China's drive towards an innovation economy and the role of intellectual property regulations: progress and tensions in the software and software services markets.

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Abstract

This paper looks at the drive by China for sustained levels of innovation as part of ambitious targets for future economic development and R&D intensity. There are a number of problems faced by China that need to be tackled in order to accomplish these goals and these issues will be explored, first at a general level, and second, with a specific focus on the software and software services industry in China. In particular, challenges related to overseas market dominance, human resource skill shortages and intellectual property violations will be shown to characterise this important, officially encouraged high technology sub-segment that will need to be overcome as part of any future policy strategy. Despite these difficulties, however, enterprises within the sector niche of software services will be shown to have embarked on a determined expansion strategy into new markets that may point to exciting future possibilities as business opportunity evolves.

Keywords: *economic development, innovation, technology, software, intellectual property.*

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Introduction

This paper will consider calls made by China's national politicians for a sustained drive towards an innovation-oriented economy and will evaluate these ambitions in light of the challenges faced by sectors such as the country's software and software services industry. It will seek to uncover answers to some important questions: how much of China's current technological growth is actually based on home-grown innovative capacity rather than imported know-how; how might domestic technology companies in specialist markets like software develop original strategies that could challenge overseas corporate dominance; and how important is an effective intellectual property regime as a stimulus for enterprise led innovation in key sectors?

These themes will be analysed from the perspective of three interconnected dimensions. First, at the national policy level, a review will be made of the motivations behind these calls for increased innovation in the context of China's wider social and economic development and a consideration will be made of the extent to which innovation intensity has characterised domestic endeavours in knowledge-based industries. Drawing on recent assessments from the OECD, the WTO and the Chinese government, a better understanding can be determined of the challenge facing China by evaluating how significant are overseas inputs within the country's high technology domestic producers.

Second, as a useful sector case study, the development and growth of the country's software and software services market deserves more detailed exploration. Using empirically based research cases, a more accurate perspective can be gained of how domestic enterprises within this officially encouraged industry have responded to overseas penetration and what may be their potential for future success. The strategic focus and market strategy of the sector is evaluated in the context of tensions between the software services and products businesses on the one hand and export and domestic engagement on the other.

Third, the evolution of China's intellectual property (IP) regulations will be updated to explore their impact on the software sector and whether current enforcement realities offer adequate market stimuli to nurture the next stage of the industry's domestic expansion. Calls from many quarters for more effective enforcement of IP laws generally will be put into the wider context of some progress already having been made, whilst recognising ongoing implementation dilemmas. In particular, it will be shown that the role of returning members of the Chinese diaspora bring with them important new behavioural norms in relation to IP that could be readily absorbed into the domestic sector.

In conclusion, the paper argues that the process of creating an innovation economy in China may uncover a number of weaknesses in the structure of some domestic technology sectors and that an intersection of interests, attitudes and outcomes between political and corporate actors will be required to correct these imbalances.

Innovation in a Wider Economic Context

China's drive towards creating an innovation based economy needs to be put into the wider context of its economic development. In order to provide an effective focus on what is a very broad topic, it is useful to ask some initial questions: first, what plans are in train to promote innovation in China; second, what problems and weaknesses do these plans seek to overcome; and third, how will these potential inhibitors be effectively surmounted? This section will seek answers to these questions.

There is a view prevalent amongst a broad swathe of political, economic and business commentators that China's rise to pre-eminence as the industrial and technological powerhouse of the 21st Century is inevitable and is already underway. This perspective maintains that "the world is experiencing one of the biggest revolutions in history, as

economic power shifts from the developed world to China and other emerging giants" (Economist 2007a, 85). Business surveys point to recent economic and commercial projections which maintain that China is expected to overtake the United States to become the world's largest economy during the first half of this century, and perhaps even as early as the mid 2020's (Talwar 2007, 16). These interpretations of the available data may be an accurate linear projection of economic league tables but they do not fully take into account the qualitative aspects of the drivers for future economic growth, with China's per capita GDP still wedded to developing country levels and significant income inequalities continuing to mark the daily lives of its people (Economist 2007b). Despite many remarkable and profound social and economic achievements made by China during the previous thirty years of reform and market opening strategies, it is difficult to see how the country's future success can be anchored simply to offering compelling cost based manufacturing solutions in a globalised supply and demand logistics network.

Moreover, it should be recognised that the economy of the United States, which China is characterised as set to overtake in coming decades, has benefited greatly from an ability to encourage entrepreneurial dynamism in cutting edge technologies. In the past, Americans have succeeded in building wealth by creating innovative business products and groundbreaking new services based on original inventions that have challenged the status quo, and it may be too hasty an assumption to think that the US will be unable to keep on doing so across future generations (Leebaert 2006). It is not yet clear that the traditions found in America of pioneering disruptive technologies, inventing new business models and absorbing an innovation oriented, risk-taking culture have so far taken root in China to the extent that a consequential leapfrogging of the United States' economic strength and its global innovative leadership can be assured.

Exploring inconsistencies in China's current economic structure and its innovative capabilities have become pivotal in shaping perceptions of how the country's economy may

evolve over future years. Whilst scholars continue to point out that "China's science and technology prowess is expanding", predictions as to the success of high technology sectors in China are particularly hard, as "contradictions abound", and the country's abilities to acquire, disseminate and apply innovation may in fact be rather weaker than its headline economic strength and potential may infer (Jakobson 2007, 3). It is in these areas of debate that a more analytical lens is necessary, both to propagate a better understanding of China for outside observers and to help those inside China who seek to move the country along a new trajectory to embrace innovation as the bedrock of the country's future success. These issues are also at the heart of China's domestic policy debates.

President Hu Jintao, in his speech to the 17th Chinese Communist Party (CCP) Congress in October 2007, publicly recognised that China's current capacity for independent innovation was weak and required longstanding structural problems to be addressed. He called for a greatly enhanced capacity for innovation that would enable the outputs from technological development to make more of a contribution to the economy, facilitating China's emergence as an innovative country and representing a crucial link in enhancing overall national strength. He maintained that this would provide the bedrock for the country's quadrupling of its Year 2000 per capita GDP by 2020, so as to better achieve the concept of a "harmonious society" under the principles of "scientific development" (Xinhua 2007). CCP officials have presented these aspirations as part of China's ongoing national objectives for increasing the beneficiaries of economic growth and maintaining popular support for continuing economic reforms under the Party's leadership (Zhang Zhijun 2007). Also, implicitly perhaps, the Party may see the need for safeguarding the maintenance of social stability by reducing the marked inequalities prevalent across the country, and thereby sustaining the consequent continuation of the CCP in power.

The Chinese government's latest Science and Technology Strategy 2006 – 2020 (hereinafter S&T Strategy) sets out the underlying principles by which they hope to achieve their

objectives and continues themes of past policies in respect to fostering high technology incubators and funding future development projects (Zhang Gang 2008). It formalises China's ambitions to move to the next stage of its social and industrial transformation, setting out a target to "invest more than 2.5% of her GDP with contribution of S&T to economic development exceeding 60% and a reduced dependence on foreign technologies to below 30%" by the end of the period (Wu[1] 2006, 2). In particular, innovation is to be embraced in three ways: through original scientific discovery and invention; through integration of related technologies to create new products and services; and through better absorption and utilisation of available worldwide technological resources. The policy also makes clear that government sees enterprises as the foundation for productive innovative activity, and pledges to boost the support systems for innovative smaller and medium sized commercial organisations (Wu 2006; Zhang Gang 2008). These prescriptions may, however, hold distinctive challenges for some commercial actors in dealing with contradictions in the S&T policy.

