom Malaysia announced it planned to spend RM100-200 million on purchasing equipment for the first phase of its 3G W-CDMA rollout. Nokia would cover 500 sites in the Klang Valley and Huawei 100 sites in Penang.¹⁴³

Chinese Vendors

Huawei began operations in Malaysia in 2001. In December 2005, it signed an MoU with the research arm of Telekom Malaysia to cooperate on WiMax, 4G, video streaming, fraud management systems, security systems, triple-play solutions, and intelligent applications. Huawei is one of the four NGN vendors for Telekom Malaysia. In 2005, Huawei expected to generate USD 50 million in revenues from the Malaysian market, up from the USD 30 million it recorded in 2004.¹⁴⁴ By 2008 Huawei intends to establish its In Touch lab experience centre in Malaysia

which will become a gateway for Huawei to expand its business in Southeast Asia.^{145 146}

Huawei's defining feature is its price competitiveness. Communications Datuk Seri Dr. Lim Keng Yaik 'related a case where he approached a multinational company for the development of 3G service by a Malaysian telco and was told of a huge price of RM120 million for the rollout but when scouting around for similar technology, he got Huawei's for RM30 million only.'¹⁴⁷ Huawei points to the lower cost of manufacturing in China as one reason for its low prices. Scale is another reason.

ZTE is another Chinese vendor making inroads into the Malaysian market. In December 2004, ZTE won a deal with paging and trunked radio operator Electcoms to supply it with the CDMA-based GoTa digital trunking infrastructure, with a first phase deployment set for Kuala Lumpur in 2005.

Handsets

The Chinese seem to lag behind their better known rivals in the Malaysian handset market, although are catching up through companies such as Compugates and Bird.

European companies have a sizeable history and presence in Malaysia's semiconductor sector. In April 2005, STMicroelectronics started work on a M\$288 million expansion of its plant in Muar, in southern Johor state. STMicroelectronics has been operating the Muar facility since 1974 and, since then, output has soared from 2 million chips to 3.2 billion annually. In December 2004, Infineon announced that it would invest M\$3.8 billion in a new plant in the Kulim Hi-Tech Park to make semiconductors used in automotive and industrial power applications, with production scheduled to start in 2006.¹⁴⁸ In August 2003, Infineon invested an additional RM300 million to increase production at its base in Melaka state, central Malaysia, home to 4,000 staff.¹⁴⁹ In 2003, the facility produced 10 billion semiconductor chips a year, representing 20% of Infineon's global chip production.

In response to China, Malaysian semiconductor plants have tried moving up the value chain, to sell more sophisticated products to their clients, among them Chinese companies. They have also looked at direct investment opportunities in China. In December 2004, Unisem said it had incorporated a wholly-owned subsidiary in Chengdu, China with a registered capital of US\$70 million. The new unit will engage in the manufacture, assembly and testing of semiconductor devices.¹⁵⁰ In October 2004, semiconductor assembler Malaysian Pacific

Industries expanded into the China market under Carsem Semiconductor (Suzhou) Co. Ltd. where it invested RM277 million in new plant and equipment.¹⁵¹ In June 2004, Grand United Holdings Bhd invested 30 million ringgit to set up a new manufacturing facility in Suzhou, China to produce multi-layered printed circuit boards for multinational corporations operating there.¹⁵²

Investment Between Malaysia and China

Malaysian ICT start-ups, full of creativity, have been able to tap the China market, particularly on the application side. In February 2006, Mobif Bhd was finalising negotiations with a party to deploy, implement and commission VoIP networks in China and to sell and distribute its VoIP products in China.¹⁵³ In January 2006, Green Packet signed a deal with Zhejiang Telecom to leverage Green Packet's Unified Mobility Solution to integrate the Personal Handyphone System (PHS) wireless data and Wireless Local Area Network (WLAN) networks for the deployment of broadband wireless networks throughout Zhejiang province.¹⁵⁴ Green Packet has also teamed up with Guangdong Telecom, Jiangsu Telecom and Sichuan Telecom. In December 2005, it was reported that mobile messaging and interactive media applications provider mTouche Technology Bhd was in talks for an acquisition in China.¹⁵⁵ Discounted call provider REDtone has been in discussion with potential franchise partners in China.¹⁵⁶ In July 2005, REDtone formed a partnership with China TieTong Telecommunications (Shanghai branch) to offer long-distance domestic and international discounted call packages to mobile-phone and fixed-line subscribers in China. REDtone is allocating US\$7.5 million toward the partnership.¹⁵⁷ REDtone said it would need 5 years to recover its investment, and expects positive earnings to start from fiscal year 2007.^{158 159} MNC Wireless Bhd, a maker of software for mobile phone firms, is in discussion with Sina.com to market its mobile services in China.

Thailand

As part of the GMS initiative, in August 2004 Thailand and China signed an ICT cooperation agreement that will see the two countries work together to train ICT personnel and develop electronic commerce (e-commerce), as well as other ICT-related activities.

Telecoms

It was reported that both China Telecom and China Mobile were interested in 2005 to acquire Thailand's largest cellular operator, AIS, from the Shin Corporation before Temasek (Singapore) won the bidding.¹⁶⁰ In April 2006, the Shin Satellite sealed a deal to

provide broadband Internet services to China through the company's iPSTAR satellite. The company has already built a satellite gateway in Beijing that will begin providing Internet services to clients in May. Two more gateways are planned in Shanghai and Guangzhou. The service costs about USD1,000 a year in China, and would bring in revenues of Baht1.0 billion a year if the company meets its target.¹⁶¹

Chinese ICT vendors have been very active. For example, it is reported that Triple T Broadband, a unit of Thailand's fixed-line operator TT&T, is expected to award a 2 billion baht (\$52 million) contract to Alcatel and Huawei for building the first phase of its nationwide next generation network. Triple T Broadband has set aside a budget of 6 billion baht (\$156 million) for construction of the entire network.¹⁶²

Huawei will expand True Move's core GSM network, which covers Bangkok, and the south, north and the northeast of Thailand.¹⁶³ But the most spectacular success was for Huawei in winning the contract from CAT Telecom to provide 51 provinces with a CDMA 2000 1X network.

Huawei finished installing the first 800 base stations by January 2006 and is expected to finish the remaining 800 by January 2007.¹⁶⁴ This is the contract that Siemens had originally won, before Shinawatra intervened and asked for the tendering to be redone through an e-auction, which ended up being won by Huawei with a shockingly low bid that even took Shinawatra by surprise. 'Huawei obtained the contract with a winning bid of 7.2 billion baht, six billion baht (about 46.4%) below the price quoted in an earlier failed bid.'¹⁶⁵

Electronics

According to Thailand's Electrical and Electronics Institute, Thailand is one of China's major electronic export markets. 'Thailand's trade deficit with China has increased dramatically from one billion baht to between four and five billion over recent years.'¹⁶⁶ It is also suggested that Chinese companies want to take advantage of the FTAs Thailand has signed with other countries. This is one way for Chinese companies to avoid anti-dumping charges and is spurring investment on the part of companies like TCL. In May 2006, TCL allocated Bt75 million to add a new production line of liquid-crystal-display (LCD) television sets at its Thai plant (the former Thompson TV factory in Pathum Thani's Bang Kradi Industrial Estate), which currently produces only cathode-ray-tube (CRT) televisions with a production capacity of 3 million to 4 million sets a year.

Manufacturing LCDs in Thailand will decrease transportation costs and eliminate the 20% import tax.¹⁶⁷

Chinese and Thai Investment: Two Way Traffic

Hana Microelectronics PCL, Thailand's major electronics component packaging and testing company, established an IC production plant in China. Production commenced in April 2005.¹⁶⁸ The new manufacturing plant in China, located in JiaXing, southwest of Shanghai, is twice as big as Hana's plants in Thailand. Hana's ICs are used in the manufacture of household goods, telecommunications and medical equipment, printed circuit boards, micro coil winding for electrical appliances, and electronic modules for quartz analogue watches.¹⁶⁹ In February 2006, Hitachi Global Storage Technologies (HGST) moved a major portion of its hard drive output from Thailand, Japan and the US to a new mega-manufacturing base in Shenzhen.¹⁷⁰ Going the other way, in July 2004 it is reported that the Sichuan Changhong Electric Co. was looking to set up TV manufacturing plants in Thailand.¹⁷¹

In September 2003, Mazuma (Thailand) Co Ltd announced that it will set up a joint venture with a Chinese firm in 2004 to manufacture sterilising cupboards and home electronic appliances.¹⁷² In the same year, Thai investors and authorities in southern China were reported as jointly ready to spend about five billion baht developing a high-tech industrial zone in Chiang Rai province. The joint investment is part of the Greater Mekong Sub-region grouping development plan.¹⁷³ Grow Rich Enterprise Co (GRE), the distributor of Leona VCD and DVD players, plans to move production from China to Thailand where it will spend 20-30 million baht on an assembly plant.¹⁷⁴ Other reports from 2003 include: OKi Data Corp. plans to shift its production of black-and-white printers to China from Thailand, which the company estimates will help reduce its production costs by 20%¹⁷⁵; ZTE Corp and China Putian are considering investing in mobile phone manufacturing plants in Thailand¹⁷⁶; China-based computer-maker Taiji Computer is preparing to shift its production base to Thailand with initial investment of Bt400 million.¹⁷⁷

Fast forward to 2006, and reports include the following: in May 2006, Nascom Network announced an alliance with Chang Jiang Computer Group to invest about ten billion baht in a complex to produce computers and communications equipment¹⁷⁸; in April 2006, Haier (China) set up a second joint venture in Thailand with local partners TWZ Corporation, Tiga Co Ltd and Makaranan Co Ltd, under

whose partnership, a new company named Haier Business (Thailand) Co Ltd will sell Haier products locally, including mobile phones, information technology products and LCD television sets, in Thailand's Bt100-billion consumer electronics market;¹⁷⁹ in March 2006, Lenovo opened eight service centres across Thailand and will focus on the SME market outside of Bangkok¹⁸⁰; and in April 2006 it is announced that Nasda Technology, Thailand's first OEM for PCs, will build PCs for local Thai PC brands Belta and Laser.

Vietnam

Telecom Network Equipment

Huawei is always the vendor name at the top of the list. For example, along with ZTE it has contracts with Saigon Posts and Telecommunications Corp to provide CDMA equipment,¹⁸¹ and with VPT for second phase of CDMA system deployment for 12 provinces in central Vietnam, having also supplied phase one¹⁸².

ZTE, in November 2005, signed a US\$66 million contract with Vietnam Railways Corporation in Hanoi to modernise the signalling and telecommunications systems for the three railway routes in Vietnam.¹⁸³ In August 2005, ZTE won the contract to provide 450 MHz CDMA2000-1X EV-DO to Vietnam Power Telecom (VPT), Vietnam's first 3G mobile network, in Ho Chi Minh City (HCMH).¹⁸⁴ Previously, like Huawei, it supplied equipment to the second phase of VPT's CDMA network construction to cover 13 provinces, including HCMH and the Mekong Delta having also supplied phase one.¹⁸⁵

Handsets and Consumer Electronics

In September 2005, Post Office Equipment Company (Postef) announced that it would launch the first made-in-Vietnam cellphones.¹⁸⁶ But it will face stiff competition from low-priced Chinese cellphones. In June 2004, Bird said it would help its local distributor T&T assemble and manufacture cellphones in Vietnam if total sales in the country reached 200,000 units a year.¹⁸⁷ Also in June 2004, construction began in Da Nang on a US\$25 million factory by Vina-Mobi to make low-cost mobile phones for sale in neighbouring countries, using technology from Zentek, a Japanese software firm, and design from iWoW, a Singaporean company.¹⁸⁸ Nokia remains the clear leader in this market.

Cambodia

China's backing of the GMS project is bringing the two countries together. In September 2005, the AZ Communication Co Ltd was set to use the proceeds from a

concessionary loan of RMB250 million (US\$30 million) from the Chinese government to Cambodia to purchase CDMA2000 1x equipment from Huawei.¹⁸⁹ The project to develop Cambodia's telecommunications industry will get underway at the end of 2006.¹⁹⁰ Siemens and Harris (USA) will also participate in the project.

Huawei has also been involved in building out Cambodia's GSM infrastructure. In September 2001 it won two bids from Camshin for the third and fourth phase of the GSM network expansion project, valued at US\$13 million. Camshin was a Shinawatra-funded venture and the deals highlight the strong links that had developed between Huawei and the Shinawatra Corporation.¹⁹¹ Because the Cambodian countryside is littered with landmines, Huawei has made creative use of satellite transmissions to support its GSM solution so there has been no need to dig in the treacherous terrain.

Laos

In many ways Laos is very similar to Cambodia, where teledensity is extremely low, the GSM is a big driver of Chinese ICT trade and investment in the country, and also where Alcatel (through Alcatel Shanghai Bell) has a substantial presence due to the historical links between the country and France.

