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**ABSTRACT**

This paper examines the on-going high level of dependency of China’s economy on foreign sources of technology during the period since accession to the World Trade Organisation (WTO). Because this dependency is a major cause of concern for China’s leaders and policymakers, they have sought to shift the direction of the economy particularly since 2006 towards a greater focus on indigenous innovation. Achieving such a major transformation, however, in an era when much of China’s economic activity has become integrated within the global production networks of major corporations, is very challenging, and the evidence to date suggests only a modest level of success on the part of Chinese companies to substitute for the ongoing dominant position of foreign companies particularly in China’s high technology sectors. Some progress has been made, however, in the private sector’s share of economic activity in contrast to the declining share of State Owned Enterprises (SOEs).

**Keywords:** foreign technology dependency    indigenous innovation    global production networks

1. **Introduction**

Despite its impressive growth rate since its opening to the world economy more than 30 years ago, China’s economy is still transitioning towards some hybrid form of market economy. Among the major developments that have marked this transition was China’s accession to the World Trade Organization (WTO) in December 2001, and its more recent adjustment to the global downturn, helped by a state stimulus package of USD586bn. Some would also argue the significance of 2006 which was the end of the five-year schedule of market opening measures pledged by China as the price of admission to the WTO and which also saw the beginning of a major industrial policy shift towards ‘indigenous innovation’ (*zizhu chuangxin*). During this transition a major state policy has been to shift the thrust of the economy from a low-cost manufacturing model related to export processing to a more sustainable model associated with higher value added activity. Among some of the interrelated features associated with China’s recent economic transformation is the dominant role of foreign direct investment (FDI), particularly in export processing and in high tech sectors, the rapid ageing and decline on the labour force associated with China’s very low fertility rate, partly influenced by its one-child policy, and the huge environmental challenges resulting from the rapid pace of economic growth.

The main thrust of this paper will focus on the implications of China’s on-going high level of dependence on foreign sources of technology, as reflected in the significant role of foreign investors in China’s high technology exports, despite the determination of China’s policymakers to reduce this dependence by promoting indigenous innovation. In the context of this policy concern, this paper will examine the extent to which Chinese companies have progressed particularly in relation to their involvement in China’s trade. Some reference will also be made
to the growing competition within China’s domestic economy between Chinese and foreign companies. With China’s evolving role within the global production networks (GPNs) and global value chains (GVCs) of leading technology corporations, an overall upgrading of China’s industrial profile has been under way. This paper will attempt to evaluate the extent to which local companies have benefitted from this upgrading.

2. Methodological and conceptual issues

While much of the analysis to date on China’s evolving economic development has focused on trade theory, making use of trade statistics, to examine the relationship between trade patterns and economic development, such an analysis within an era of increasingly globalised economic activity has limitations (Karabell, 2009; Sturgeon and Gereffi, 2009). With the increasing fragmentation of production across production networks and value chains, it is necessary to develop more effective conceptual frameworks such as global production networks and global value chains to determine the particular roles of different regions within production networks as well as providing a better indication of the added value accruing to those regions (Sturgeon, 2008; Coe et al, 2008). This can help to avoid the exaggerated evaluation of gains to a particular economy by an uncritical examination of trade data, which is particularly relevant in the case of China whose key role in many value chains is a somewhat subordinate one as a low cost assembly location of components imported from other regions. Xing and Detert (2010) note that conventional trade statistics are not consistent with trade where global production networks and production fragmentation determine cross-country flows of parts, components and final production. Using the ‘direct value added exports’ indicator, which evaluates the added value to particular countries of their exports, Horn et al (2010) found that China’s export sector contributed 19 to 33% of total GDP growth between 2002 and 2008, which was only half of the export contribution indicated by traditional total export measures.