On the one hand, there appears to be a drive to promote indigenous enterprise level development to foster domestic intellectual property that can be licensed internationally and can reduce the country's reliance on overseas technology inputs (State Council 2006). To some extent, these exhortations can also be seen as a continuation of the essentially dualist themes of economic openness, domestic industry support and carefully controlled market oriented reforms that have characterised progress to date (Naughton 2007). Yet this may not be in the best interests of all domestic firms, as some may decide that a successful strategy to achieve global sales and international brand recognition is best achieved through development of innovative products and services built to recognised existing international standards, and marketed through overseas network channels.

On the other hand, S&T policy pronouncements would appear to reflect official enthusiasm to expand and develop future cooperation between foreign R&D firms and Chinese partners, to

improve prospects for further technology spillovers. This is despite the fact that these are trends to which some scholars have attributed limited success to date, likening some of the multinational presence more to a public relations exercise – "PR&D" – than to a framework for genuine research and development exploration in China (Jakobson 2007; Steinfeld 2007). It is too early in the current phase of the S&T Strategy to draw firm conclusions, but tensions may persist as China moves forward along this policy pathway, grappling for an appropriate equilibrium between what has been described as "the balancing of techno-nationalist and techno-globalist objectives" (Jakobson 2007, 26).

China's S&T Strategy has been clearly designed to build upon the country's strengths and achievements made to date: a GDP of US$3.4 trillion for 2007 (Xinhua 2008), an 8% share of world total exports and a trade/GDP ratio of 69% by 2006 (WTO 2007, 38), together with having concurrently taken over 400 million of its own people out of absolute poverty[2] since 1981 (Chen and Ravallion 2007, 21). In terms of technology trade alone, China has grown to be one of the world's major producers of information and communications technology products and has been the world's largest exporter of ICT goods since 2004 (OECD 2006). All of these accomplishments indicate the pace and extent of China's economic development and its commitment to trade engagement with the rest of the world, whilst also highlighting the considerable social challenges that continue to be faced by government decision makers. The question at issue, however, is whether these figures really characterise an innovation based economy or one that is just highly capable of importing, assembling and exporting high technology products.

The Organisation for Economic Cooperation and Development, in concert with the Ministry of Science and Technology recently published a report that synthesised the strengths, weaknesses and opportunities facing China's leaders in securing effective S&T policy outcomes[3]. Its findings praised the progress that China has achieved to date in its commitment to enhancing the domestic research and development landscape. China's has

annually increased its national R&D expenditure by 19% in the years since 1995, and reached a total spend of US$30 billion for 2005, which represented an R&D/GDP ratio of 1.34% for that year. Moreover, since the turn of the millennium progress towards developing innovative capabilities within the domestic economy has been "significant" (OECD 2007, 9).

However, these successes need to be balanced by a number of structural weaknesses in China's ICT production profile that can directly impact on the country's ability to embed domestic innovation into product outputs to achieve the long-term sustainability that is at the heart of the leadership's S&T aspirations. A number of interconnected difficulties must first be considered and will then need to be overcome as part of China's national policy evolution.

First, China's status as the world's technology and manufacturing factory masks the dominance of overseas firms in much of its output, with wholly owned affiliates or foreign funded joint ventures conducting over 50% of China's foreign trade (WTO 2006; Pei and Peng 2007). Moreover, this trend accelerates when the ICT sector is analysed more closely, with up to 88% of the country's high technology exports originating from foreign (or Taiwanese) owned firms (Jakobson 2007; Bergsten 2006; OECD 2007). Equally importantly, most of those firms within China's ICT sector that are genuinely domestic are far away from exercising leadership in international IT markets, lacking both managerial skills and innovative vision, and wedded to outmoded strategies of seeking to create indigenous technology substitutes for pre-existing overseas inventions (Kroeber 2007; Bergsten 2006).

Second, estimates of the value added captured by China in high technology product creation are modest and have been put as low as 10 – 15 per cent (Kroeber 2007; Tong and Zheng, 2008), with many scholars characterising the country's contribution as not much more than a highly efficient final assembly location for imported technology know-how using non-differentiated production processes, that compete internationally by offering a compelling but

straightforward low-cost value proposition (Bergsten 2006, Kroeber 2007; Saxenian 2007; Steinfeld 2007).

Third, without upward movement along the value chain in the long term, this singular specialisation could expose China to threats from alternate locations for such assembly work in the future. A couple of reasons for this possibility appear especially salient. In the first place, switching costs for overseas customers are kept manageable by the efficient and streamlined processes that have already been created and that can be duplicated across national boundaries. Moreover, the increased trade integration under globalisation that has taken place in recent times means that firms seeking advanced processing services could now choose to include the rapidly reforming economies of Vietnam or Cambodia as production locations as easily as they could choose to stay in China. This may help to explain the national leadership's concern about the future sustainability of China's current growth patterns.

However, the strength of the overseas Chinese community, whether from Taiwan, Hong Kong or further afield, could mitigate such a risk, at least in the short term. This is because those overseas residents of Chinese origin may be creating what has been termed a cultural "brain circulation" (Saxenian 2007, 191), linked to their ongoing interest and familial loyalty in continuing to build bridges into the mainland of China. These characteristics are part of closer regional trade integration and may reflect future desire to take advantage of growing domestic Chinese consumption patterns as a complement to targeting only export markets from the mainland (Cai 2007).

Fourth, domestic framework conditions required to nurture and sustain a drive towards an innovation economy have been found wanting in China. In a number of key areas, including educational weaknesses, innovation funding constraints and a lack of coordination between central and regional policy initiatives, problems persist.

Educational shortcomings continue to be significant, resting within an overall system in which major problems persist. China's adherence to the importance of rote learning, fact assimilation and examination performance pervade all levels of the institutional spectrum, from primary school to university, and act as a platform for later weaknesses in soft skills such as problem solving, disruptive thinking and team building, all of which can fatally undermine innovative capabilities at enterprise levels once graduates have entered the job market (Jakobson 2007; OECD 2007). Experiments at new approaches have been partial and uncoordinated and it is difficult to see how changes to both curriculum design and teaching approach can be made without concomitant alterations to national examination systems and teacher training programmes[4].

Procuring funding for innovation, outside of the state-owned sector, can be difficult for Chinese enterprises. Venture capital penetration is still in its early stages (Bergsten 2006) and major banks still appear wedded to lending criteria that lack effective risk management assessments, all of which can severely constrain borrowing opportunities, especially for smaller and medium sized enterprises where levels of entrepreneurial activism and R&D investment are often at their highest (Bell 2007; OECD 2007).