In June 2005, the president of the Laos Economic Development Fund signed a MoU with the director of the Beijing New Technology Development Department to develop Laos's communications infrastructure (Internet, mobile cellular, and CATV).¹⁹² ZTE and Huawei are also present. In February 2005, ZTE won a contract to provide a CDMA 2000 1X EV-DO network, in the 800 MHz spectrum range, to Laotian operator Sky Telecom. ZTE will deploy the network in the capital Vientiane and in the provinces of Savannakhet, Thakhek, Pakse and Luangprabang.¹⁹³ As of September 2004, Huawei was supplying Lao Telecom with CDMA 1X networks in the 450 MHz and 800 MHz frequency bands, with the 800 MHz service differentiated from Lao Telecom's 900 MHz and 1800 MHz GSM services through the offering of multimedia and mobile data services whereas the 450 MHz service was meant to provide fixed line services in rural areas.

Mirroring the GSM Information Superhighway, in February 2001 Singtel and five regional telecoms carriers (China Telecom, Vietnam Posts and Telecommunications Corporation, ETL, CAT, and Telekom Malaysia) built the SDH 2.5 Gbps overland China-Southeast Asia Cable linking China, Vietnam, Laos, Thailand,

Malaysia, and Singapore, the first of its kind. The cable spans 7,000 km across the 6 countries and will be used as diversity for international leased circuit, Internet, and voice services that are carried on submarine cables such as APCN and SEA-ME-WE3.¹⁹⁴

Myanmar

Despite its international political isolation, Myanmar has been able to receive economic and political support from China.

On the telecommunications front the Chinese government has played an active role and sent two official delegations to Myanmar to discuss cooperation between the two countries in the telecommunications sector. China lent Myanmar 250 million yuan at a low interest rate for use in the installation of auto-telephones in Yangon and districts and establishment of a GSM mobile telephone system and communication links.¹⁹⁵

Indonesia

With the dominance of cellular GSM networks in Indonesia (a market dominated by European vendors like Nokia, Siemens and Ericsson) it was difficult for Chinese vendors to get a foot in the door. But they were able to do this through inexpensive fixed wireless access technology, like CDMA 450 WLL, that caught the interest of Indonesian fixed line operators under pressure to raise fixed teledensity. With network operators upgrading to CDMA2000 1x, 3G and NGN Chinese vendors stand in a much stronger position to compete with their European rivals.

China-Indonesia Trade Links

In September 2005, it was announced that China signed agreements to invest US\$20 billion (euros16.2 billion) in Indonesia to build scores of electricity, telecommunications and other infrastructure projects over the next 20 years. The rupiah's recent depreciation -- the currency fell to a four-year low against the U.S. dollar -- offered the Chinese an opportunity to get more for their money.¹⁹⁶ In January 2005, it was reported that at least 10 of China's major state-owned firms committed \$1.5 billion for investment projects in Indonesia, in areas including power generation, coal, oil and gas exploration and telecommunications.¹⁹⁷ In September 2003, Indonesian Communications Minister Agum Gumelar said that Indonesia's telecommunication community should learn from China, where fast telecommunication development has helped promote economic growth.¹⁹⁸

Telecommunications Services

Chinese operators have eyed acquisitions in Indonesia. However, in March 2004, China Telecom was said to have backed off from bidding for Excelcomindo. The Chinese newspaper *21st Century Business Herald* ran

the following line, 'In full consideration of Indonesia's long-term political instability, as well as various risks arising from war and racial conflict, China Telecom finally halted this acquisition plan.'¹⁹⁹

Telecommunications Equipment

Indonesia's mobile phone penetration rate is relatively low compared with Malaysia, where 65% of the population has access to mobile phone services, and Thailand with 45%.²⁰⁰ Some 70% of Indonesia's population lack access to even basic telecommunications services.²⁰¹ This is one major reason why vendors have proclaimed Indonesia to be the second-most important market, after China, in terms of potential and growth.^{202 203} The introduction of CDMA based 450 MHz wireless local loop (WLL) technology, which offered limited mobility services but at a tariff equal to that of an ordinary fixed line thus far cheaper than cellular ones, gave Chinese vendors an entry card into the Indonesian market. The service was pioneered by PT Telkom in May 2003 under the brand name Telkom Flexi. In August 2004, Mandara Selular Indonesia/MSI (formerly Mobisell) joined in, with a network and handsets provided by Huawei.

Reports of Huawei's sales include: in March 2006, Huawei will build 20 base transceivers (BTS) for East Java under an agreement with the Post and Telecommunications Directorate General to build CDMA 450 networks in Indonesia²⁰⁴; in February 2006, NTS awards W-CDMA contract to Huawei to unify NTS's 3G and 2G softswitch core networks and implement intelligent service platforms and IP backbone networks²⁰⁵; in October 2005, the company signed a deal with PT Excelcomindo in Jakarta to provide a customised network solution covering many isolated islands, with the project delivering GSM and GPRS services to 40% of Indonesia's 220 million population.²⁰⁶ Huawei booked US\$10 million in terminal sales and the company expects 'that [2005] domestic sales will grow by up to 200%'.²⁰⁷ Huawei won four other contracts in the 2003 and 2004.

Reports for ZTE include: in May 2006, ZTE opened a new US\$1.5 million training facility in Bandung, Indonesia, in partnership with STT-Telekom, to provide telecoms training for clients, ZTE staff and colleges in the Asia Pacific region, with the facility having capacity to train around 4,000 students annually, eventually increasing to 10,000 students²⁰⁸; in August 2004, the company won a contract with PT Telkom to build an NGN-DLC (Digital Loop Carrier) network the finished network offering users broadband and narrowband integrated services such as

POTS, ISDN, ADSL, SHDSL and HDSL²⁰⁹; in February 2004, ZTE won a US\$46.4m contract with PT Indosat for the first phase roll-out of 250,000 CDMA-based WLL lines in Jakarta and Surabaya.²¹⁰

Philippines

Telecommunications Equipment and Handsets

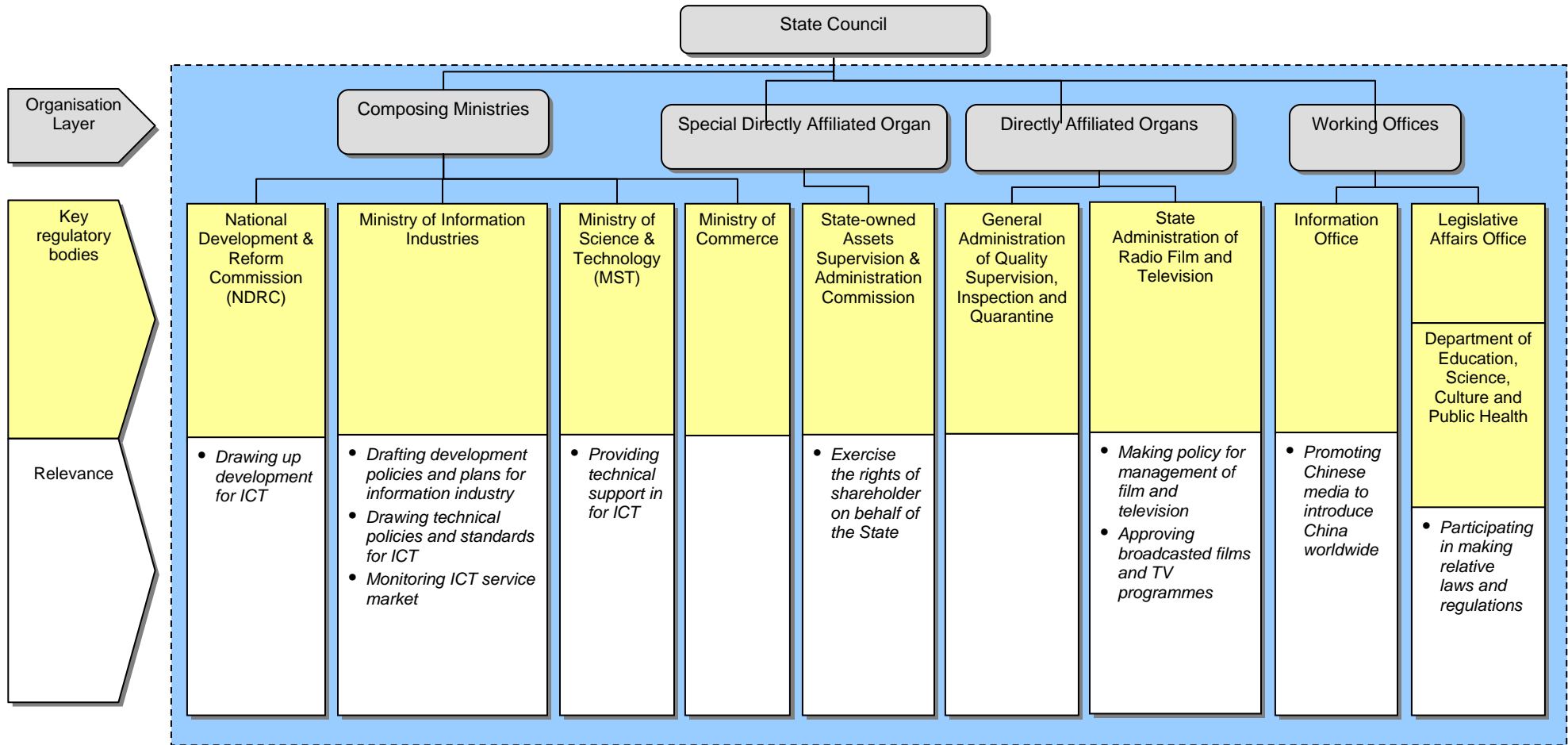
As is true for most of ASEAN, where mobile subscribers far outnumber fixed line subscribers, providing mobile cellular solutions has been one area where Chinese vendors have found a modicum of success in the Philippines. Huawei has been successful in selling equipment to the late entrant in the Philippines mobile market, Sun Cellular, the mobile division of Digital Telecommunications Philippines Inc. (Digitel). Huawei has signed two contracts with Digitel Mobile for a GSM network expansion contract and a GSM equipment contract. Huawei is also trying to sell its data communication products (switches and routers) to the banking, government, and manufacturing sectors, on the basis that Huawei's gear is 30-40% cheaper than Cisco's. Huawei worked out other deals with 3Com for \$60,000.²¹¹ and sold \$20 million worth of CDMA gear to Multimedia Telephony Inc. for the Philippines's first CDMA network.²¹²

Brunei

Even in Brunei, a country with a population of 360,000, Chinese companies have made their presence felt, mostly in the sale of telecommunications equipment to Brunei service providers. In January 2006, both Huawei and ZTE announced that they had completed construction of pilot 3G WCDMA networks for DST, a private company which provides cellular mobile services in Brunei.²¹³ Huawei said its network would be ready to be used commercially by 2007.²¹⁴ Huawei has been more active than ZTE. In April 2005, Huawei won a WCDMA contract from another Brunei mobile carrier, B-Mobile. The contract was signed during Chinese President Hu Jintao's 2-day state visit to Brunei.²¹⁵ Huawei had been running a 3G trial network with B-Mobile since April 2004. In July 2003, Huawei received a US\$20 million NGN contract deal with Jabatan Telekom Brunei (JTB), the main provider of telecommunications services in Brunei. Huawei said this was the first large-scale commercial deployment of Chinese home-grown NGN products overseas.²¹⁶

One other major telecoms network deployment in Brunei was a February 2004 TETRA (terrestrial trunked radio) system from Nokia. The system was for use by the Brunei Ministry of Defence.²¹⁷