In seeking to determine the extent to which Chinese companies have evolved technologically during China’s recent period of rapid economic growth the approach taken in this paper is to exploit both trade data and also company interviews, which provide the opportunity to consider the evolving role of different company types in trade and also the domestic market. The need to consider both the trade activity and the domestic economy relates to how economic activity has evolved during recent decades with a greater focus on export-led growth initially and the more recent involvement of both foreign and Chinese companies in the domestic economy. For Yu (2008, 2354) the success of Chinese companies in the domestic market is ‘the synchronisation of China’s export upgrading and domestic market growth, rather than export alone’. An unusual feature of China’s development has been the rare combination of a very large domestic market with a high level of FDI that is focused on this domestic market (Brandt and Thun, 2010). The tendency in many studies of China’s economic development to date has been to adopt an either/or approach: to either focus on trade or on the domestic economy, rather than on interactions between both; to focus on either foreign or Chinese companies while not paying attention to the many interactions between them. Recent reality in China is more complex, with a range of interactions between different sectors of the economy and between different types of companies.
Trade data showing imports and exports to China, particularly in the post-WTO accession period are used, differentiating trends for foreign invested firms (FIFs), state-owned enterprises (SOEs) and private forms are used. In addition an annually published list of China’s top importing and exporting firms in recent years is used to determine the performance of different company types. Analysis of both these sources is supplemented by material from 50 hours of interviews with a number of major foreign multinational companies in Shanghai between 2009 and 2011, which explored a range of questions associated with the experience of the companies in China.

3. China’s subordinate role in GVCs

By default, during the earlier period of China’s integration within global production networks and value chains, its role was mainly as a low cost assembly location, a role which it partly took over from neighbouring countries as they moved further up the value chain. Because its opening up coincided with the increased internationalisation of supply chains, China rapidly became interconnected with assembly activity in Asia and grow at an impressive rate. This was facilitated by the offshoring of production by large multinational companies seeking lower cost locations, together with Chinese state policy promoting export processing by generous tax breaks.

During the earlier period of China’s integration within global production networks and value chains, its role was mainly as a low cost assembly location, a role which it partly took over from neighbouring countries as they moved further up the value chain. Because its opening up coincided with the increased internationalisation of supply chains, China rapidly became interconnected with assembly activity in Asia and grew at an impressive rate. This was facilitated by the offshoring of production by large multinational companies seeking lower cost locations, together with Chinese state policy promoting export processing by generous tax breaks. The more recent period, however, has seen important changes in the factors underlying China’s comparative advantage, with both the decline in the labour force, the rapid ageing of the population associated with very low fertility and the rising cost of labour (Eberstadt, 2012). Some economists have pointed to China’s passing of the Lewis Curve, resulting in a decline in surplus rural labour which was so plentiful in earlier decades (Cai, 2010). The global downturn in recent years, did not affect China as severely as other regions during the earlier stages (2008-2011), partly because of a huge state stimulus package. After 2011, because of excess production capability generated by the stimulus package, with the continuous appreciation of the Chinese RMB and the recession in export markets, China’s export-led growth model faced considerable challenges.

China’s dominant role as a relatively subordinate partner in global production networks became more important with its integration into the global economy, and continues to be a key aspect of its on-going comparative advantage. Trade in parts and components in the region reflects China’s development as an import dependent producer of increasingly high technology exports, with China being the final production platform in a transnational structured production system (Hart-Landsberg, 2011). Associated with this role has been its significant dependence on foreign technology sources and on foreign markets, as multinational corporations offshored their mainly
low value-added assembly activities to China while retaining the higher value added functions in more developed regions. Neighbouring Asian countries, including Japan, Korea, Hong Kong and Taiwan exploited the low cost advantages of China to which they offshored assembly functions. All of these Asian neighbouring countries have become major sources of foreign investment in China, developing strong value chain linkages with the mainland. The integration of Taiwan’s electronics sector with the Chinese mainland has been particularly impressive, with Taiwanese companies playing a key role in China’s electronics sector (Saxenian, 2007). Computer manufacturing is dominated by Taiwanese companies and suppliers who control this part of the supply chain from mainland China (Hart-Landsberg, 2011). In a detailed analysis of patents in China, Boeing and Sandner (2010) found that two-thirds of a sample of intermediate value class patents were accounted for by foreign firms, but with 78% of coming from Taiwanese firms like the huge Taiwanese contract manufacturer Foxconn, with access to a global R&D and production network in Europe, North America and Asia.