Moreover, such constraints combine with organisational complexity when seeking state supported assistance. Whilst the five existing government funds (Key Technologies; Spark; 863; Torch; and 973) seek to channel capital injections into domestic enterprises, their interaction with, and dispersal through, different government ministries creates a complex diagram of fund distribution that may have led to a culture which hitherto preferred large state sponsored projects to smaller entrepreneurial ones in funding priorities. The Finnish Institute of International Affairs has created an insightful network diagram that includes four separate hierarchies and 18 distinct entities which has led to what has been described as a "stovepipe syndrome" in China's state funding mechanisms (Jakobson 2007, 22), operating within a

central plan that consists of many non-communicating S&T initiatives and directions, all of which need a radical policy overhaul as part of nationally integrated reforms (Kroeber 2007, OECD 2007). These arrangements appear to have been built on to an unstructured and uncoordinated plethora of legal codes and unclear rules at both national and local levels to create a business environment that undermines the creation of an effective climate in which to innovate (Steinfeld 2007).

There are also continuing problems in China regarding the respect for intellectual property rights and legal enforcement conditions, concerns which are echoed across wider international, commercial and political communities (the impact of these will be explored in more detail later in this paper).

Nevertheless, despite these shortcomings and policy problem areas, success at international level has taken place in China's high technology sector and the scale of the problems should not be allowed to mask the emergence of significant commercial actors in fostering innovative enterprises capable of taking a role in international markets. Huawei and Lenovo are two such examples that have become genuine global players, and indicate that old formulas of technology substitution have not been the only models followed in China. They show that success can emerge from both privately funded ventures (Huawei) and from public-sector spinouts (Lenovo).

The particular test that confronts Chinese policymakers in the next phase of implementing the country's innovation strategy is how to move from the position where corporations such as these are cited as single examples of success to a point where, instead, the country has created new innovative models that have been adopted more widely across its industries, as part of the absorption of newly embedded norms of national behaviour. It is difficult to see how a more enterprise based innovation economy can emerge without significant reform in a number of areas: in its complex funding framework; in its human resources training and

related education policies; and in the way that small and dynamic private enterprises are embraced as full participants in taking forward national policies. Indeed, the S&T Strategy has indicated that the creation of new, more streamlined SME oriented funding mechanisms will be a priority, which is likely to be a development very much welcomed by the small business community, but it remains to be seen how, and to what extent, such pledges will result in progress on the ground.

Significant challenges clearly face China's policy makers in the pursuit of their goals to create an innovation oriented economy, and that these are evident in their impact across all of the sectors that the Chinese government has targeted for particular encouragement: greater scientific invention, improved products and services, better assimilation of international norms. A more detailed scrutiny of potential pathways to surmount some of these problems is therefore useful and, to achieve this, a sector specific approach will be taken to evaluating how individual businesses have tried to overcome some of these problems.

The second part of this paper will, therefore, survey one of the key knowledge sectors in more detail, the Chinese software and software services industry, in order to seek a better understanding of the sector's profile and structure. This analysis will also explore the extent to which domestic firms are confronted by an overseas commercial presence, as well as the potential of these local businesses to embrace innovation in their product and service offerings.

Innovation in China's Software Products and Services Sector

The software product and services industry is a sector of growing importance for the Chinese mainland. The industry itself had a difficult start, and even now, it is something of a "laggard" within China's IT businesses (Kroeber 2007, 59). It emerged from the shadow of the hardware market and for some time, software was regarded as simply a mechanism for

making high technology hardware function effectively, rather than as a value added product in its own right, in contrast to attitudes in the United States and India. Some of the earliest achievements in software development were actually solutions that supported the creation of the first Chinese word processing machines (Pecht et al 1999, 136-7). Of particular significance in its evolutionary history was the declaration in 2000 that software sector growth was a national goal and that software should become an official "encouraged industry" under the Torch Project (State Council 2000)[5]. Subsequent to this, specific subsidies became available in tax, investment and earnings distribution for enterprises within the sector, detailed under the State Council guidelines, which effectively launched the next phase of development for the sector[6].

In terms of its actual size, China's software industry presents some challenges to be able to create an accurate assessment, although it is clearly a multi-billion dollar market. The most recent figures from Chinese official sources at the Ministry of Information Industry have put total revenues from the Chinese software industry in 2007 as being just over US$80 billion, representing a 20% rise over the previous year (Xinhua 2008b). However, according to the OECD, "[f]igures on Chinese software industry revenue … and exports vary widely, seem high or are not available from official sources" and the organisation has counselled that the Chinese industry's total revenue levels "must be used with care" (2006, 157). It is therefore extremely difficult to acquire reliable, ongoing and accurate assessments of China's software industry, and it cannot be ruled out that some "software" sales in official revenue figures may be actually hardware-based solutions in different markets for which software is provided as part of an overall IT deliverable.

One recent report that integrated perspectives from various respected sources[7] put pure software and software services revenues in China for 2006 at US$12.3 billion, of which US$3.2 billion was spent on software products and the remainder on software services and business process outsourcing, with an estimated compound aggregate growth rate (CAGR) of

22% to 2010 for the industry as a whole. Of this total, only US$1.8 billion worth of sector outputs were exported, indicating significant domestic market dominance (NASSCOM 2007). In respect to offshore software outsourcing services, whilst this element in China is still very small under all agreed estimates, it presents compelling growth rates for future potential, and as a segment appears to dominate the export fragment of China's wider software industry. One assessment by Chinese firm CCID Consulting put revenues for this sub-sector during 2006 at US$1.43 billion[8], with the same research indicating a growth rate of over 31% on previous years[9]. Indian estimates for offshore software outsourcing export growth in China are even more aggressive, indicating a potential CAGR of 41% to 2010 (NASSCOM 2007, 15).

Estimating the industry's size and structure accurately is not the only issue of concern, as there have been a number of recognised problems that have beset the Chinese software sector over recent years. First, it has frequently been characterised as technologically immature. Under the Capability Maturity Model (CMM)[10], which has become an internationally recognised benchmark for assessing a firm's software development abilities, China has only a small handful of companies who have reached CMM Level 5 (the top level), most of which are foreign managed outsourcing specialists (McKinsey 2005)[11]. Second, the industry has suffered from a long-term structural immaturity, with the number of software and service enterprises put at around 10,000 "of which only half are capable of developing their products independently" (Kumar, Jamieson, Sweetman 2005, 238)[12]. Third, it has shared in the staffing challenges that beset other innovation sectors, with a struggle to find and retain key project leadership and software analysis skills seen as a particular shortcoming. Fourth, in core product areas, industry sales profiles are dominated by the success of foreign corporations rather than domestic companies, selling solutions embedded with overseas-created intellectual property, generating license revenues that promptly leave the country.

Moreover, the national business group for the industry, the China Software Industry Association (CSIA), has been criticised for appearing to be predominantly a vehicle used by the government to channel information and regulations in a classical top-down strategy of state centric direction, although the organisation now appears at least to be organising more frequent international conferences and seminars in response to industry's marketing needs[13]. However, this rather limited one-way dialogue is in stark contrast to proactive industry led initiatives common in India (NASSCOM 2006).