ANNEX 5: CHINESE GOVERNMENT'S ICT STRUCTURE



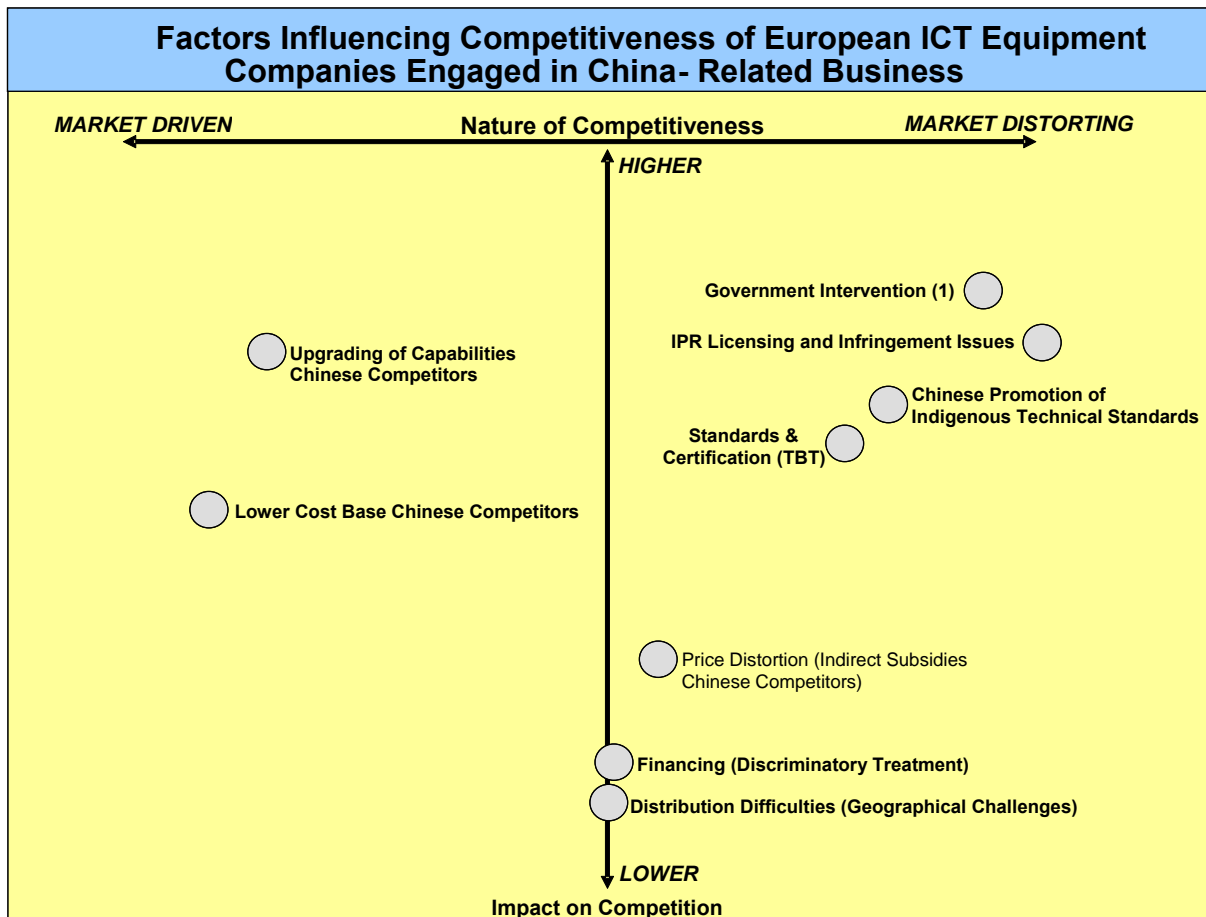
ANNEX 6: TABLE OF KEY LAWS AND REGULATIONS PERTAINING TO ICT SECTOR

Key Laws and Regulations
Measures for the Administration of Telecommunication Equipments Entering into the Public Telecommunication Networks 2001-6-1;
Interpretation of the Supreme People's Court Concerning Some Issues on the Specific Application of Law for the Trial of Criminal Cases on Sabotaging Public Telecommunication Facilities 2004-12-30.
E-Signature Law adopted on 28 Aug 2004
Administrative Measures on Internet Information Services effective on 24 Sep 2000
Interim Provisions on the Administration of Internet Culture effective on 30 Jun 2003
Measures for the Administration of Import of Audio and Video Products effective on 17 Apr 2002
Measures for the Administration of Internet E-mail Services effective on 30 Mar 2006
Provisions on the Administration of Internet News and Information Services effective on 24 Sep 2005
Regulation on Protection of the Right to Network Dissemination of Information effective on 1 Jul 2006
Detailed Rules for the Implementation of the Regulation on the Administration of Commercial Performance effective on 1 Sep 2005

ANNEX 7: FACTORS INFLUENCING COMPETITIVENESS IN THE CHINESE MARKET

In addition to the genuine market driven competitive threats posed by Chinese operators in this sector, European companies also face competitive forces as a result of non-tariff or 'behind the border' barriers (NTBs). Those NTBs which are deemed to result from strong Chinese government intervention are plotted on the right of the horizontal axis while those derived from

genuine competition are plotted to the left. The author has indicated the relative importance of these competitive forces in terms of their position on the vertical axis with those nearer the top deemed as the most significant. The graph is designed as a guide only to give some perspective to the descriptions of competitive forces in this sector.



Notes: (1) preventing market access by excessive regulatory controls, discriminatory practices in applying laws and regulations and other forms of local protectionism

ANNEX 8: INDUSTRY SURVEY RESULTS

Information and Communications Technology

SECTION 1: SECTOR OVERVIEW

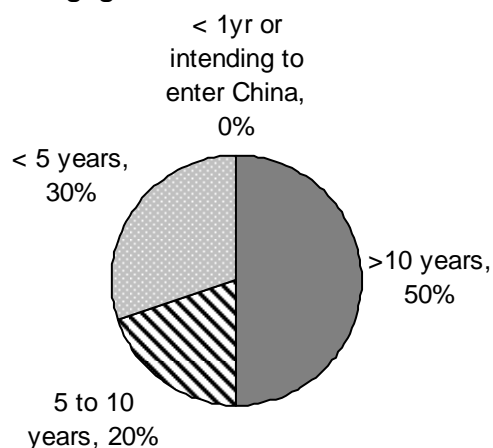
1.1 Sample group profile

Table 1 – Sample Group Profile

MNC		SME	
WFOE	6	WFOE	1
JV	3	JV	0
Total	9	Total	1
% Sample	90	% Sample	10

1.2 For how many years has your company been engaged in China-related business?

Chart 1 – Length of Engagement in China-related Business Activities



The companies surveyed had considerable experience of operating in the Chinese market. 50% of them have conducted business in China for over ten years and a further 20% for between 5 and 10 years. Only 20% of respondents are relatively new to the market having established offices in China in the last five years.

1.3 Which market segments does your China business operate in?

Table 2 & 3 – Involvement in ICT Market

	Total	%
Telecom Equipment	5	50%
Office Equipment	2	20%
Others	7	70%

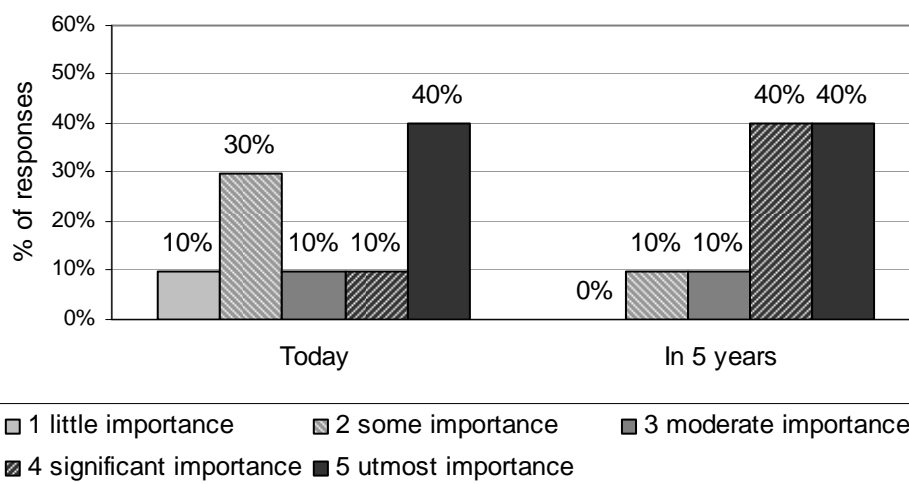
	Total	%
EU Exports to China	5	50%
China-based production for exports to Europe and other destinations	3	30%
China-based production for local market	6	60%
Sourcing	5	50%
Others	3	30%

Respondents often aligned their organisations with multiple market sectors indicating diverse involvement of European companies in the ICT sector in China. This is also reflected in the nature of business being conducted. 50% of the respondents indicated that they export ICT Equipment from Europe to China. Only 30% of the respondents are involved in China-based production for export to Europe and other destinations. In addition, 60% of the respondents indicated that they are involved in China-based production for the local market. The sourcing of raw materials from China is also of considerable importance to European companies, 50% of the respondents are involved in sourcing.

SECTION 2: CHINA MARKET OPPORTUNITIES

2.1 - How important is the China market for your business in terms of sales?

Chart 2 – Chinese Market Importance



There are varying responses regarding the importance of the Chinese market in terms of sales for today. 30% believed the market to be of only of some importance whilst in contrast 40% believed it to be of utmost importance. However, in terms of the importance of the Chinese market in five years time, a marked shift occurs. 80% believe that the Chinese market will be of significant or utmost importance in five years time. On average this is a shift away from a score of 3.4 today to 4.1 in five years time.

2.2 What is the percentage of your company's turnover in China today compared to overall/ global turnover in sales and market share?

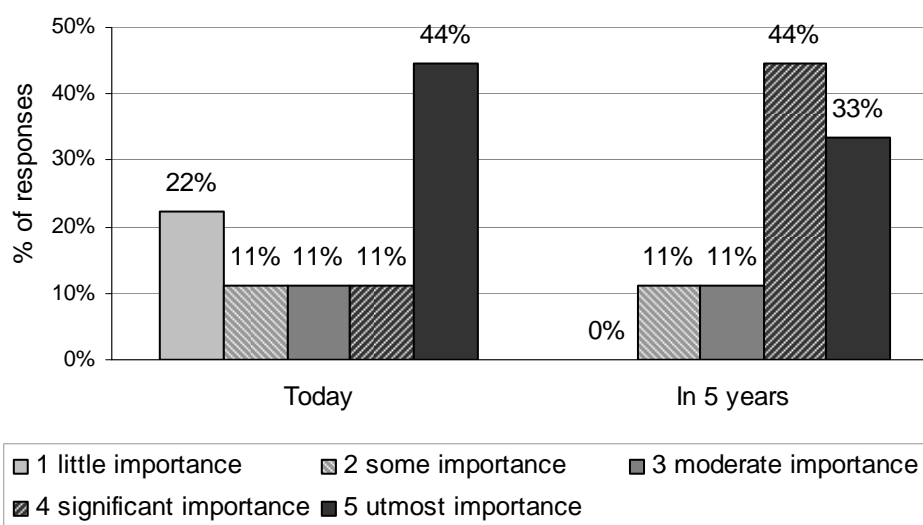
The companies surveyed displayed a significant presence in China in terms of sales and market share. The majority of the surveyed wholly owned foreign enterprises (WOFEs) placed their company's turnover in sales between 2%-8%, with one company reporting a turnover of as high as 90% in China. The reported market share reflects their turnover in sales with the average company placing their turnover in market share between 5%-10% and one company reporting a 90% turnover. These statistics indicate that the majority of the wholly owned companies have considerable investments outside of China. Joint Ventures made up a smaller section of those surveyed however they are considerably more reliant on the Chinese market with up to 98% of sales occurring in China and around 90% of the market share.

2.3 Over the next 5 years, how do you expect business opportunities to evolve in the telecom services sector in China? How will this likely impact on your sales/ market share figures?

There is an optimistic expectation among the majority of companies surveyed that they will share in the benefits of China's projected growth rate of over 10% over the next 5 years with an increase in sales and market share of between 5 and 10%.

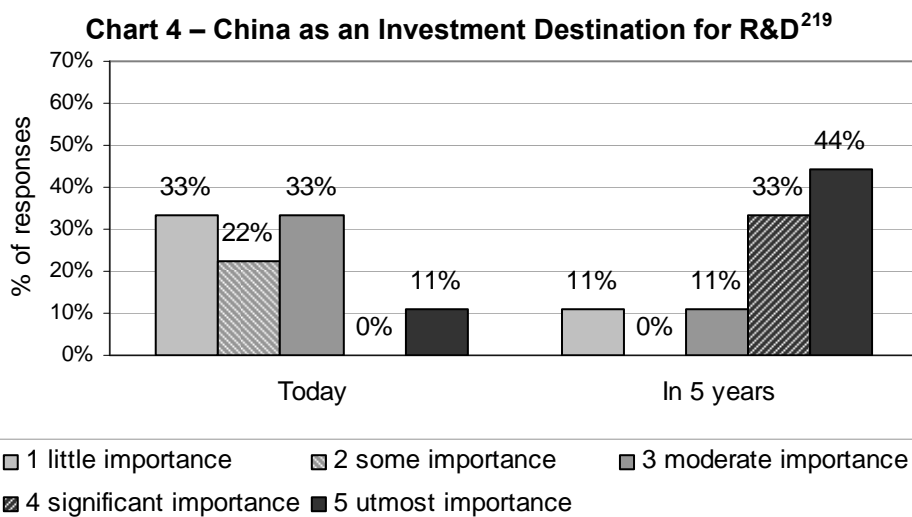
2.4 How important is China as an investment destination for manufacturing?

Chart 3 – China as an Investment Destination for Manufacturing²¹⁸



A clear delineation can be seen regarding the importance of localising manufacturing at the present time. 22% of surveyed companies consider it to be of little importance contrasting with 44% placing it as being of utmost importance. A clear progression can then be perceived as the respondents ascertain its importance in 5 years time. None consider it to be of little importance while 77% rate its importance as being of significant or utmost importance. This indicates a shift in averages of 3.3 today to 3.9 in five years time.