All of these developments, however, have been characterised by strategic attempts to locate key intellectual property activities in their home countries. When Japanese companies, who were among the first to offshore to China in the 1990s, began establishing R&D centres there, they sought to retain their most advanced technologies locked away from Chinese competitors (Segal, 2011). More recently significant FDI linkages have been forged with the US and Europe, with increasing integration of both trade and global production networks between these regions. While this pattern of development associated with global integration follows similar trends in other regions, it appears that China presents particular challenges to the protection of IP by global corporations, and with its determined push for indigenous innovation in recent policy developments, it may present a more threatening environment to lead technology corporations despite its relative openness to date towards FDI.

The push for technology autonomy

China’s determination to reduce reliance on foreign technology and to gain greater control over intellectual property explains the push from 2006 onwards towards indigenous innovation. This policy, however, creates certain tensions between, on the one hand the need to develop Chinese technology, and on the other ensuring that China continues to benefit for its growing integration into global innovation networks, by acknowledging the key role the country plays in the global production networks and global value chains of lead technology corporations (Yeung, 2009). In evaluation of this new policy, Chinese scholars Xielin Liu and Peng Cheng (2010) call for a more open innovation policy to help Chinese companies reach the necessary level of innovation to compete internationally, and wonder whether the large domestic market in China which helps local companies prosper more easily may also slow down the urgency for them to become more innovative. Others have suggested that China’s market allows Chinese companies to scale copycat products without crossing national borders (McGregor, 2010).

During the drafting of China’s most recent fifteen-year “Medium- to Long-Term Plan for the Development of Science and Technology (2006-2020)” China’s technical community argued that the country could no longer expect to receive core technologies from international sources and policy should focus on indigenous innovation (Serger and Breidne, 2007). Although many economists have argued that at its current level of development, there was greater potential for China to benefit from spillovers created by foreign multinational companies in China, others
have found limited benefits from such as spillovers and suggest that innovation from both indigenous and foreign sources was complementary and necessary (Boeing and Sandner, 2011; Xu and Sheng, 2011; Fu and Gong, 2010). An important aspect of the new indigenous innovation policy involves developing the capacity among Chinese companies to absorb foreign technology and to optimise its exploitation for the local market.

Since tariffs and quotas are no longer available as tools to protect its market in the wake of its accession to the WTO, McGregor (2010) argues that China is making use of its rapidly growing market and powerful regulatory regime to reduce its reliance on foreign technology and payment of associated license fees. Among the measures being used to achieve these objectives are domestic technology standards, which can block or delay penetration of the local market by foreign technology as well as the production of a catalogue of products eligible for access to the public procurement market. Although similar measures such as local content requirements, joint ventures, and forced technology transfers have been used by other Asian countries, it has been suggested that China’s approach is more aggressive with new complex regulations being constantly modified to keep companies off balance, and with China been criticised specifically for using access to its domestic market to leverage the transfer of technology for use in the high-speed rail sector (Hout and Ghemawat, 2010; Anderlini and Dickie 2010; McGregor, 2010).

Initially policymakers expected, perhaps somewhat naively, that Chinese companies would benefit greatly from a policy which sought transfer technology in exchange for market access and which was underpinned by a requirement on foreign companies to be part of a joint venture with a local company. China’s ambition to become a technology leader is made difficult by being a latecomer to areas of high technology such as semiconductors and software architecture that are dominated by global corporations from outside China. Since China’s accession to the WTO in 2001, many foreign companies have shifted towards Wholly Owned Foreign Enterprises (WOFEs), in order to have more control over their operations and to protect their IP, but China continues to pressure foreign companies to share intellectual property. It is argued that China’s push for indigenous innovation is partly influenced by political factors and a tendency towards techno-nationalism, but considerations including poor levels of absorption and assimilation of imported technology have also been important (Whalley and Zhou, 2007). A distinction should be made between a relatively small number of highly successful, innovative Chinese companies in high technology sectors, and many state owned enterprises which are still undergoing transformation from the earlier command economy (Boeing and Sandner, 2012).

While Chinese leaders and policymakers realise the urgency of moving China’s development model more towards knowledge exploitation, they appear to be still struggling to find the most effective way forward. Although always strongly influenced by political considerations, China shows evidence of adopting a pragmatic approach which is often based around hard bargaining with foreign investors (Ernst, 2011). Experience of other Asian countries provide some lessons for China’s future, but the challenges of achieving significant industrial upgrading during a more globalised era may prove quite daunting, particularly when Chinese policy is so focused on its own domestic economy. While China’s primary influence is within its own borders, the complex integration of both foreign and Chinese companies in China into global networks requires an approach which can improve China’s competitiveness within these networks rather than one which seeks to contain innovation within China (Yeung, 2009; Memedovic, 2008). In relation to
the potential for industrial upgrading, Henderson and Nadvi (2011) suggest upgrading might involve indigenous firms that were formerly subordinate within a global production network could become more innovative and thus have the capacity to contribute to higher value added activities.