All of these deficiencies have had a negative impact on the progress of domestic enterprises in China's software industry. According to research by the International Finance Corporation, since the turn of the millennium, only five Chinese corporations have emerged with an ability to challenge established international vendors in product specialities, and all of these have far smaller levels of market share, even despite competing head-on with multinational vendors in terms of both functionality and price. These are: Kingdee in enterprise resource management software; UFSoft (now renamed UFIDA as part of a new international branding strategy) in accounting and asset management solutions; Neusoft in medical scanner software and related services; Huawei in telecom support software; and finally, the China National Computer Software and Service Corporation (CS&S), a state owned organisation with interests across IT products and services (IFC 2006).

The following table quantifies the challenge facing China's domestic software enterprises.

Software Structure in China: foreign firm dominance

System software:	90%
Tools and languages:	70%
Applications:	60%

Software market in China: domestic market dominance

Domestic Products:	41%
Domestic Services:	51%
Exports of either:	8%

Source: Yang, Chavri, Sonmez 2005.

China's software industry today can therefore be seen as representing the antithesis of India's: heavy reliance on domestic markets, foreign firm dominance and a products rather than services orientation (Yang, Chavri, Sonmez 2005; McManus, Li, Moitra, 2007). The extent of foreign dominance appears especially prominent in software products markets and this sector in China could be said to reflect the wider challenges of knowledge-based industries in the country as a whole.

Within this profile, however, structural shifts appear to have been taking place over recent years, particularly in the software services sector. Chinese enterprises have been building on a growing domestic demand base to expand into culturally sympathetic regional overseas markets, such as Japan and Korea, especially through systems integration services in complex software configurations (Kshetri 2005; Qu and Brocklehurst 2003). This can be seen as part of a progression along multiple stages of expansion towards more sophisticated sector outputs (Kumar, Jamieson, Sweetman 2005). Moreover, Chinese enterprises have been able to increase their visibility through brand development, company renaming and website redesign exercises, as well as internet keyword-based profiling that have enabled relatively unknown firms to appear high on international search results lists in response to requests that include, for example, "China software" and "China outsourcing", in the entry criteria[14]. In this task, Chinese firms have had to start from a very low level of sales sophistication, project scale and overseas market penetration but now appear to be adopting more outward looking strategies.

A further phase of overseas expansion may now be taking place as they begin to aggressively target export markets in the United States and Europe, and especially the UK, through the establishment of local sales, customer support and marketing operations. This could begin to bring some Chinese firms into direct competition with Indian counterparts in the software services market, in moves that may be part of a marked acceleration of previous trends by Chinese firms (NASSCOM 2007, 16). Whilst clearly in its very early stages at this time, such moves would seem to point to a confident and sophisticated strategy as some Chinese

software services companies seek to consolidate their growing credibility in these new markets.

One interesting case study that illustrates this wider trend is that of ShineTech China[15], established in Beijing in 2001 as an outward focused software outsourcing specialist[16]. From its base near the Haidian district in the north west of the city, it nurtured reference customers in both UK and US markets and has since more than tripled the number of staff, having overcome recruitment bottlenecks by offering both hard and soft rewards for key skills, although it continues to encounter problems finding sufficient numbers of experience project managers from the available pool of potential Chinese workforce, illustrating ongoing soft-skill shortages highlighted by the OECD. In order to try and combat human resource constraints, the company has a multi point proposition to potential recruits, including competitive remuneration (National Bureau of Statistics 2007, 165 – 175)[17], an attractive working environment, leading edge development projects and the prospect of international customer engagement[18].

The company makes important use of technology in their service delivery systems, with customer dialogue managed on a multi level basis, providing a means of problem escalation and solving language deficiencies. The first level of communication is via email or internet messaging system, based on customer preference and timezone considerations, which, enables those on the staff with good written English but weaker spoken language skills to still make active contributions to development and solution design teams (often the more junior staff fall into this category). The second level is through either email or telephone conversations with proficient English speaking project management and customer account management teams, with the final level of contact based handled through fluent English language conversations with the company's senior management. In this way, Chinese firms may be able to offer viable alternatives to language advantage selling points often put forward by Indian firms.

ShineTech China now has projects ranging across different software platforms and market sectors, with predominant specialisation in key parts of the Microsoft architecture, having become a Gold Certified Partner (the highest level of attainment) in 2006. In March 2008, the company opened an overseas office in the UK with resident locals to steer the firm along its next phase of expansion. Key members of the Chinese management team have had significant overseas working experience, which they have brought to bear in both their management style and commitment to touchstone issues for international clients, such as intellectual property protection. For example, the company's internal IP controls and external IP policy document were recently presented to other firms as a model approach through the discussion forums of the World Intellectual Property Office in Geneva (WIPO)[19]. The company puts across a poised and confident vision for the next stage of its international corporate evolution.

Nor is ShineTech's experience an isolated case as it would seem clear that other software services companies spread across China have also adopted similar strategies. For example, Chinese firms such as VanceInfo (formally WorkSoft Corp)[20], UFIDA Offshore Services (formally the services function of UFSoft)[21] and Pine-Soft[22] all appear to be an illustration of Chinese firms embarking on expansionist international business development trajectories. Moreover, firms such as these are complemented by the success of intermediary services offered to all types of industry sector by internet based sites such as Alibaba[23], a Chinese company that may have been instrumental in having helped to foster and expand the growth of the software cluster near to its corporate headquarters in Hangzhou, Zhejiang Province[24]. The company has most recently expanded into SME software product sales through its subsidiary Alisoft[25].

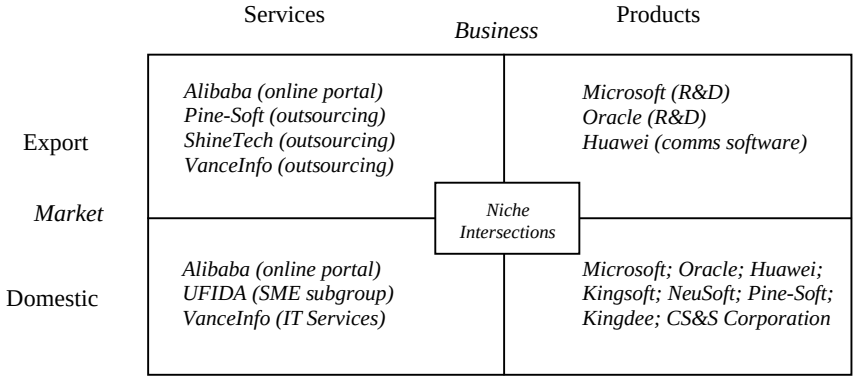
Chinese software services suppliers may now, therefore, be seeing opportunities for expanding sales networks through the creation of overseas subsidiaries to attract potential customers interested in taking advantage of competitive off-shoring business models, whilst

also offering some of the latest software development skills and technologies to complement their value proposition. This can be seen as directly mimicking the Indian strategy of the mid to late 1990's, as their own key software enterprises embraced an export of services model to replace previous reliance on export of labour approaches, which were no longer necessary in the modern internet era (D'Costa 2004).