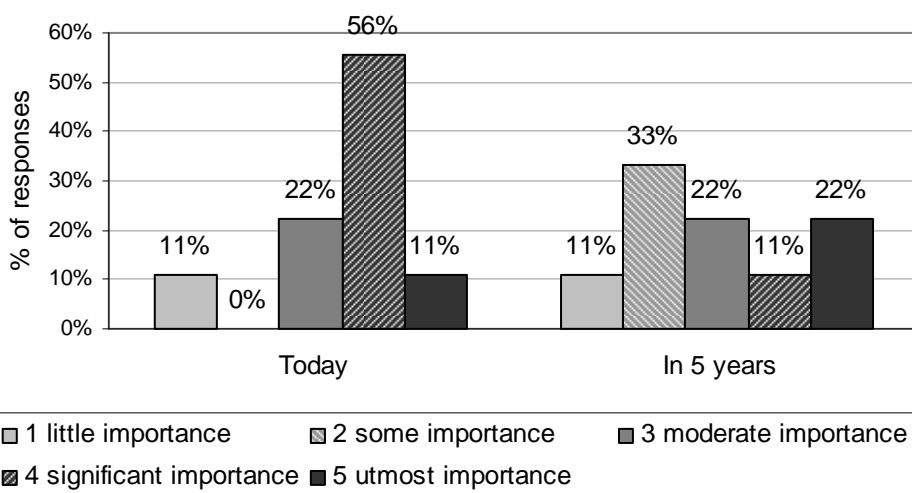
2.5 How important is China as an investment destination for Research and Development?



From the responses of those surveyed it is clear that the majority of companies do not consider China to be important as an investment destination for R&D. 88% considered it to be of moderate importance or less at the present time. The projection for the forthcoming five years indicates a sizeable swing as companies place increasing emphasis on investment in R&D. Thus it can be seen that in 5 years time 77% of companies consider investment in R&D in China to be of significant or of utmost importance. On average this is a shift from 2.3 to 3.7.

2.6 How much of a problem would you rate market access and other commercial practices by China?

Chart 5 – Market Access and other Commercial Practice Problems in China²²⁰



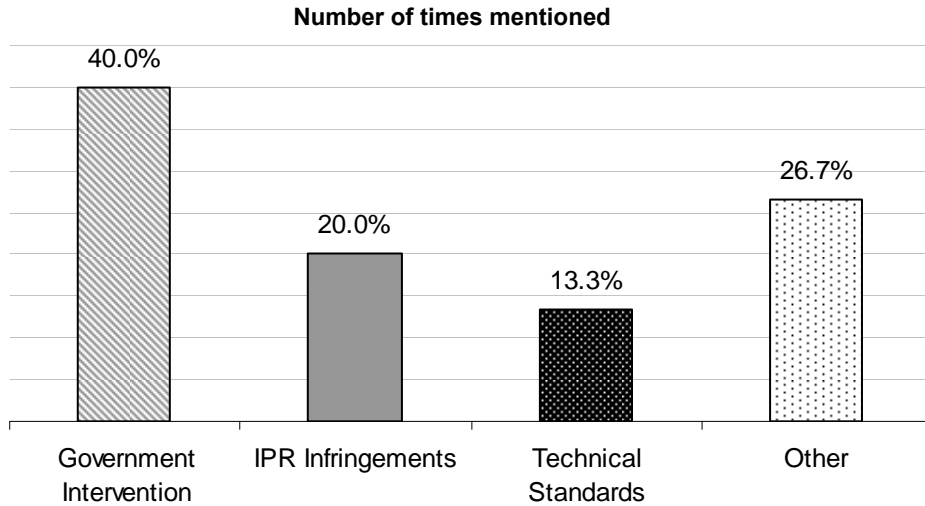
Respondents reported that market access obstacles and other commercial practices in China are of significant importance today with companies giving an average rating of 3.5. The surveyed indicated that market access will improve with the respondents rating problems in market access and other commercial practices an average of 2.9.

The difficulties posed by market access problems and other commercial practices today are considered to be of significant importance by 56% of respondents. While 11% considered it to be of little importance, 22% rated it as being of at least to moderate importance. The market access is projected to improve considerably over the forthcoming five years. Those considering the problem to be of significant or of utmost importance are substantially reduced from 67% to 33%.

In addition, those considering the problem to be of little or some importance increased from 11% to 44%.

2.7 What are the main current obstacles preventing you from expanding further in the Chinese market? Please list in terms of priority (e.g. market access constraints, IP protection, Chinese standards/ operating practices, etc.).

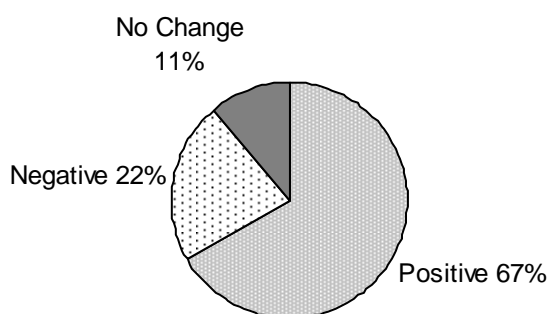
Chart 6 – Main Current Market Obstacles



Respondents indicate that government intervention is the most important market access obstacle preventing further expansion into the Chinese market (40% of times mentioned). Government intervention as described by respondents include: preventing market access by excessive regulatory controls, discriminatory practices in applying laws and regulations, and other forms of local protectionism. The lack of IPR protection is also of significant concern (20% of times mentioned) acting as a disincentive for the transfer of high-end technologies. Of further concern is the adoption of indigenous technical standards (13.3% of times mentioned) which are increasingly seen as a technical barrier to trade. The European companies surveyed also mentioned a host of other obstacles, including price competition, geographical challenges and difficulties with access to financial services (26.7%).

2.8 How will this situation likely evolve in the next 5 years?

Chart 7 – Market Access Situation in 5 years



The overall outlook of the companies surveyed for the next five years is positive. As the market matures regulatory infrastructures will become more effective in dealing with issues such as IPR. Respondents are keen to stress however, that this process will be slow and will not be achieved without continued international pressure from EU-China bilateral and multilateral trade dialogue.

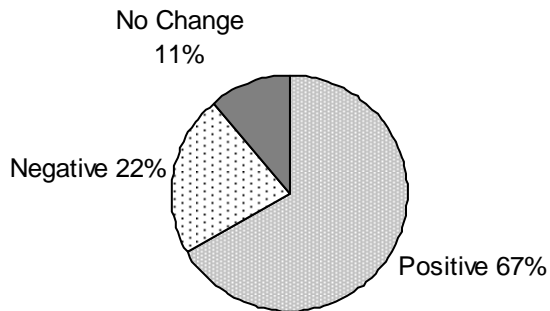
2.9 What are the quantitative costs or impacts resulting from these obstacles on your business today? This can be indicated as a percentage of revenues, profits, etc. Please specify.

Table 4 – Quantitative Costs or Impacts from China’s Market Access Obstacles

Where respondents made specific calculations:			
Comment		Sub-sector	
		Service	Equipment
“20%-30% of the revenue” - ICT Services include: Technology Transformation Service; Workspace Management Service; Application Service; Communication Service and Security Service.”		•	
“Around 40% of the turnover” - Other ICT Equipment include: Flight Simulators, Urban Traffic Control Systems, Railway High Speed Control Systems.			•
“The growth constraint is -40%” – Broad Band Access			•
“Revenue loss is around 10%-15%” – Telecom Equipment, Office Equipment and other Equipment for the Aviation Industry.			•
“Revenue loss probably 30%-50%” - Software for mobile and embedded devices		•	•
Where respondents made estimates:			
Comment		Sector	
		Service	Equipment
Financial Commitments	“50% of revenue loss due to outstanding payments/Account Receivable.”	•	•
Where respondents found it difficult to quantify market access obstacles:			
Comment		Sector	
		Service	Equipment
“There are no big obstacles that are identified. Therefore, future higher costs are not expected.”			•
“The unnecessary local product modifications and lost of new business opportunities are significant however we cannot quantify them.”			•

2.10 How is this situation likely to change in the next 5 years?

Chart 8 – Situation in 5 years



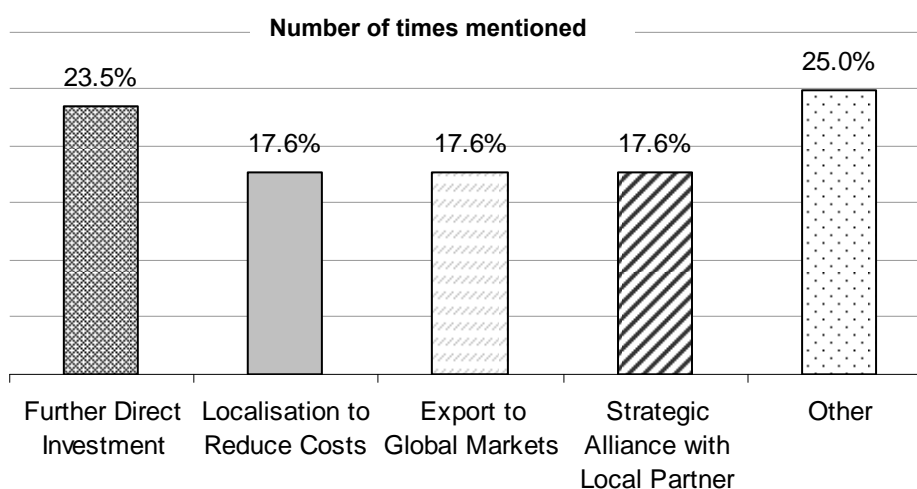
Generally speaking the majority of companies surveyed (67%) have a positive outlook on the situation over the next five years. It is believed that the regulatory situation will be improved through continued EU-China Trade and Investment framework negotiations and through the further involvement of Chinese companies in the global marketplace. Many respondents indicate that desired that particular attention is paid to IPR infringement. The competitiveness of the market will also improve with competition projected to outstrip market growth.

Table 5 – Situation in 5 years

Selected Comments	
Positive	“The situation is bound to improve. The EU-China Framework Trade dialogue is important to facilitate business specific negotiations.”
No Change	“Hopefully there will be some improvements but modernising the local regulatory regime will take a long time.”
Negative	“It depends on how fast MNC develop business in China and how fast Chinese local vendors develop, but anyway the competition growth is faster than the market growth.”

2.11 How does the European ICT equipment producers plan to maximise the opportunities brought about by the Chinese market (e.g. outsourcing and exporting to home markets/ investment in China, etc.)?

Chart 9 – Plans to Maximise Opportunities in the Chinese Market



There is a general consensus amongst the industry stakeholders surveyed that the maximisation of opportunities in China will be achieved through increased manufacturing and R&D through further direct investment (23.5%). Related to further direct investment, but often mentioned separately by industry practitioners is increased localisation to reduce cost and exporting from china to global markets (both 17.6% of times mentioned). Forming a strategic alliance with a local partner is another way in which industry practitioners attempt to maximise opportunities brought about by the Chinese market.

2.12 China’s 11th 5-year programme (2006 to 2011) sets ambitious targets and priorities for rural development, environmental protection (rural and urban), energy efficiency (rural and urban context) as well as the need for a home grown innovation society, affecting all sectors. This direction would represent a major step change in China’s approach to sustainable development.

- a. Please consider how the direction of China’s sustainable development as described above provides opportunities and challenges within your own sector and business units (e.g. new markets, new investment opportunities, partnerships, etc.)?**
- b. What will likely be the challenges and constraints of realising these opportunities?**

The companies surveyed are positive regarding the implications of the China's 11th 5 year programme. The placement of emphasis on the development of Western China will significantly benefit ICT companies as increasing numbers join the digital age. Increased compliance with international standards put European companies on a more equal footing with local competitor. European companies are familiar with best practices in these areas and should reap considerable benefits. However industry representatives do see potential difficulties in operating into Western regions in terms of logistics and local protectionism. Of major concern for industry representatives is China’s desire under the 11th Five Year Programme to develop indigenous innovation through introduction of its own technical standards.