4. The role of FDI in China’s development

In the early stages of China’s integration into the world economy, it had little choice but to rely heavily on attracting FDI, at which it became hugely successful, becoming one of the most significant locations for such investment in recent years. Initially much of the investment came to develop the export processing sector in what was a low cost location with a plentiful labour supply. In the late 1990s, export processing was particularly encouraged, but in 2000, the quota for mandatory exports to which wholly-owned foreign enterprises were subject was removed as part of the preparations for WTO entry (Economist Intelligence Unit, 2012). Over time, however, the factors underlying China’s comparative advantage for FDI have evolved, with a much greater focus by many more recent investments on the domestic market. State policy towards FDI has also evolved and more recently, China has become much more selective about the type of FDI it seeks to attract, partly in response to the relatively disappointing results of the earlier policy of providing market access in exchange for technology transfer (Davies, 2012). Rather than being an important source of employment creation, foreign capital was expected to bring advanced technology and expertise to China (Economist Intelligence Unit, 2012).

Although it is widely acknowledged that China benefitted significantly from the existence of many of the world’s leading technology companies in the country, particularly in relation to employment, economic growth particularly in sectors such as export processing, and in a general upgrading of its industrial profile, the results in relation to technology transfer and spinoffs to Chinese companies fell short of the expectations of policymakers. Part of the explanation of how the FDI sector evolved in China is also related to the specific policy environment of China in which the state continues to exert considerable control over industrial policy and particularly over foreign investment. All states seek to achieve the highest level of benefit from the FDI sector, and with such a rapid rate of growth in one of the world’s largest markets, few states have been in such a powerful bargaining position to exert considerable pressure on foreign investors to share their technological know-how.

The outcome in China, however, was little different than in other world regions in which the operations of global corporations go to significant lengths to retain their intellectual property within the confines of the corporation’s boundaries. While China has had some measure of success to date in acquiring technology from foreign companies, whether the policy they have pursued so far has been the most successful one remains open to question. In fact some Chinese scholars have been wondering whether market forces in a globalising world will allow a transitional economy such as China to succeed with its indigenous innovation policy (Liu and Cheng, 2011).

The reality is that the geography of technology hegemony has for a long period privileged major locations in the west, with newly emerging locations in parts of Asia, particularly Japan, Korea and Taiwan beginning to compete with these locations more recently. The geography of global
production networks and global value chains reflects the hegemony of leading global technology corporations, with some more recently emerging locations particularly in China acquiring relatively subordinate roles within these networks as low cost assembly locations of high technology components produced in other locations. In some senses, China has been acquiring such a role from of its Asian neighbours which held such a role previously, but have already moved into higher value added activities.

There is little doubt that the Chinese state has long grown impatient with the relatively low level of benefits arising from its subordinate network position and has been actively seeking to transform its development model towards a greater exploitation of knowledge-related activities. China’s achievements to date in investing in the necessary infrastructure to bring about such a transformation has been impressive, but the necessary major shift in in the centre of gravity of higher value added activity to China, while ostensibly under way, is likely to take a number of decades to bring to completion. In 2009 at the unveiling of key indigenous innovation regulations, Premier Wen stated that “only by using the power of science and technology will China, this massive ark, be able to produce the immeasurable ability to allow nobody to stop our advance forward” (quoted in McGregor, 2010, 6).

While it is likely that geopolitical considerations among western powers may seek to constrain to some extent China’s technological progress, for the most part such an ascendency is likely to be associated with the strategies of major global technology corporations as they seek to gain control over an increasing market share in different world regions. In 2007, a Chinese official responsible for technology policy referred to the challenges facing China as follows:

> The majority of the market is controlled by foreign companies, most core technology relies on imports, the situation is extremely grave as we are further pressured by developed countries who use blockades and technology controls – if we are not able to solve these problems we will forever be under the control of others (quoted in McGregor (2010, 17).