The existence of locally based and English speaking representatives in Britain and the United States helps Chinese service providers overcome local inhibitions in using offshored solutions, especially amongst smaller enterprises, thus enabling a wider range of companies to consider an outsourced approach involving a Chinese supplier than might have been the case before, as early dialogue and project planning considerations are rendered much easier with locally based representatives. This is despite the fact that travel costs and cultural issues must still be considered in such engagements to ensure long term success (Carmel and Tjia 2005). These moves appear to show a deepening and a widening of previous commitments by the Chinese to pursue outward facing overseas market penetration and to move away from previously constrained strategies.

It may now be instructive to coalesce these points by building on Heeks's work on software industry strategies for developing countries by mapping the intersection of markets and business sectors to examples of existing corporations in China's industry and by charting their potential strategies for future success.

Fig. 1: Software enterprises in China under a Business/Market model:



Source: Heeks 1999; author's own assessments.

It is now possible to map constraints with opportunity and perceived commitment amongst different types of Chinese software firms to evaluate potential strategies for domestic enterprises based on discrete sector challenges.

In terms of software services, it would appear particularly significant that some firms that have hitherto been focused on domestic and localised delivery models may now be moving overseas in their determination to compete with India in the services domain. In the domestic market for software products, there may be potential glimmers of opportunity from the increased deregulations of particular local business markets such as banking, insurance and legal services, which could provide niche opportunities, especially when targeting smaller and medium sized enterprises in such sectors who may be either less willing or less able financially to commit to purchase multinational products.

However, in terms of international exports of products, apart from sector niches such as Huawei in telecommunications software, it remains *very* difficult for Chinese organisations to secure traction, with the consequence that the effective market penetration of such firms remains "almost nonexistent" (McManus, Li, Moitra 2007, 131).

Fig. 2: Chinese software enterprise strategies in market/business segments:

	Services	Products
Export	*Compete with India* *Exploit Internet Services* *Consolidate East Asia Markets*	*Difficult market entry* *Huawai is standard bearer*
Domestic	*Service Domestic SMEs* *Offer Internet Services* *Channel Partners in verticals*	*Difficult market entry* *Exploit niche focus linked to deregulating domestic market (especially law & finance)*

Source: Heeks 1999; McManus Li, Moitra 2007; author's own assessments.

This second section has looked at some of the most recent trends in the Chinese software products and services markets. It has shown both indications of marked progress and expansion coupled to continuing challenges and constraints, and has also highlighted diverging potential in respect of software services versus software products, with the former appearing to be positioning itself for direct competition with India, whilst the latter continues to struggle for visibility.

The Chinese software sector has been shown to be aggressively grappling with many of the constraints common across all types of innovation enterprises in China. One area of domestic regulation that is of particular importance is the quality and effectiveness of intellectual property (IP) legislation and enforcement. The next section reviews the IP landscape in China and applies current norms and practice to the software industry, highlighting both the progress made to date and the continuing deficiencies that can sap innovative capacity

Mapping China's Intellectual Property Regulations with Software Industry Progress.

Historically, China's adoption of intellectual property regulations was marked by successive failure, characterising the country's struggle to move from the ancient "rule of man" precept to modern "rule-of-law" principles (Peerenboom 2002). It has been argued that the

instrumentalist and paternalist nature of the traditional Chinese socio-legal system clashed with the overtly adjudicative western approach to lawmaking and dispute resolution (Stephens 1992, 55 – 61) making traction for western legal concepts such as IP extremely difficult to achieve. In China, there was an absence of any cultural evolution that facilitated authors and inventors holding private rights over knowledge that could be asserted against those who attempted to exploit an individual's intellectual property, in contrast to that which emerged in Europe during the 17th Century (Granstrand 1999; Maddison 2005). China's early legal landscape instead focused more on the maintenance of social harmony under a parental disciplinary framework and the promulgation of imperial control edicts to restrict flows of information about sensitive subjects, such as mathematics of the stars and details of calendars (which were considered as reserved for use only by the Chinese emperors) rather than on fostering incentives for invention and on promoting a dialogue of ideas (Stephens 1992; Alford 1995, 12 – 13).

Attempts in the late Qing dynasty to introduce a semblance of IP regulation foundered with the collapse of the Westernisation Movement and the absence of commitment by the leadership under a fatally weakened emperor (Yang 2003). Republican initiatives to consolidate an IP legal framework during the inter-war period were overwhelmed by factional feuding, social instability and a difficult conceptual assimilation of IP principles that was exacerbated by an arrogant insistence by western Treaty Powers that "what was good for each treaty power was deemed…perforce, to be good for China" (Alford 1995, 49). A Soviet model emerged in the early communist era that focused on community ownership and social contribution, wherein rewards and peer recognition for inventions took the place of licensing and monetary income streams, all of which, however, disappeared in the political maelstrom of the Cultural Revolution. It was not until the economic reforms took shape in the modern era after 1978 that the evolution towards a modern intellectual property regime began again, initiated by China joining the World Intellectual Property Organisation in 1980.

The pace and extent of IP legal development over recent times has, therefore, been remarkable, given all of the traumas faced by China in its social, economic and political development. An entire legal framework has had to be recreated from scratch, with all key legislation being recently updated in line with WTO commitments and subsequent extensions of China engagement with international IP norms. The extent of this achievement is illustrated by the country's recent accession to the WIPO Copyright Treat (WCT) in 2007, seen as a benchmark for recognition and protection of internet application systems and electronically delivered cultural outputs. Indeed, it has been argued that China's legislative position, at least as it exists on paper, easily meets international standards (Taubman 2003).

The problem has not, therefore, been with China's IP laws as such, but instead with China's *enforcement* of its IP regulations, a concern that continues to be the subject of controversy and criticism from both international and domestic sources. Criticisms have especially focused on China's opaque three-way enforcement regime incorporating administrative, civil and criminal proceedings whose operations and outcomes have not always been as clear as participants would have wished, especially given the additional complexities of navigating through China's provincial and national institutional structures (Yang 2003; Kumar, Jamieson, Sweetman 2005; Menon 2005; Li and Fung 2006). Additional concerns have stemmed from ongoing allegations of persistent and endemic collusion between some local enterprises engaged in pirate activity and political figures within provincial authorities, which often involves financial corruption (Chow 2003). Most recently, China has been taken to task by United States trade negotiators for alleged deficiencies in the criminal sanctions it has applied to IP violators, which culminated in the US bringing an action against China under WTO Dispute Settlement rules[26]. Mitigating these deficiencies to some extent, China is a contracting party to the New York Convention for the Recognition of Foreign Arbitral Awards, enabling overseas firms to include arbitration clauses in commercial contracts with Chinese partners that can facilitate an international intercession in disputes, followed by domestic enforcement of arbitration decisions. Some Chinese scholars characterise the

arbitration method as having particular advantages, including its flexibility, enforceability and confidentiality and finality (Lo and Tian 2005).