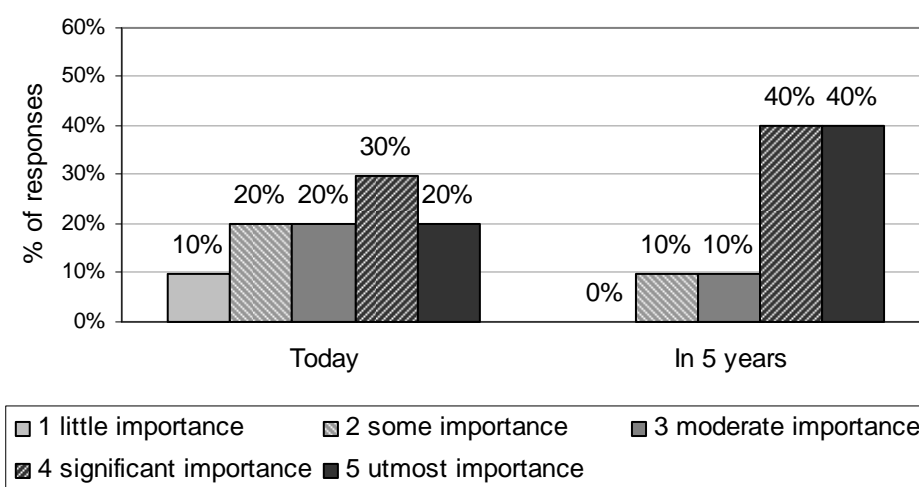
Table 6 – Implications of China's 11th 5-year Programme

a) Selected Comments	
New market opportunities (1)	“Rural area development requires telecom investments and creates new business opportunities.”
New market opportunities (2)	“There are very strong opportunities in air traffic control and high-speed train traffic. Notably influenced by the 11 th -5 year NPC program.”
Higher standards (1)	“It will force Chinese competitors to respect fundamental rules about pollution, safety on the job etc. It will lead to an increase in their production costs and will finally and hopefully be comparable to our costs.”
Higher standards (2)	“The attention to innovation and sustainable development can affect positively our company.”
b) Selected Comments	
Constraints	“Self innovation is a threat because it may stimulate local innovation in areas where natural business opportunities do not exist and in this case we may be mandated to use the local solutions instead of global solutions.”

SECTION 3: CHINESE SECTOR COMPETITION

3.1 - How significant is the competitive challenge of Chinese enterprises operating in your sector in the Chinese market?

Chart 10– Competitive Challenge of Chinese Enterprises Operating in the Chinese Market

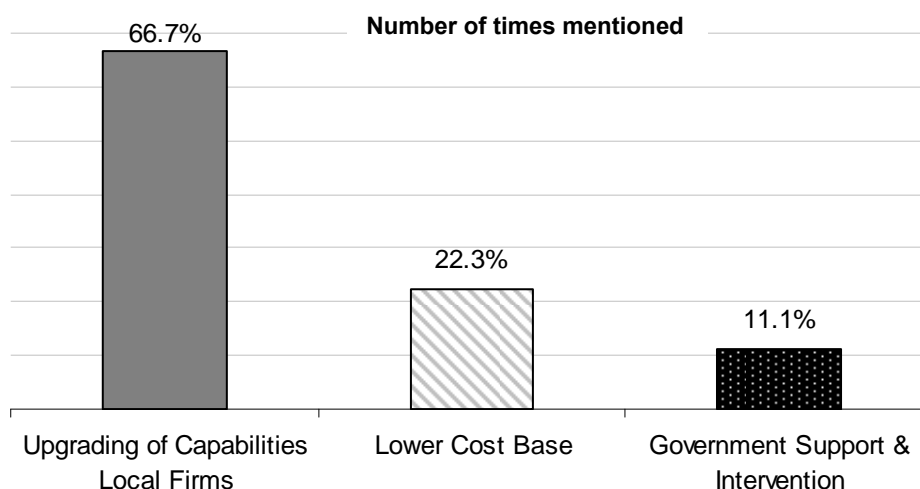


Respondents believe there will be an increase in the competitive challenge posed by competitors in the next five years. Today's average score of 3.3 indicates the challenge of Chinese enterprises at a level of moderate importance. European ICT companies on average expect local enterprises to become a significant challenge in five years time (avg 4.0).

The perceived competitive challenge of Chinese enterprises operating in the sectors of those surveyed at the present time is considerable. 70% consider the competitiveness of Chinese companies to be of at least moderate importance. In the future, it is expected that this competitiveness will increase and 80% have deemed this to be of significant or of utmost importance.

3.2 Please describe the nature of this challenge. Include the role of SOE's in your description. How is it evolving?

Chart 11 – Competitive Challenges Presented by Chinese Companies



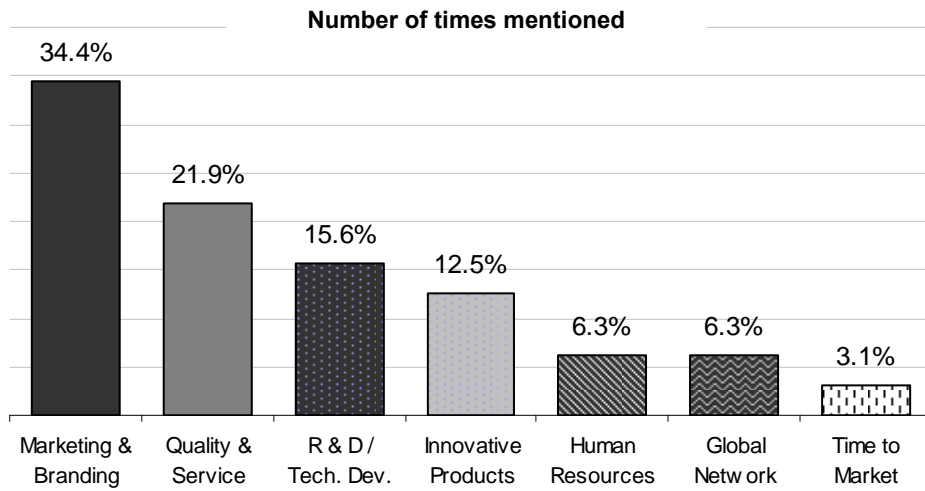
The perceived competitive challenge of local companies to European Companies operating in the Chinese market is significant. The majority of respondents (66.7%) believe that the challenge comes mainly due to the upgrading of capabilities which increasingly allows them to offer higher quality products whilst growing in terms of skills, experience and Western "know-how". 22.3% of respondents believe that the lower cost-base of Chinese companies remains their key competitive advantage. Continued support given by the Chinese government to local companies at both local and national level is a further source of advantage for Chinese companies.

Table 7 – Expected Challenges of Chinese Companies

Selected Comments	
Upgrading of Capabilities Local Firms (1)	"Chinese companies grow fast from skill set, experience perspective and customer experience of receiving services."
Upgrading of Capabilities Local Firms (2)	"There will be quality and effectiveness improvements of Chinese Competitors."
Lower Cost Base (1)	"Chinese competitors can offer low prices due to mature technology."
Government support & Intervention (1)	"Network operators are state owned and in that business government has a strong possibility to influence investment decisions."

3.3 What are the main advantages your company has in China compared to Chinese competitors? Please list in terms of priority (e.g. Product/ innovation, brand, service/ maintenance, people, etc.).

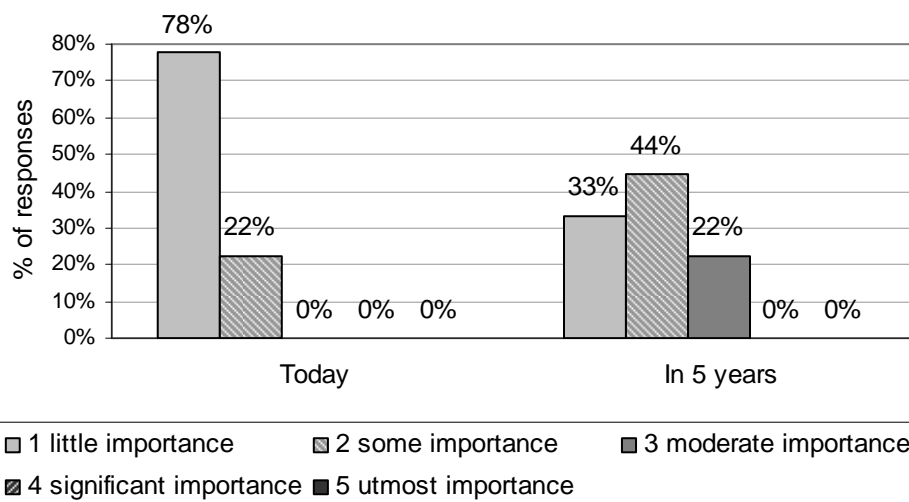
Chart 12 – Main advantages of European Companies



The competitive advantages European companies as expressed by the industry representatives surveyed are predominantly concerned with marketing & branding (34.4% of times mentioned). This includes superior sales models, market understanding and brand reputation. It is believed that European companies are more able to innovate products based on their technological leadership. In addition, superior quality and service provision (21.9% of times mentioned) is also believed to be of significant importance. Better human resources (6.3%), a global network (6.3%), and a faster time to market of new products (3.1%) are also mentioned.

3.4 How significant is the competitive challenge of Chinese enterprises operating in your sector within the US market?

Chart 13 – Significance of Chinese Companies in the US Market²²¹

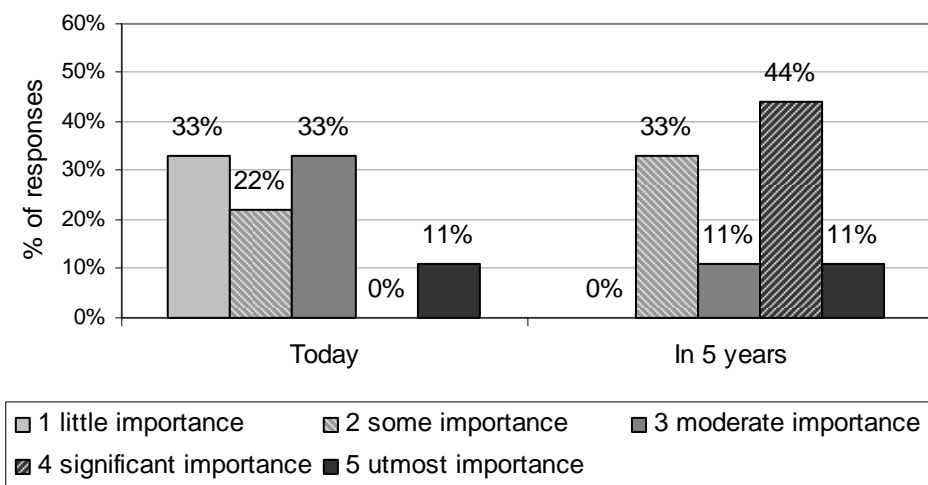


The competitive challenge of Chinese ICT enterprises operating within the US market is not considered to be of significant importance at the present time. 78% of respondents place little importance on it with the remainder rating it as being of only some importance. While the competitiveness is not anticipated to become extremely important over the next five years a marked shift can still be observed. 22% consider it be of moderate importance whilst the percentage placing only little importance on it has fallen from 78% to 33%. On average, the score given for today's situation is 1.2, and increases to 1.9 in five years time.

The development of China as a producer of ICT equipment for the US market is highlighted by the majority of the industry representatives taking part in the survey. It is noted that the market share for Chinese companies increased due to outsourcing to lower cost countries where prices are significantly lower and quality is "reasonable". While it is generally accepted that this development will take place, there some have doubts on the speed and ease with which Chinese firms will penetrate the US market.

3.5 How significant is the competitive challenge of Chinese enterprises operating in your sector in the ASEAN market and other Asian markets (e.g. India, Japan, etc.)?

Chart 14 – Competitiveness of Chinese Companies in ASEAN and other Asian Markets²²²



The competitive challenge of Chinese enterprises operating in Asian markets (ASEAN and others) is not identified as considerable for the present time. 88% of respondents considered it to be of moderate importance or less. The competitiveness of Chinese enterprises is expected to rise slightly with an increase in those believing it to be of moderate importance from 33% to 44%. It can be derived from the survey that competitiveness in this sector in Asia is not expected by the respondents for at least the next five years. On average, the score giving today is 2.3 increasing to 3.2 in five years time – a significantly higher score and increase than given to the competitiveness of Chinese ICT equipment companies in the US market.

3.6 Please describe the nature of this challenge. What is its likely future evolution (5yrs)?

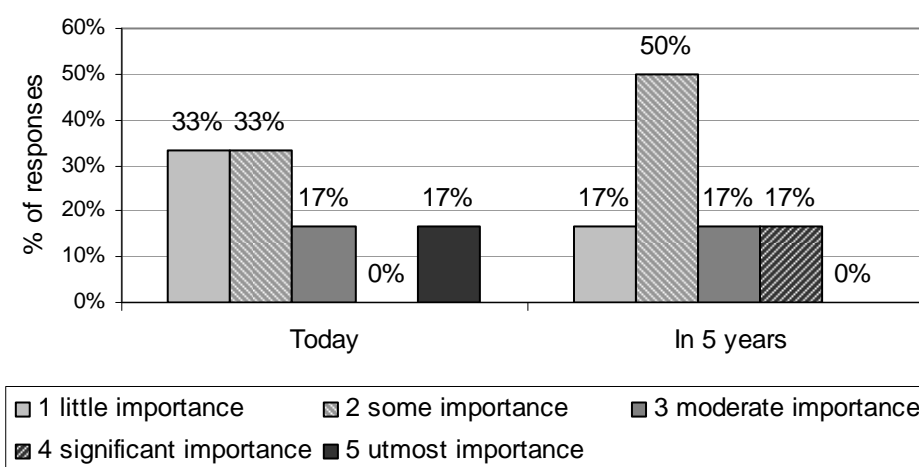
The majority of the companies surveyed expressed the opinion that China market share of ICT equipment sales will rise in the US and ASEAN market over the coming five years. Reasons given for this include the lowering of costs and improvements in technology placing them ahead of local competition. It is believed that China's international development in this sector will be observed at its highest in ASEAN countries.