The frequently expressed dissatisfaction of Chinese leaders with the role of manufacturing low cost products in markets with low margins partly explains its nationalist agenda in science and technology, but a side effect of the political drive behind technology development policy is the huge challenge involved in building the necessary institutions and culture of innovation (Segal, 2011).

In addition to the considerable outflows of royalty payments and license fees from China, reflecting its subordinate and low value added roles in global production networks, Chinese industrial policy is also strongly influenced by political considerations such as the implications for state security arising from the on-going high level of dependence on foreign sources of technology. Thus while the ability of China’s leaders to adopt a pragmatic approach to the major challenges the country faces, it could be argued that industrial policy in China is overly influenced by a top-down, state-directed approach with influences of economic nationalism leading to a focus on the domestic economy as opposed to ways of increasing the competitive advantage of China within global production networks (Ernst, 2006). Rather than being a policy of technological autarky, it has been argued that the indigenous innovation policy encourages
continued participation in global innovation and commercial networks, with the objective of accumulating integrated technology from importing, digesting, absorbing and re-innovating (Springut et al., 2011). At the same time, Liu and Cheng (2011) make clear that a key motivation for China’s government taking leadership in innovation policy is to ensure that foreign direct investment will no longer be allowed to play a leading role in the technological progress of the country.

5. Technology upgrading in China’s industry

While some scholars are quite positive about the approach adopted and the level of upgrading of the industrial profile, others are critical of the overly directive approach of the state in the market, suggesting that techno-nationalism has slowed the evolution towards greater technological sophistication (Li et al, 2012; OECD 2012). Rather than constructing protectionist, inward-looking policies, emerging countries like China need to learn to deal effectively with the permeable borders of knowledge-creation and innovation, as technology development now encompasses the output of many workers in different global locations (Salter, 2009; Segal, 2011). A distinction can be made between the political objective of the Chinese state to achieve technological autonomy and the pragmatic approach of many Chinese companies who, rather than cutting themselves off from global markets have considerable cooperation with companies in Japan, Korea and Taiwan (Segal, 2011). Some of China’s leading firms such as Huawei have called for a more open innovation policy which would allow them more easily to cooperate with foreign firms (Liu and Cheng, 2011).

It could be argued that China’s economic progress has benefited significantly from the attraction of major technology corporations, but it must also be acknowledged that the volume of FDI going to China also reflects the fragmenting of production and value chains in a more globalised era, resulting in the greater integration of major Chinese regions into these networks (Sturgeon, 2003). The on-going tendency, however, to analyse these developments both within policy and academic circles within the narrow framework of trade theory may create an obstacle towards developing more innovative policies to improve China’s competitiveness within global value chains.

The geography of the global production network of the semiconductor industry illustrates some of the major challenges faced by China in relation to developing high technology industry. Despite the fact that the centre of gravity of semiconductor demand has shifted to China, following China’s role as a major global manufacturing hub, and with the presence of many of the world’s major semiconductor companies with operations in China, the fact is that much of the activity is at the lower end of the value chain. Although China set itself very high targets in relation to self-sufficiency in integrated circuits in 2006, Ernst (2011a) questioned how these could be attained in one of the most globalised industries. Meanwhile, China has made only modest progress in developing semiconductors despite major policy initiatives accompanied by significant state funding, while Taiwan, which had a much earlier start and more effective industrial policy has come to play a major role in the semiconductor sector. More generally, Taiwanese companies have shifted much of their electronics manufacturing to mainland China to
benefit from a low cost location as well as from a rapidly growing market. The huge disparity
between the global production and consumption of semiconductors, as reflected by China’s
relatively lower role in this significant production network reflects some of the major challenges
which China must yet face in seeking to become an important player in high technology sectors.