However, there does appear to be a sea-change taking place in Chinese attitudes to conventional intellectual property regulations, perhaps linked to an increasing appreciation by domestic actors that protection policies and enforcement clarity may now be in their own interests, rather than being a foreign concept imposed on them by overseas interlocutors. In this way, China may be progressing along a spectrum of adoption principles, wherein the latest stage of progress can be characterised by a growth in defensive actions taken by domestic enterprises to safeguard their own IP, as Chinese companies begin to recognise the value of brands, products and accumulated goodwill (McManus, Li, Moitra 2007). Increased incidents of litigation by Chinese plaintiffs to protect their IP position have been observed over recent years, in terms of both patent, trademark and copyright actions, with some being against foreign firms as well as other Chinese enterprises (Cox and Sepetys 2006; Managing IP 2008a)[27]. All of these initiatives may slowly be having an effect on domestic attitudes, as even international bodies have observed a reduction in overall levels for software piracy across China since the turn of the millennium, down to 82% for 2006 (NASSCOM 2007, 12). Whilst still very high in itself, the trend does indicate progress.

Moreover, according to WIPO, China's State Intellectual Property Office (SIPO) is now amongst the top five most active in the world for new patent filings, with resident filings having increased over 500% in the decade after 1995 (WIPO Patent Report 2006). This trend can be seen as concomitant with a marked increase in interest in IP activism by domestic Chinese in respect to patent applications and grants (SIPO Annual Report 2006). Some dichotomies do still remain, as observers have pointed out that many domestic patents are granted in the category of lower level "utility model" incremental innovations rather than full invention patents, with overseas non-residents still dominating the patent grants figures for the "invention" category, although by a narrower margin in 2006 than in previous years

(Kasper 2006; SIPO China 2006, 25). Nevertheless, such progress can be interpreted as showing a marked swing towards an increasingly favourable embrace of IP principles within domestic industries, which may be consolidated with the release of China's National IP Strategy in the first half of 2008, which is expected to take a pan-government view of existing IP policies with a view to boosting levels of innovation across China (Managing IP 2008b).

The software sector, though, is reliant on copyright rather than patent protection for its outputs, which implies a need to foster a genuine culture of compliance in the absence of the more definable protection offered by patent grants, and some progress has additionally been made in this context. First, national government has required the use of licensed software in all hardware solutions built in China since 2006[28], and has brought to bear the considerable energy and determination of Vice Premier Wu Yi to drive forward IP centric policies at the senior government level[29]. Second, China announced, also in 2006, the intention to create a national-level Judicial Court of Intellectual Property within the civil law system, aiming to help centralise and streamline IP violation cases in respect to copyright, patent and trademark disputes (China Daily 2006; Pantesco 2006). This is a somewhat controversial area as existing IP specialist courts in innovative regions, such as Shanghai and Guangzhou, may not be content to see local IP litigation transferred to Beijing for central judgement and internal disputes such as this may be part of the reason why the court's precise operational role is taking some time to establish (Managing IP 2006).

The influence of returning members of China's diaspora in changing attitudes in terms of corporate policies towards IP should also not be underestimated. Attracted back to China by a mix of patriotism, entrepreneurial excitement and government funded incentive schemes (Bell 2007), these "*hai gui*"[30] can infuse the boardroom strategies of innovating high technology enterprises with international attitudes toward IP commercialisation and can lead behavioural compliance across company teams through an induced rather than imposed approach to adopting IP compliance principles. This certainly seems to have characterised

the tactic adopted by some directors of Chinese software services companies, who now appear to be venturing overseas to secure new clients and form profitable partnerships.

It would seem to be clear from both policy level pronouncements and corporate level initiatives that domestic Chinese actors have recognised the link between enhanced rigour in IP enforcement and the establishment of the foundations for innovation based economic growth and future enterprise success. This section has focused in particular on the pace of change in China's intellectual property climate and the ways in which the country's legal IP landscape has been evolving in recent years. It has also discussed the influence brought to bear on these changes by national technology strategies, corporate expansion plans and overseas Chinese returnees.

Conclusion

The drive to create a knowledge-driven innovating economy is now centre stage in China's economic development strategy. This paper has outlined clear challenges that face policymakers and corporate actors in trying to achieve the ambitious goals set out by Hu Jintao in his 2007 speech. Structural deficiencies persist in a number of areas vital to the creation of a coherent policy for supporting and sustaining innovation oriented companies. Continuing weaknesses have been highlighted in a number of areas: in the complexity of funding arrangements for new companies; in the educational curriculum and skills development of human resources; and in the protection and enforcement of intellectual property rights. All of these issues will need to be tackled, but there are signs of real progress in some areas, especially in respect to initiatives in the IP domain. Nor can foreign firm dominance of Chinese high technology sectors be simply swept away through legal dictate, as China has moved beyond trade autarky. Instead, local firms must grow their market positions through a concerted effort to create domestic value chains that can move beyond providing simply a cost-based, low-value, manufacturing and assembly proposition.

The three areas of innovation central to China's S&T Strategy include the provision of innovative and higher value goods and services, and this paper has taken a view of the software industry to gauge opportunities in this context. Therefore, strategic moves now being made by domestic software development enterprises to embrace an offshore services model offering the latest technologies, with a growing awareness of the value and importance of intellectual property to both customer and supplier business portfolios, linked to aggressive overseas expansion policies and partnership strategies, offer an exciting view of the future. They provide a compelling glimpse of the potential for this important sector in China's high technology industry.

Achieving change is always difficult and challenging. In order for China to achieve its policy objectives to build an innovation-based economy, it will require dialogue between many different types of stakeholders in ways that may not immediately sit comfortably with the top-down decision-making more often found in China's political system and industry support structures. Instead, a more pluralist approach is likely to be required, bringing together returning diaspora, locally based innovators and members of both national and provincial governments to foster an intersection of interests to solve some of these complex problems. However, there are likely to be few who would disagree that the future potential of the results from such an inclusive stratagem, given the country's remarkable achievements to date, would be well worth the effort.

Notes

[1] Vice Minister of Science & Technology, Government of China http://www.most.gov.cn/eng/organization/leadership/wuzhongze.htm , accessed 18th February 2007.
[2] Defined by the World Bank as living on less than US$1 per day.
[3] OECD Review of Innovation Policy. China: Synthesis Report, OECD August 2007.
[4] Author's interview with Mr Brind Zhang (ZHANG Cheng Xi), who is an educational reformer and language teaching pioneer in Beijing whose radically different learning methods are encapsulated in his brand "Cheng Xi English". This was as part of a working project conducted by the author within the education sector in Beijing, November 2003.