Table 8 – Expected challenges of Chinese Companies in Asian Markets

Selected Comments	
US market prospect (1)	“Chinese competitors are starting to access the US market through local partnerships and developing sales channels. Yet, no Tier 1 order has been gained so far.”
ASEAN market prospect (1)	“China is more competitive in ASEAN markets because many of them are also developing countries, and so Chinese technology can be higher than local ones.”
ASEAN market prospect (2)	“Chinese competitors have the biggest market share in the ASEAN market and other Asian markets. It can be expected that this situation continues in the next 3 to 5 years.”

3.7 To what extent does the infringement on IPR affect your business with China?

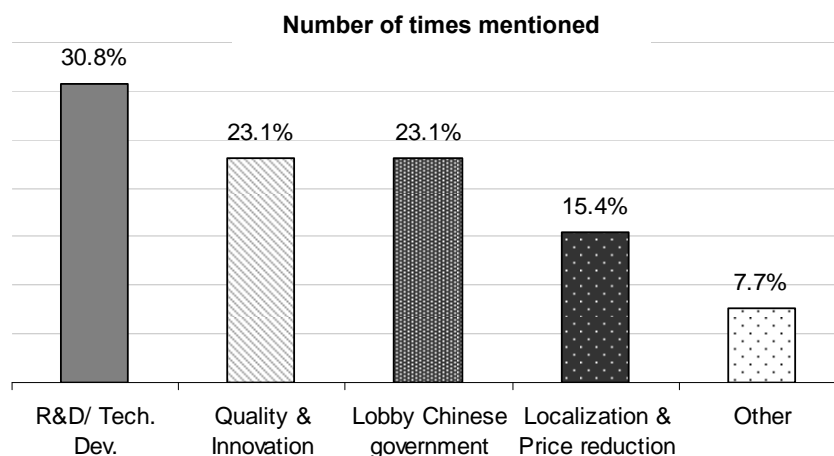
Chart 15 – Effect of IPR Infringement on Business with China²²³



IPR infringement was not identified as being a problem of significant importance by the ICT industry representatives surveyed. 66% of respondents placed little or only some importance on the problem for the present time. There is a slight increase from 33% to 50% in the five year projection of those considering the issue to be of some importance although respondents although those considering IP infringement .of utmost importance reduces as well. This means that the average score of 2.2 given to IP infringement today is the same as in five years time. It should be noted that the companies surveyed do not consider themselves to be of considerable risk. High technology companies argue that they are not so much at risk due to the complexities involved.

3.9 What are European ICT equipment manufacturers doing operationally to maintain competitiveness vis-à-vis Chinese manufacturers?

Chart 16 – Plans to Increase European Competitiveness in the Chinese market



The industry representatives identified numerous operational developments to maintain competitiveness in this sector. The most cited way that respondents intend to maintain competitiveness vis-à-vis Chinese competitors is through increased emphasis on R&D and technological development (30.8% of times mentioned), an area where European companies already say they have advantages. Related to this, European companies say they will increase the quality of their products and engage in innovation facilitating the provision of goods and services that cannot be offered by local companies (23.1%). In addition, respondents emphasise the importance of lobbying the Chinese government (23.1%) in order to achieve better market protection. Localisation and further price reduction (15.4%) and other measures (7.7%), such as increasing capital strength are also mentioned.

3.10 Please highlight ideas for acceptable investment scenarios in China outside those currently permitted by the Chinese government. Please be creative in considering EU-China win-win approaches to investment and cooperation.

Several areas for investment scenarios are highlighted by the industry representatives surveyed. The easing of regulations governing the acquisition of Chinese companies is indicated as a measure for increasing market flexibility. Similarly the easing of restrictions governing participation in public procurement bidding will also be highly beneficial for the companies surveyed.

Table 9 – EU-China Win-Win Investment Scenarios

Selected Comments
“Cooperation enhancement through JVs and other related cooperation works (including standardisation and mutual licensing works)”
“Finding a partner that can benefit from you, either by providing access to overseas market or exchange/share technology to exchange access to the market.”
“Having attractive technology that is wanted in China. Teaming up with government partners to gain ‘good’ protection if things go sore and if someone tries to copy/steal technology.”
“Higher Chinese investment in Education sector and Medical & Hospital sector.”
“Western authorities must become more flexible with the exit of their own technologies from their countries.”

ENDNOTES

¹ G.Dang Nguyen and C.Genthon (2006) 'Has the European ICT sector a chance to be competitive?' citing the Technology Foresight for Decision Makers, 17-18 November 2003, Moscow/Russian Federation.

² This office should be complimentary to the EU-China Information Society Project and in particular aim to provide services and support for European ICT companies trying to trade with or invest in China.

³ Some long term changes can reverse, such as the relative cost of oil or the aging of a population.

⁴ ICTs are equally a component of other forms of communications, such as jumbo jets and container ships.

⁵ The argument implied here is that change is inevitable, there are always winners and losers, but if part of the benefits can be recycled to compensate the losers, the social costs can be minimised. This is a basic tenant of welfare or social economics, and in theory should be common ground to all economic actors.

⁶ In this context 'hardwired' is synonymous with solid state electronics in which electrical currents pass through solid material, for example silicon, rather than through a vacuum valve such as the cathode ray tubes (CRT) in traditional TV sets. A step further would be photonics or optical electronics.

⁷ For example, in Hong Kong, SAR (China) PCCW has been very successful in cross-selling IPTV and broadband lines for telephony and fast Internet access.

⁸ This is typically described by economists as 'monopolistic competition' meaning that each vendor tries to establish a monopoly over a brand name for a product that is otherwise undifferentiated from and therefore closely substitutable by its competitors.

⁹ Since IP can run over an ATM switch the argument is not conclusive.

¹⁰ Many ICT manufacturers have their own venture capital funds to support entrepreneurial start-ups and spin-offs so they can scout these technologies without committing to them.

¹¹ Operators, and handset vendors, hoped it would be incremental towards a multimedia messaging service (mms) which adds graphics to text, and with high bandwidth 3G phones it would lead to video-messaging service (vms), but so far these have not proved to be very popular with consumers.

¹² China SME Online, also cited by 'The foreign share of what China deems to be high-tech exports is now 88 per cent.' Joe Studwell, editor of *China Economic Quarterly*. The CEO on FT.com: China's export conundrum, 5 June 2006.

¹³ *Chinese High-Tech Manufactures*
http://www.trp.hku.hk/papers/2002/china_hitech_mfrs.pdf

¹⁴ For official summary see
http://english.gov.cn/2006-05/12/content_279021.htm

¹⁵ See
http://www.chinadaily.com.cn/english/doc/2005-04/22/content_436527.htm

¹⁶ The White Paper was followed in June 2006 by the publication of two Action Plan documents by the State Intellectual Property Office (SIPO) setting out a reform agenda.

¹⁷ EC *Key Indicators of the Competitiveness of EU's ICT Industry*.

¹⁸ OECD *Information Technology Outlook, 2004*

¹⁹ G.Dang Nguyen and C.Genthon (2006) 'Has the European ICT sector a chance to be competitive?' citing the Technology Foresight for Decision Makers, 17-18 November 2003, Moscow/Russian Federation.

²⁰ The custom's Harmonised System (HS) was used and included the office machinery items of category HS 84 and electrical machinery and equipment in category HS 85. In only one other category 'Other office machines' (HS 8472) did the EU export over US\$100 billion worth of goods to China. But the data suffers from a lack of time series as it relies upon the UN's Comtrade database which only goes back as far as 2002.

²¹ This group of countries accounted for between 37 per cent and 66 per cent of world trade for each of the ICT categories.

²² Many exports from Mainland China are recorded through Hong Kong, Special Administrative Region.

²³ This is because of so-called 'screw-driver' companies that work out of unofficial workshops, often avoid paying taxes and minimum wage rates, and certainly do not pay royalty fees. These companies are not just undermining the sales and patents of foreign companies operating in China, but are also driving China's own legitimate companies out of the market

²⁴ This is partly because the Taiwanese government does not allow any company to transition semiconductor process technology below 0.25 micron to China.

²⁵ Metal Semiconductor Field Effect Transistors Light-emitting diodes (MOSFETs) are tiny chip-based lights that serve as indicators on electronic devices, but now using polysilicon rather than oxide.

²⁶ 'China Pours More on IC Industry', *SinoCast China IT Watch*, March 9, 2006.

²⁷ Survey by the *Electronic Engineering Times - China*.

²⁸ 'China Pours More on IC Industry', *SinoCast China IT Watch*, March 9, 2006

²⁹ SinoCast China Business Daily News, March 27, 2006.

³⁰ 'Industry in Infancy', *Purchasing*, May 18, 2006.

³¹ For the most part, the foundries in China use older semiconductor processing technology such as 0.25 or 0.35 micron, whereas leading-edge chips such as microprocessors and ASICs require 90 nm and 65 nm process technology which Taiwan restricts. 'China chipping away at Taiwan', *AP*, May 5, 2006.

³² As a very broad generalisation, telecoms equipment manufacturers tend to cluster around the Pearl River Delta in Guangdong province and IT companies tend to cluster in Shanghai and around the Yangtze River.

³³ SinoCast China Business Daily News, 7 March, 2006

³⁴ Chinese made handsets are cheaper, but even consumers in the poorer Western parts of China often prefer to pay higher prices for what they regard as better quality. In April 2006, the director of the MII's Science & Technology Quality Supervision Department reported that local handsets suffered from quality problems. 'MII Disparages Poor Quality of Domestic Handsets', *Pacific Epoch*, 14 April 2006.

³⁵ Fourth generation wireless networks will offer communication speeds of up to 100 Mbps and are expected to emerge from the research laboratories for commercial development around 2012.

³⁶ 'Nokia Forms New JV with Chinese Partner', *SinoCast China IT Watch*, June 5, 2006

³⁷ 'China Telecom to Build CN2 Within This Year', *SinoCast China IT Watch*, April 5, 2005.

³⁸ SMG is officially the only enterprise with a license to trial IPTV in China, which it has been doing in partnership with the network operators such as China Telecom and China Netcom in various cities.

³⁹ 'Who is more advisable, digital TV or IPTV?', *Xinhua's China Economic Information Service*, February 13, 2006.

⁴⁰ The holders of the 'essential patents' for DVDs (DVD 6C Licensing Agency) are Hatachi, Matsushita, Mitsubishi, Sanyo, Sharp, Toshiba, Victor Company of Japan, Warner Home Video. Royalties average around US\$0.05 per disk made, and 4% of the 'Net Selling Price' (gross minus discounts to third parties) or US\$4 per DVD player (US\$6 per DVD recorder; US\$1.50 per DVD encoder) whichever is the greater up to a maximum of US\$8. See <http://www.dvd6cla.com>

⁴¹ http://www.chinadaily.com.cn/bizchina/2006-04/28/content_579280.htm. The agreement allows Chinese DVD manufacturers to pay back royalties over a period of time.

⁴² Microsoft's Media 9 uses VC-1 codec, but mainly confined to PC usage.

⁴³ For full details, see 'MPEG-4 Royalties Revealed', 18 November 2003, contributed by ByteEnable at: <http://www.linuxelectrons.com/article.php/20031118211505452>

⁴⁴ 'With our own AVS standard, we will be able to develop China's audio video standards without being controlled by foreign patent-holders.' Gao Wen, head of the AVS standard working group. *China Daily* July 31, 2003.

⁴⁵ At May 2006 exchange rate. See MPEG LA at <http://www.mpegla.com/dvb/dvb-agreement.cfm>

⁴⁶ See <http://www.windowsfordevices.com/news/NS4779637630.html>

⁴⁷ Given that the largest market for handsets is domestic, Qualcomm offered Chinese manufacturers a lower royalty payment for handsets sold on the domestic market and a higher royalty payment for handsets exported than was being offered in other countries. The offer was extended to all Qualcomm customers, for example to South Korean companies, who as exporters saw no benefit.

⁴⁸ 'During drafting BWIPS [*Broadband Wireless IP Standard Working Group*] was quite secretive and apparently had far more connections with the security side of the Chinese government than with either Chinese industry at large or with the usual information technology regulators, such as the Ministry of Information Industries (MII).' Scott Kennedy 'The Political Economy of Standard Coalitions: Contrasting Wireless LAN and Home Networking Standards Development' WP (quoted with author's permission).