China’s role within GVCs is becoming more sophisticated, but what is less clear is the extent to
which Chinese-owned companies are beginning to substitute for foreign companies in this
upgrading OECD (2012). In relation to China’s trade data, which provide some evidence of
upgrading, it is useful to distinguish between ordinary and processing trade. Around two thirds of
the former, which dramatically increased to USD 721bn by 2010, is accounted for by indigenous
Chinese firms, and involves high domestic value added activity in mainly labour-intensive
sectors. With its share of world trade in parts and components increasing by 9.2% between 1995
and 2007, China is gradually becoming a key supplier. Although around 85% of processing
trade, which totalled USD 211bn in 2007, is accounted for by foreign firms, the role of Chinese
firms in this trade has been shifting from simple assembly to ‘full package’ manufacturing with
the emergence of an Original Equipment Manufacturing (OEM) sector, which may also include
major Taiwanese companies. Despite being one of the world’s largest economies, China’s
dependency on imported intermediate inputs at 27.4% of total inputs, reflects its ongoing
subordinate position in global value chains, while compared to other large manufacturing
exporters, China retains less value added in ICT sectors such as office, accounting and computer
manufacturing.

While there is little doubt that China’s economic structure is undergoing an underlying change
from the assembly and processing of low technology goods to higher technology products, and
while some level of know-how has been transferred to Chinese companies through foreign
investment, some critical technologies have not yet been mastered (Li et al., 2012). Using a
world electronics dataset, Van Assche and Gangnes (2010) suggest that there is little evidence of
upgrading in China’s electronics sectors, for example. In a study which focused on the exporting
role of foreign manufacturing multinationals in China while paying no attention to developments
in the domestic market, Moran (2011) notes that foreign manufacturing investors have been
responsible for 96% of all Advanced Technology Products (ADP) since 2002, and that Chinese
exporters are not even ‘keeping up’ let alone ‘catching up’ with foreign companies in China. In
arguing that Chinese companies have received few spillovers from multinationals, Moran (2011,
3) also suggests that:

the accumulated evidence simply does not show FDI to be a powerful source for
indigenous-controlled industrial transformation. In the case of exports, the production of
increasingly sophisticated goods destined for international markets from China has been
remarkably well constrained and contained within the plants owned and controlled by
foreign MNCs and their international suppliers. China has remained a low-value-added
assembler of more sophisticated inputs imported from abroad – a ‘workbench’ economy
largely bereft of the magnified benefits and externalities from FDI enjoyed by other
developing countries.
While such an evaluation may appear to be overly critical, the following examination of Chinese trade data provides some indication of more positive trends.

6. Contributions of foreign and Chinese companies

This section examines trends during the post WTO accession period relating to the contribution of foreign (including JVs in some cases) and Chinese companies (including State Owned Enterprises and private sector companies) to the Chinese economy and to trade. Companies operating in China can be usefully divided between State Owned Enterprises (SOEs), which play a dominant, though declining role in key sectors of strategic interest to the state, Foreign Invested Firms (FIEs), operating either as part of Joint Ventures (JVs) or Wholly-Owned Foreign Firms (WOFIs) and those Chinese companies that make up the private sector. Some would suggest that during the early opening-up period, when China hoped to gain access to badly needed technology from foreign firms in exchange for market access, that foreign companies were in an advantaged position in the economy, being provided with tax holidays and other incentives. SOEs have long played an important role from the days of the centrally planned economy, but that role has been significantly reduced in recent times, as China has sought to make these companies more productive. It has been suggested that private sector companies constituted the sector most discriminated against by the state, and a recent World Bank report argues for policy initiatives to release more fully the innovative potential of this important sector (World Bank 2012).

Because of discontinuity in statistical data sources during this period, it is necessary to focus on value added for the period 2001-2007 and then on industrial output for the following years. The dominant and dramatically increased role of foreign companies together with JVs in China’s high tech sector is impressive, growing from 37.4% in 2001 to 65.5% in 2005 and falling back a little to 62.6% of the total in 2007. One of the features of the post WTO period, however, was the strong preference among foreign companies move from JVs to Wholly Owned Foreign Enterprises (WOFEs). Although private companies (others) made an increasing though much smaller contribution to value added, it is noticeable how they began to overtake the contribution of SOEs during this period.