[5] See details of funding for high technology firms under the Project, accessed 20th February 2008 at http://www.innofund.gov.cn/english/index.htm.
[6] State Council Document Number 18, "Some Policies to Develop the Integrated Circuit & Software Industry", issued June 2000. This helped to set in motion ongoing double-digit growth.
[7] India's National Association of Software Service Companies (NASSCOM) is the Indian software sector's highly effective industry association and conducted a full scale review of China's software industry and the implications of its rise for Indian enterprises. This report coalesced indicators from both industry and government sources.
[8] See http://www.ccidconsulting.com/default_e.asp accessed 25th February 2008.
[9] See also an article from April 2007 in Computer Business Review for an optimistic indicator of China's potential in software services. http://www.cbronline.com/article_cbr.asp?guid=ED23811B-B0B2-465B-BD99-78AD9C0A889E accessed 25th February 2008.
[10] The CMM was developed out of the Software Engineering Institute of Carnegie Mellon University with independent appraisers trained and authorised by the SEI making inspection assessments of application companies, similar to the way that Quality Management kitemarks are assessed in the UK. There is, however, some debate about the usefulness of these assessments as they focus only on processes rather than products and project outcomes, but for now at least, Level 5 remains the target.
[11] For corporate examples see: Bleum Software of Shanghai, <http://www.bleum.com/news/news_22.htm> and FreeBorders Outsourcing, <http://www.freeborders.com/news/press20060208_b.html>, both accessed August 2006. Neusoft Corporation was the first Chinese company to be granted Level 5 status, in 2002.
[12] Sameer Kumar, Jamieson Jacky, and Sweetman Mathew, 'Software industry in the fastest growing market: challenges and opportunities', *International Journal of Technology Management*, Vol. 29 Nos. 3 / 4, pp231 – 62. See especially page 238.
[13] See the organisations website at http://www.csia.org.cn (Chinese only). Currently, there is only a minimal amount of information available in English. In fact, before its recent site redesign, there was actually *more* information available in English than there is at present, and it is to be hoped that previous levels will be replicated (and perhaps even improved) under the new design in due course, assisting potential foreign partners to gain insights into the Chinese industry. However, there was, and is, nothing like the depth and utility of partner "seek and search" facilities characteristic of NASSCOM's website at http://www.nasscom.in. Nevertheless, some progress is clearly being made.
[14] See for example, results for the following entry with the Google search engine, http://www.google.co.uk/search?q=china+software&hl=en&start=10&sa=N accessed 22nd February 2008.
[15] See corporate website http://www.shinetechchina.com/ and UK subsidiary http://www.shinetechchina.co.uk based in Windsor, Berkshire.
[16] Author's interviews with company executives: Beijing, 2004 and 2005; Cambridge, 2006; London, 2008.
[17] According to China's National Bureau of Statistics, annual salary levels for software developers in Beijing are actually the highest in the country for that skillset, exceeding even those offered in Shanghai, averaging RMB83,000 in the capital for 2006. See China Statistics Yearbook, 2007, pp165 – 175.
[18] ShineTech China directors call this a "win-win-win" strategy: for staff, for customers, and for the company.
[19] The company was invited to present an overview of its approach to customer IP protection policies to WIPO in April 2005. See http://www.wipo.int/sme/en/case_studies/shinetech.htm for further details.
[20] See VanceInfo's corporate website at http://www.vanceinfo.com/ accessed 25th February 2008.
[21] See UFIDA's website for overseas services information at http://www.ufida.com/stories/index.aspx accessed 25th February 2008.
[22] See company website at http://www.pine-soft.com.cn/web/english/about.asp accessed 25th February 2008 . They have a recent new UK office in Chelmsford and are in dialogue with UKTI for partnerships and UK customers.
[23] See main service website at http://www.alibaba.com/ accessed 25th February 2008.
[24] See Cluster and Incubator information at http://en.espark.net/funcms/espark/enespark.net/index.html accessed 25th February 2008.
[25] See AliSoft reference at http://www.alibaba.com/aboutalibaba/aligroup/index.html#Alisoft accessed 25th February 2008.
[26] See DS362 at http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds362_e.htm accessed 25th February 2008.

[27] The following link provides an interesting analysis of recent IP activities in 2007 compiled by the Chinese government, in conjunction with China's own State Intellectual Property Office. See http://english.ipr.gov.cn/ipr/en/info/Article.jsp?a_no=67243&col_no=985&dir=200704 accessed 26th February 2008.

[28] The announcement of licensing requirements for newly installed Chinese-produced computer hardware came on the eve of Hu Jintao's visit to the US in April 2006, which began with a long meeting between the Chinese President and Bill Gates of Microsoft. The two events are unlikely to have been a coincidence.

[29] Madam Wu retires from public life in March 2008 and it is not yet clear at time of writing who will take over her IP role, either in terms of the replacement's seniority or their individual's personal commitment to the IP cause.

[30] Literally, "sea turtles".

References

Alford, William P. 1995. *To Steal a Book is an Elegant Offense. Intellectual Property Law in Chinese Civilisation.*: Stanford University Press.

Bell, Jonathan. 2007. China's New Mantra: Innovate not Imitate. *Far Eastern Economic Review* Vol. 170 (2):pp37 – 40.

Bender, Tobias. 2006. How to cope with China's (alleged) failure to implement the TRIPS obligations on enforcement. *Journal of World Intellectual Property* Vol. 9 (No. 2):pp230 - 50.

Bergsten, C. Fred, Bates Gill, Nicholas Lardy, and Derek Mitchell. 2006. *China: The Balance Sheet*: Institute of International Economics.

Cai, Kevin G. 2007. Regional Economic Integration in East Asia. In *Globalisation and Change in Asia*, edited by D. A. Rondinelli and J. M. Heffron: Lynne Rienner London.

Carmel, Erran, and Paul Tjia. 2005. *Offshoring Information Technology*: Cambridge University Press.

China Daily. 2006. China Created Court to Enforce IP Cases. *China Daily Online*, http://www.chinadaily.com.cn/english/doc/2006-03/10/content_531992.htm.

Cox , Alan, and Kristina Sepetys. 2006. Intellectual Property Rights Protection in China: Litigation, Economic Damages, and Case Strategies. *NERA Economic Consulting*, http://nera.com/image/PUB_IPR_Protection_China_IP1138.pdf.

D'Costa, Anthony P. 2004. Export Growth and Path Dependence: the locking in of innovation in the software industry. In *India in the Global Software Industry. Innovation, Firm Strategies and Development*, edited by A. P. D'Costa and E. Sridharan: Macmillan.

Economist, The. 2007b. Asia's Rich and Poor. *The Economist* 11th August 2007:page 50.

———. 2007a. Briefing: Emerging Market Economies. *The Economist* 17th November 2007:pp85 - 87.

Granstrand, Ove. 1999. *The Economics and Management of Intellectual Property. Towards Intellectual Capitalism*: Edward Elgar.

Heeks, Richard. 1999. Software Strategies in Developing Countries. *Development Informatics Software Working Paper Series* University of Manchester.

Heeks, Richard, S Krishna, Brian Nicholson, and Sundeep Sahay. 2000. Synching or Swimming: Trajectories and Strategies in Global Software Outsourcing Relationships. *Development Informatics Working Paper Series, Institute for Development Policy and Management, University of Manchester*.

International Finance Corporation, (IFC). 2005. *The ICT Landscape in the PRC Market Trends and Investment Opportunities*: IFC.

Jakobson, Linda. 2007. China Aims High in Science and Technology. An Overview of the Challenges Ahead. In *Innovation with Chinese Characteristics*, edited by L. Jakobson: Plagrave Macmillan.

Kang, David C. 2007. *China Rising. Peace, Power and Order in East Asia.*: Columbia University Press.

Kasper, Alan. 2006. Corporate America's Slow Boat to China. *Managing Intellectual Property Print Edition - China IP Focus Special Supplement*:pp85 - 88.

Kroeber, Arthur. 2007. China's Push to Innovate in Information Technology. In *Innovation with Chinese Characteristics*, edited by L. Jakobson: Plagrave Macmillan.