⁴⁹ SMEC (State Encryption Management Commission); SAC (Standardisation Administration of China).

⁵⁰ Legend Group Ltd., Huawei Technologies Co. Ltd., Shenzhen Mingwah Aohan High Technology Co. Ltd., Wuxi Jiangnan Computer Technology Research Institute, Shanghai Koal Software Co. Ltd., Shenzhen ZTE IC Design Co. Ltd., SDT Telecom Group, Chengdu Westone Information Industry Co. Ltd., China IWNCOMM Co. Ltd.,

Shenyang Neusoft Co. Ltd. and Beijing Watch Data System Co. Ltd.

⁵¹ One of the companies with patent claims on OFDM is Flarion, acquired by Qualcomm. See http://en.wikipedia.org/wiki/WiMAX#Intel_WiMAX_Collaborations_with_Nokia_2C_Motorola_in_2005 and also <http://www.wimaxforum.org/home>

⁵² See Fujun Lai, Joe Hutchison and Guixian Zhang (2006) 'RFID in China: Opportunities and Challenges' *International Journal of Retail & Distribution Management*, Volume 33, Number 12, January 2005, pp. 905-916(12).

⁵³ The air quality in China's major cities is seriously poor, exacerbated by the profusion of coal burning power stations, often not legally built nor authorised, that have sprung up to serve the nation's insatiable demand for energy. Poor quality, unclean and hazardous industrial processes are everywhere, and environmental controls over emissions and waste disposal often lacking or ignored.

⁵⁴ Projects led by State Council approval, often under the leadership of a senior official, are termed 'golden'.

⁵⁵ R&D spending is due to increase from 1.23 per cent to 2.5 per cent of GDP.

⁵⁶ This is a continuation of the Chinese High-Technology Research and Development Programme first drafted in March 1986, forever known as Project 863, which listed ICTs as one of seven priority areas or 'pillar' industries. For references, see John Ure (1995) *Telecommunications in Asia: Policy, Planning and Development*, HKU Press.

⁵⁷ Alessia Amighini (2005) 'China in the international fragmentation of production: Evidence from the ICT industry' *The European Journal of Comparative Economics*, v.2.2, pp.203-219.

⁵⁸ Cheung, K-Y and Lin, P (2004) 'Spillover effects of FDI on innovation in China: Evidence from provincial data' *China Economic Review*, v.15, pp.25-44.

⁵⁹ Values range from 1 which indicates pure exports and maximum comparative advantage, to -1 which indicates pure imports and maximum comparative disadvantage, and 0 which indicates the highest proportion of intra-industry trade.

⁶⁰ Values ranging from <1 down to zero indicate lack of comparative advantage, while values ranging from 1 to infinity indicate positive and rising levels of comparative advantage.

⁶¹ Land and labour costs have been rising in China, especially along the industrial southern and eastern coastal areas where provincial level per capita incomes are reaching middle income country levels.

⁶² Essential IPRs traditionally relate to research and development done by companies in their home country where their most valued assets are located. Licensing fees and royalty payments on patents are extracted from overseas subsidiaries and foreign-invested companies, along with other business service payments such as 'management consultancy'. But charging substantial prices for these and other trade inputs the profit margins of the overseas subsidiary or foreign-invested company are squeezed to the benefit of the investing company. For this reason the profit margins made directly in China by foreign investors may significantly under-estimate the profits being made from foreign investment in China.

⁶³ China SME Online, also cited by 'The foreign share of what China deems to be high-tech exports is now 88 per cent.' Joe Studwell, editor of China

Economic Quarterly. The CEQ on FT.com: China's export conundrum, 5 June 2006.

⁶⁴ 100 per cent foreign-owned companies are still relatively rare in China in the ICT sector, with Alcatel and Motorola in Shanghai and Tianjin respectively being two notable exceptions. At the other end of the scale, domestic Chinese companies like Huawei, Datang and ZTE have a considerable number of licensing agreements with multinational ICT companies.

⁶⁵ *China Daily*, 15 May 2006, http://www.chinadaily.com.cn/bizchina/2006-05/15/content_589774.htm

⁶⁶ In 2004, domestic applications (65,786) also outnumbered foreign (64,347) while patents issued to domestic applicants (18,241) again fell short of those to foreign applicants (31,119).

⁶⁷ *www.forbes.com*, October 16, 2006

⁶⁸ But overall by 2004 'invention' patents were still only 23.6% of applications registered to Chinese companies compared to 86% registered to foreign companies. See SIPO Annual Reports at http://www.sipo.gov.cn/sipo_English/ndbg/default.htm

⁶⁹ *Interfax China IT & Telecom Report*, 7 January 2006.

⁷⁰ WTO (2006) *Trade Policy Review: Report by the Secretariat – People's Republic of China*, p. 94, citing OECD data.

⁷¹ Total government procurement grew from 0.04 % GDP in 1998 to 9.64% GDP in 2002 according to Richard P. Suttmeier and Yao Xiangkui (2004), 'China's Post-WTO Technology Policy: Standards, Software, and the Changing Nature of Techno-Nationalism', NBR Special Report, <http://www.nbr.org/publications/specialreport/pdf/SR7.pdf#search='Richard%20P.%20Suttmeier%20and%20Yao%20Xiangkui'>

⁷² According to the MII in 2002 foreign companies accounted for 95.3% of China's software and software integration markets. In 2000 the State Council issued Document 18 'Notice of Certain Policies to Promote the Software and Integrated Circuit Industry Development' and in 2002, Document 47 'Programme of Action for Promotion of the Software Industry', incorporating new software development in the '863' programme. The State Council called for 60% of software value to come from domestic companies and the creation of 20 large domestic software companies with revenue goals of RMB1 billion. See <http://www.china.org.cn/english/features/investme nt/36736.htm> for details of tax incentives. See also Richard P. Suttmeier and Yao Xiangkui (2004), 'China's Post-WTO Technology Policy: Standards, Software, and the Changing Nature of Techno-Nationalism', NBR Special Report, <http://www.nbr.org/publications/specialreport/pdf/SR7.pdf#search='Richard%20P.%20Suttmeier%20and%20Yao%20Xiangkui'>

⁷³ WTO (2006) *Trade Policy Review: Report by the Secretariat – People's Republic of China*, WT/TPR/S161 p.60

⁷⁴ For a summary, see Ann Weeks and Dennis Chen, 'Navigating China's Standards Regime', *China Business Review*, 1st May 2003 url: <http://www.chinabusinessreview.com/public/0305/weeks.html>

⁷⁵ Private interview with the author on 19 July 2006

⁷⁶ According to Su Jun and Du Min (2005) 'Market Failure and Government Failure: Research on the Mechanism of AVS Standard Setting' (Draft) Social

Science Development Office, Tsinghua University, the Chinese Government played little direct role on the R&D process until approval by MII and SAC in 2002 after which funding of RMB8 million came from the National Development and Reform Commission and a further RMB10 million from the Zhongguancun Science Park. (p.15)

⁷⁷ Further details regarding the methodology for deriving the partial equilibrium model can be found in the qualitative analysis technical supplement.

⁷⁸ WTO (2006) *Trade Policy Review*, Report by the Secretariat, People's Republic Of China, WT/TPR/S/161, 28 February 2006.

⁷⁹ WTO (2006) *Trade Policy Review: Report by the Secretariat – People's Republic of China*, WT/TPR/S161

⁸⁰ For instance, the U.S. market is marked by long-term ties between phone companies and their equipment suppliers, and leading-edge technology is just as important as a good price.

⁸¹ This is often attributed to a perception that private Chinese companies are not truly private, but agents of the Chinese government. One casualty in 2002 was Hong Kong-based Hutchison Whampoa having to withdraw a bid for the distressed assets of US telecoms company Global Crossing.

⁸² Most prominent are the mergers between Siemens and Nokia, Alcatel and Lucent, and Ericsson and Marconi. European vendors also lower their costs by basing production and R&D in China (see the example of Alcatel Shanghai Bell).

⁸³ This matters as it allows a company like Huawei to offer almost free financing at a time when most established vendors have decided not to do so, for such vendor financing in the late 1990s caused hundreds of millions of euros of bad debt.

⁸⁴ Deals won by Chinese vendors like Huawei and ZTE in North America and Europe are comparatively small in nature. According to BDA, emerging markets accounted for 70 per cent of both companies' combined overseas sales of US\$3.9 billion in 2004. (*AFX Asia*, July 8, 2005)

⁸⁵ 'Trial and Error: A Chinese Telecom Powerhouse Stumbles on Road to the U.S.', *The Wall Street Journal*, July 28, 2005

⁸⁶ Haier's US\$16 a share bid, backed by Bain Capital and Blackstone Group, was thwarted by a rival US\$21 a share bid by Whirlpool.

⁸⁷ The Chinese government, through the Chinese Academy of Science, has a 27% stake in Lenovo.

⁸⁸ Telfort was later acquired by KPN.

⁸⁹ The Vodafone deal expires in 5 years time and covers 21 countries. It is part of a growing trend of carriers looking beyond Tier 1 handset vendors.

⁹⁰ Marconi was eventually bought out by Ericsson. Marconi had been in a partnership with Huawei since May 2005 to sell Huawei's L2 and L3 equipment to carriers while Huawei sold Marconi's fixed-wireless equipment in China for cellular backhaul.

⁹¹ Chinese companies would like to use Spain as a bridge to Latin America, a market of about 500 million people where Spanish companies control a large swath of the telecoms, banking, and energy markets.

⁹² Huawei will provide a UTRAN system based on the new generation Node B technologies.

⁹³ China's Telecom Equipment Market 2005 by CRC-Pinnacle Consulting Co. Ltd.

⁹⁴ Because the ICT industry is very much a demand driven industry, in terms of market size the same

growth fundamentals are assumed under the baseline scenario as was assumed in the optimistic scenario. Increased government-led investment and promotion of indigenous standards is not expected to influence demand patterns.

⁹⁵ The industry survey also reveals that 65% of companies expect positive developments with regard to the reduction of market access obstacles in five years time.

⁹⁶ For official summary see http://english.gov.cn/2006-05/12/content_279021.htm

⁹⁷ See http://www.chinadaily.com.cn/english/doc/2005-04/22/content_436527.htm

⁹⁸ The White Paper was followed in June 2006 by the publication of two Action Plan documents by the State Intellectual Property Office (SIPO) setting out a reform agenda.

⁹⁹ The responsibility of SIPO (State Intellectual Property Office)

¹⁰⁰ The responsibility of the SAIC (State Administration for Industry and Commerce)

¹⁰¹ The responsibility of the SCB (State Copyright Bureau)

¹⁰² <http://www.ccsa.org.cn/english/const.php>

¹⁰³ See http://www.chinadaily.com.cn/english/doc/2005-04/21/content_436276.htm

¹⁰⁴ According to the Information Centre of the Tianjin Economic Development Area, between 2000 and 2004 there were criminal charges brought against 2,566 persons.

¹⁰⁵ In overall terms, the ASEAN countries constitute China's sixth largest trading partner, while China is ASEAN's fifth largest trading partner. Chinese government statistics reveal that between 2001 and 2004, ASEAN-China trade on ICT-related products registered 52% growth year-on-year. Trade volume surpassed US\$48.5 billion in 2004. (*Asia Pulse*, May 13, 2005)

¹⁰⁶ The five fields are ICT investment, foreign trade policies, ICT technology standards, human resources development and capacity building. ('ASEAN-China ICT Business Forum opens in Malaysia', *Xinhua's China Economic Information Service*, April 18, 2006)

¹⁰⁷ Under WTO rules (Article 25 of GATT and article 5 of GATS) FTAs are allowed to give preferential treatment over and above the norms of MFN (Most Favored Nation) status. ASEAN has been working towards a free trade area (AFTA) since 1992, establishing the Common Effective Preferential Tariff (CEPT) mechanism to reduce intra-ASEAN trade tariffs on industrial products. Services, including telecommunications, were added to the goals at the 6th ASEAN Summit held in Hanoi in 1998. The same summit added the goal of an ASEAN Investment Area that would exempt capital goods from import tariffs and extend tax exemptions to three years, and a Mutual Recognition Arrangement (MRA) whereby governments would mutually recognize each other's type approval certificates on imported equipment, see <http://www.aseansec.org/6674.htm>. In all these areas progress has been slower than originally planned.

¹⁰⁸ See <http://www.aseansec.org/acfta-brochure.doc>

¹⁰⁹ See <http://www.aseansec.org/13196.htm>

¹¹⁰ See <http://www.aseansec.org/6269.htm>

¹¹¹ Industry Updates, May 19, 2005

¹¹² BBC Monitoring Asia Pacific, May 12, 2005

¹¹³ See <http://www.adb.org/Projects/GMS-biodiversity/kunming-declaration.pdf>

¹¹⁴ China Daily, July 5, 2005

¹¹⁵ See <http://www.aseansec.org/18368.htm>

¹¹⁶ China announced in June 2006 that it would create its own national RFID standard and establish an RFID R&D facility in Shanghai's Zhangjiang Hi-Tech Park. 'Ma Songde, vice-minister of MOST, said on 6/9/2006 that RFID technology has been included in China's 11th 5 year programme and "836 Plan" (a hi-tech development plan of China) as a key national project.' (*South Metropolis Daily*, 14 June 2006 – as reported by US Information Technology Office's *Weekly China Summary* 16 June 2006, Beijing.)

¹¹⁷ Joint Ministerial Statement ASEAN-China ICT Ministerial Forum, 21 April 2006, Penang, Malaysia, para.12

¹¹⁸ 'China Boosts Regional Trade --- Dependence on Exports Leaves Southeast Asia Vulnerable', *Washington Post*, February 6, 2004

¹¹⁹ It has also raised new concerns, one being that Southeast Asia's *dependence* means that its own growth could be vulnerable if China's economy cools. And as Chinese manufacturing grows in sophistication, it likely will eat into the flow of finished products those countries send directly to the U.S., Europe and Japan. According to UBS Malaysia's exports to China grew by 54% through the first nine months of 2003 but its overall exports were flat because the increase in sales to China was offset by a slowdown in exports to the U.S. (where Malaysian companies were edged out by China).

¹²⁰ Among the benefits, a November 2003 Morgan Stanley report estimated that China's purchases amounted to 20% to 30% of the total export growth for Malaysia, Thailand and Singapore. In the fall of 2003 a UBS economist noted that exports from Malaysia, Taiwan and Singapore to China now make up about 7% of their overall economies.

¹²¹ Xinhua News Agency, 4 July 2005

¹²² See GMS: Sixth Meeting of the Subregional Telecommunications Forum (STCF-6), Hanoi, 27-28 October 2004 <http://www.adb.org/Documents/Events/Mekong/Proceedings/stcf-6.pdf>

¹²³ Indian Business Insight, January 24, 2006

¹²⁴ Business Times Singapore, November 16, 2005

¹²⁵ The SGX requires Chinese companies to have at least five shareholders and earn a pre-tax profit of \$1 million a year for the last three years before listing.

¹²⁶ Straits Times, January 27, 2006

¹²⁷ AFX Asia, December 6, 2005

¹²⁸ Business Times Singapore, September 15, 2005

¹²⁹ China Industry Daily News, June 7, 2005

¹³⁰ Industry Updates, May 10, 2005

¹³¹ Senior Minister Lee Kuan Yew was less than happy when in 1999 the Suzhou municipal government set up a Suzhou New District Park in competition with the Suzhou Industrial Park – see <http://www.sfdonline.org/Link%20Pages/Link%20Folders/Other/suzhou.html>

¹³² Xinhua's China Economic Information Service, April 11, 2006

¹³³ Interfax China IT & Telecom Report, April 16, 2005

¹³⁴ 'Malaysia's leader completes 22-year trek into 21st century', *Electronic Engineering Times*, November 17, 2003

¹³⁵ 'China's Huawei sees jump in Malaysia sales', *Reuters*, December 20, 2005

¹³⁶ *SinoCast China Business Daily News*, December 20, 2005

¹³⁷ 'He learnt three important ingredients in turning the country into a new economic powerhouse. The ingredients are human capital development, research and development capabilities and having faith in the younger generation to spearhead the country's development.' (*Bernama Daily Malaysian News*, September 4, 2005)

¹³⁸ According to an article in the *Nikkei Weekly*, labor costs in Malaysia are now two to three times those in China. Malaysia tends to treat its workers well - with pay rising every three years, regular raises given above the cost of living and bonuses based not on merit but on tenure. And the Japanese ICT firms, unlike their Western counterparts, have not been able to take advantage of Malays' good English-language capabilities. ('Malaysia losing manufacturing luster for Japan's consumer electronics firms', *Nikkei Weekly*, May 10, 2004) With a large ethnic Chinese population, many Malaysians also have strong Chinese language skills.

¹³⁹ *Agence France Presse*, September 2, 2004

¹⁴⁰ *The Edge Financial Daily*, May 31, 2006

¹⁴¹ *Agence France Presse*, May 10, 2004

¹⁴² 'Net Value: Siemens picks KL', *The Edge Malaysia*, March 8, 2004

¹⁴³ The three losing parties were Alcatel, Ericsson, and Siemens and NEC in a joint effort.

¹⁴⁴ *Interfax China IT & Telecom Report*, December 23, 2005

¹⁴⁵ The In Touch experience lab focuses on connecting global carriers, content and service providers, and application providers to customers and business partners. It is a specialised centre designed to help boost Huawei's new development of data and voice value-added services, such as 3G and broadband services.

¹⁴⁶ 'Huawei Reaches Deal with Telecom Malaysia', *SinoCast China IT Watch*, December 21, 2005

¹⁴⁷ 'New 3G Licences To Be Assessed On Promotion Of MVNO', *Bernama Daily Malaysian News*, December 20, 2005

¹⁴⁸ *Economist Intelligence Unit*, May 1, 2005

¹⁴⁹ *Bernama Daily Malaysian News*, August 28, 2003

¹⁵⁰ *Business Daily Update*, December 10, 2004

¹⁵¹ *The Edge Malaysia*, October 18, 2004

¹⁵² *AFX Asia*, June 4, 2004

¹⁵³ *Industry Updates*, February 15, 2006

¹⁵⁴ *Asia Pulse*, January 25, 2006

¹⁵⁵ *Xinhua Financial Network*, December 19, 2005

¹⁵⁶ *The Edge Financial Daily*, October 17, 2005

¹⁵⁷ *Business Times*, July 2, 2005

¹⁵⁸ *Business Times*, September 30, 2005

¹⁵⁹ In July 2005 15 MSC companies participated in the 2005 China International Software and IT Services conference in Dalian, China. i-Navigate Sdn Bhd. signed an MOU with Dreamfun Digital Technologies Company Ltd for the sale and distribution of mobile multimedia content and applications. Media Space Distribution Sdn Bhd also signed an MOU for the co-production of a 3-D animation titled 'Zheng Ho' with Dalian Coordinate Digital Technology Ltd. M-Mode Bhd and Dreamfun Digital had signed an MOU to enter into a joint-

venture for the development of mobile games to be marketed in China. (*Bernama Daily Malaysian News*, July 5, 2005) In April 2005 Viztel teamed up with China's CERNET to develop VoIP services. (*AFX Asia*, April 25, 2005) In December 2004 Global Soft (MSC) Bhd signed a letter of intent to undertake an ERP project for China-based hard disk drive manufacturer GS Magic Inc for RM4.24 million. (*The Edge Financial Daily*, December 7, 2004) In June 2004 IguanaMobile Sdn Bhd, NuSuara Technologies Sdn Bhd and Cyber Village Sdn Bhd signed pacts with their Chinese partners, while Inavigate Sdn Bhd sealed a memorandum of agreement with Quandong Tekson Industry, to market products in China. (*Business Times*, June 3, 2004) In April 2004 Malaysian financial solutions provider eBworx Bhd received a letter of award from Hua Xia Bank in China to install a digital credit management system for a total of 6.23 million ringgit (US\$1.58 million). (*Business Daily Update*, April 5, 2004)

¹⁶⁰ 'Japan's NTT DoCoMo and China Telecom made offers for the Shinawatrass' AIS stake [in 2005], but the deals were scuttled after original shareholders, particularly SingTel, exercised their first right of refusal.' ('Temasek protects SingTel stake', *The Nation*, January 26, 2006) 'China Mobile Co., Ltd. is likely to quit the bidding for acquisition of AIS, the largest mobile telecom operator in Thailand... the Thailand side marks price at 1.7 billion US dollars, far higher than what China Mobile has expected.' (*Xinhua's China Economic Information Service*, January 18, 2006)

¹⁶¹ *AFX Asia*, April 25, 2006

¹⁶² *DMAsia*, June 8, 2006

¹⁶³ *Xinhua Financial Network*, May 11, 2006

¹⁶⁴ *Global Insight Daily Analysis*, May 29, 2006

¹⁶⁵ *Global Insight Daily Analysis*, May 29, 2006

¹⁶⁶ ('China's electronics flood Thailand', *Thai News Service*, October 21, 2004

¹⁶⁷ *The Nation*, May 21, 2006

¹⁶⁸ *Dow Jones*, March 4, 2005

¹⁶⁹ *Business Day*, June 10, 2004

¹⁷⁰ *Reuters*, February 21, 2006

¹⁷¹ *Thai News Service*, August 23, 2004

¹⁷² *The Nation*, September 15, 2003

¹⁷³ *Bangkok Post*, September 1, 2003

¹⁷⁴ *Bangkok Post*, July 30, 2005

¹⁷⁵ *Nikkei Weekly*, July 7, 2003

¹⁷⁶ *fnWeb Daily News*, June 23, 2003

¹⁷⁷ *Thai News Service*, April 11, 2003

¹⁷⁸ *Thai News Service*, May 30, 2006

¹⁷⁹ In 2002, Haier set up its first joint venture in Thailand, Haier Electrical Appliances (Thailand) Co Ltd, in partnership with publicly traded Distar Electric Corp Plc, which makes home appliances. (*SinoCast China IT Watch*, May 2, 2006)

¹⁸⁰ *Bangkok Post*, March 15, 2006

¹⁸¹ *Vietnam News Brief Service*, June 28, 2005

¹⁸² *SinoCast China Business Daily News*, July 23, 2004

¹⁸³ *Fibre Optics Weekly Update*, November 18, 2005

¹⁸⁴ *Interfax China IT & Telecom Report*, April 25, 2005

¹⁸⁵ (*M2 Presswire*, September 29, 2004

¹⁸⁶ *Vietnam News Brief Service*, September 1, 2005

¹⁸⁷ *Vietnam News Brief Service*, June 21, 2004

¹⁸⁸ *Agence France Presse*, May 28, 2004

¹⁸⁹ Azcom received a license for the project from the Royal Government of Cambodia in August 2005. (*BBC Monitoring Asia Pacific*, September 30, 2005)

¹⁹⁰ After years of genocidal warfare, Cambodia's telecoms infrastructure is in need of being rebuilt. In September 2005 Cambodia had more than 800,000 mobile phone users in a population of 13 million. Most mobile phone users lived in and around Phnom Penh.

¹⁹¹ *IPR Strategic Information Database*, September 6, 2001

¹⁹² *Organisation of Asia-Pacific News Agencies*, June 15, 2005

¹⁹³ *WMRC Daily Analysis*, February 1, 2005

¹⁹⁴ *Newsbytes News Network*, February 4, 2001

¹⁹⁵ *BBC Monitoring Asia Pacific*, June 28, 2004

¹⁹⁶ *Associated Press Newswires*, September 1, 2005

¹⁹⁷ *Dow Jones*, January 14, 2005

¹⁹⁸ *Asia Pulse*, September 30, 2003

¹⁹⁹ *Dow Jones*, February 16, 2004

²⁰⁰ *Business Times Singapore*, December 31, 2005

²⁰¹ 'Indonesia promotes broadband in remote areas, offer WiMax licenses', *BBC Monitoring Asia Pacific*, April 6, 2006

²⁰² Of course, India might disagree with that assessment.

²⁰³ 'Alcatel Shanghai Bell looking at RI investment opportunities', *The Jakarta Post*, July 4, 2005

²⁰⁴ *Asia Pulse*, March 23, 2006

²⁰⁵ *Emerging Markets Daily News*, February 2, 2006

²⁰⁶ 'Huawei harbors global telecom ambitions', *The Jakarta Post*, October 31, 2005

²⁰⁷ 'Huawei plans to enters country's WCDMA market', *The Jakarta Post*, May 30, 2005

²⁰⁸ *DMAAsia*, May 8, 2006

²⁰⁹ *M2 Presswire*, July 8, 2004

²¹⁰ *WMRC Daily Analysis*, March 9, 2004

²¹¹ *BusinessWorld*, November 28, 2005

²¹² *Reuters*, September 3, 2004

²¹³ By January 2006 ZTE had built nearly 10 pilot WCDMA commercial networks worldwide and the figure was set to approach 20 in 2007. (*Xinhua's China Economic Information Service*, January 3, 2006)

²¹⁴ *Global Insight Daily Analysis*, January 4, 2006

²¹⁵ *Interfax China IT & Telecom Report*, April 30, 2005

²¹⁶ *Business Daily Update*, July 8, 2003

²¹⁷ *Insight Online Exclusive*, February 20, 2004

²¹⁸ These percentages have been rounded to two significant figures.

²¹⁹ These percentages have been rounded to two significant figures.

²²⁰ These percentages have been rounded to two significant figures.

²²¹ These percentages have been rounded to two significant figures.

²²² These percentages have been rounded to two significant figures.

²²³ These percentages have been rounded to two significant figures.