Kshetri, Nir. 2005. Structural Shifts in the Chinese Software Industry. *IEEE Software* July/August 2005.

Kumar, Sameer, Jacky Jamieson, and Mathew Sweetman. 2005. Software industry in the fastest emerging market: challenge and opportunities. *International Journal of Technology Management* Vol 29 (3/4):pp231-62.

Leebaert, Derek. 2006. How Small Businesses Contribute to U.S. Economic Expansion. *Economic Perspectives* (Vol 11 January 2006), http://usinfo.state.gov/journals/ites/0106/ijee/ijee0106.pdf.
Li & Fung Research Group. 2006. *The Ten Highlights of China's Commercial Sector, 2006 - 2007*: Secretariat, Expert Committee of China Chamber of Commerce.
Li, Mingzhi, and Ming Gao. 2003. Strategies for Developing China's Software Industry. *MIT Research Reports* Vol. 1 (No. 1):pp61 - 73.
Lo, Vai Io, and Xiaowen Tian. 2005. *Law and Investment in China. The Legal and Business Environment after W.T.O. Accession.*: Routledge Curzon.
Maddison, Angus. 2005. *Growth and Interaction in the World Economy*: AEI Press.
Managing IP. 2008b. China gets ready for National IP Strategy. *Managing Intellectual Property Online Edition*, http://www.managingip.com/Article.aspx?ArticleID=1853384. (25th February 2008)
———. 2006. China IP court on the cards. *Managing Intellectual Property Online Edition*, http://www.managingip.com/Article.aspx?ArticleID=619309 (25th February 2008)
———. 2008. Country News: China. *Managing Intellectual Property Print Edition* January 2008.
Mckinsey & Co. 2005. Can China compete in IT services? *McKinsey Quarterly*, http://www.mckinseyquarterly.com/article_page.aspx?ar=1556&L2=4&L3=115&srid=7&gp=1. (25th February 2008)
McManus, John, Mingzhi Li, and Deependra Moitra. 2007. *China and India: Opportunities and Threats for the Global Software Industry*: Chandos Publishing.
Menon, Deborah, ed. 2005. *China Intellectual Property Law Guide*: Kluwer Law International.
National Association of Software Service Companies, (NASSCOM). 2006. *Strategic Review*: NASSCOM India.
———. 2007. Tracing China's IT Software and Services Industry Evolution. *NASSCOM India Research Whitepaper*.
National Bureau of Statistics of China. 2007. China Statistical Yearbook: Government of China.
Naughton, Barry. 2007. *The Chinese Economy. Transitions and Growth.*: MIT Press.
Organisation for Economic Co-operation and Development. 2006. *Information Technology Outlook 2006*: OECD.
———. 2007. *Reviews of Innovation Policy. China Synthesis Report*: OECD.
Pantesco, Joshua 2006 China creates special intellectual property court. *Jurist Online Research, University of Pittsburgh School of Law*, http://jurist.law.pitt.edu/paperchase/2006/03/china-creates-special-intellectual.php.
Pecht, Michael, Chung-Shing Lee, Zong Xiang Fu Jiang Lu, and Wang Yong Wen. 1999. *The Chinese Electronics Industry*: CRC Press New York.
Peerenboom, Randall. 2002. *China's Long March Toward Rule of Law*: Cambridge University Press.
Pei, Changhong, and Lei Peng. 2007. Responsibilities of China after Accession to the WTO. *China and World Economy* Vol 15 (4):pp89 - 101.
Qu, Zhonghua, and Michael Brocklehurst. 2003. What will it take for China to become a competitive force in offshore outsourcing? An analysis of the role of transaction costs in supplier selection. *Journal of Information Technology* 18:pp53 - 67.
Saxenian, Annalee. 2007. Brain circulation and regional innovation: the Silicon Valley - Hsinchu - Shanghai Triangle. In *The Economic Geography of Innovation*, edited by K. Polenske: Cambridge University Press.
Scott, David. 2007. *China Stands Up. The PRC and the International System*: Routledge.
State Council, Government of China. 2000. Funding for high technology firms under the Torch Project. (25th February 2008), http://www.innofund.gov.cn/english/index.htm.
———. 2006. Science & Technology Guidelines. (25th February 2008), http://www.gov.cn/english/2006-02/09/content_183426.htm.
Steinfeld, Edward S. 2007. Innovation, integration and technology upgrading in contemporary

Chinese industry. In *The Economic Geography of Innovation*, edited by K. Polenske: Cambridge University Press.
Stephens, Thomas B. 1992. *Order and Discipline in China. The Shanghai Mixed Court 1911 - 27*: University of Washington Press.
Talwar, Rohit. 2007. *The Future of China's Economy. The Path to 2020 - Opportunities, Challenges and Uncertainties*: Global Futures and Foresight and Fast Future.
Taubman, Anthony. 2003. TRIPS Goes East: China's interests and international trade in itellectual property. In *China and the World Trading System. Entering the New Millennium*, edited by D. Cass, B. Williams and G. Barker: Cambridge University Press.
Tong, Sarah, and Yi Zheng. 2008. China's Trade Acceleration and the Deepening of an East Asian Region Production Network. *China and World Economy* Vol 16 (1):pp66 - 81.
Wilsdon, James, and James Keeley. 2007. *China: The next science superpower?, The Atlas of Ideas: Mapping the new geography of science*: DEMOS.
World Intellectual Property Organisation, (WIPO). 2006. Patent Report 2006. *WIPO Statistics* (20th January 2007), http://www.wipo.int/ipstats/en/statistics/patents/pdf/patent_report_2006.pdf.
World Trade Organisation. 2006. *Trade Policy Review for People's Republic of China* WTO.
———. 2007. *Trade Profiles* WTO.
Wu, Zhongze. 2006. Innovation: China's New National Strategy. Paper read at Forum for China-EU Science and Technology Year, at the European Commission Brussels, 11th October 2006.
Xinhua News Agency. 2008b. China software industry reports 20% rise in revenue *Xinhua English Edition*, http://news.xinhuanet.com/english/2008-02/12/content_7593471.htm
———. 2008a. China's GDP grows 11.4% in 2007 *Xinhua English Edition*, http://news.xinhuanet.com/english/2008-01/24/content_7485388.htm. (25th February 2008)
———. 2007. Full text of Hu Jintao's report at 17th Party Congress *Xinhua English Edition*, http://news.xinhuanet.com/english/2007-10/24/content_6938749.htm. (25th February 2008)
Yang, Deli. 2003. *Intellectual Property and Doing Business in China.*: Pergamon.
Yang, Deli, Pervez Ghuari, and Mahmut Sonmez. 2005. Competitive Analysis of the Software Industry in China. *International Journal of Technology Management* Vol. 29 (Nos. 1 & 2):pp64 - 91.
Zhang, Gang. 2008. Perspectives on China's Innovation Policy. Paper read at New Perspectives on Chinese Innovation, at Nesta London.
Zhang, Zhijun. 2007. Paper read at China-EU Relations: Common Challenges for the Future, at European Parliament Brussels.
Zhao, Zhangxiu. 2007. China's Industrial Policy in Relation to Electronics Manufacturing. *China and World Economy* Vol 15 (3):pp35 - 51.