Data for gross industrial output for the more recent years, which include the global downturn and the China’s significant stimulus package, favouring SOEs in particular, foreign companies and JVs continued to dominate and even increase in significance, while the ‘others’ category pulled away more strongly from the SOE sector which made the smallest contribution. Both Figs 1(a) and 1(b) refer to the contribution of these different types of companies to the overall economy, both domestic and export, and provide some indication of the relatively modest progress of China’s new indigenous innovation policy had made to date in reducing dependence on foreign technology. The reduction in the contribution by foreign companies and JVs to gross industrial output from 70.2% in 2008 to 65.1% in 2010, despite overall growth in volume, may indicate modest progress, but could also indicate increasing competition with Chinese companies in addition to some policy obstacles for foreign companies in some components of the domestic market such as public procurement.
Turning to the traded sector of the economy in general, which includes both processing trade in which foreign companies dominate and ordinary trade in which Chinese companies dominate the increased growth of the Foreign Invested Firms’ (FIEs) contribution is striking compared to a lower, though impressive performance of the ‘other’ sector and a lacklustre performance of SOEs (Fig 2). The FIE share peaked at 58.3% in 2005 and fell back to 49.9% in 2012. Some have suggested that signs of peaking of the FDI sector in the Chinese economy could be a source of concern to the government (OECD, 2012). All categories of firms appear to have been affected by the downturn to some extent, but the recovery of the private sector, although having a lower share than that of FIEs has been quite impressive and does suggest some measure of success in China’s industrial policy with the rise in particular of some very successful Chinese companies. A qualification may be necessary in relation to the apparent rise of the private sector in China, with Guillaume et al., (2011) suggesting that it is not clear whether this rise may be the result of the entry of new firms or simply legal changes associated with the privatisation process and foreign trade liberalisation which allowed any firm to undertake foreign trade.

The OECD (2012) analysis of Chinese trade patterns throw some additional light on the above trends. Chinese indigenous firms accounted for two-thirds of ordinary trade, which grew dramatically to USD 721bn in 2010. In 2008, FIEs accounted for 28% of China’s ordinary trade, indicating their involvement in a range of interactions with Chinese companies including local procurement. But FIEs were responsible for 84% of processing trade which constituted 50% of China’s total trade for the period 2006-2010. Fig 3 indicates the dominant role of FIEs accounting for around 59% of the total for 2005-2006, when it peaked, and then falling back to 47.9% in 2012, despite overall volume growth. Not too surprisingly, the SOE sector, which also grew during this period remained stronger than the private (Other) sector, with the significant role of SOEs in importing key commodities to China.

Taking both exports and imports together, Fig 4 shows the FIE trade surplus peaking at USD 171bn in 2008 and falling back to USD 124bn by 2010, indicating the dominant role of FIEs in processing trade, with relatively low levels of added value accruing to China, and an apparent modest reorientation within the overall Chinese economy away from export-led growth towards
a greater focus on domestic consumption. While the trade surplus of the SOE sector has been marked by a considerable decline during this period, this has been counterbalanced by the rise of the private sector with its significant role in ordinary trade with high, levels of local content and adding considerably higher levels of added value to the economy than that of processing trade.

Fig 4 about here

Turning to China’s trade in high technology products, Fig 5 reveals the exceptionally dominant role of the FIE sector, whose total share grew from 73.8% in 1998 to 78.3% in 2012, and whose volume growth has also been spectacular. So, despite the overall peaking of the FDI sector in the Chinese economy, Chinese companies continue to play a very minor in relation to high tech trade. Clearly much of Chinese company involvement in the economy in relation to trade continues to be related to labour-intensive lower skilled areas, as suggested by Moran (2011). It’s not surprising, therefore, to find that the FIE sector share of high tech imports (Fig 6) which constitute the components required for assembling high tech products in China, grew from 66.5% in 2002 to peak at 88% in 2005 and falling back to 72% in 2012, which may indicate some growth in the provision of components by local companies.

Fig 5 about here

Fig 6 about here

Moving below the aggregate trade data and using an annual listing of top (more than USD1bn) exporting and importing companies in China, it is possible to add some further insights into the performance of different types of companies. This listing also shows the dominant role of FIEs among China’s top exporters, growing from 100 in 2001 to 152 in 2010, with a recovery occurring after a dip in 2006 (Fig 7). While the number of SOEs has fallen from 91 in 2001 to 35 in 2010, the number of private sector forms among the top exporters has grown only marginally from 9 in 2001 to 13 in 2010. More than half of the top 200 importing firms were FIEs, reaching a peak of 130 in 2005 with a slight decline since then. Although the number of SOEs in the listing has fallen from 82 in 2001 to 60 in 2010, the number of private sector firms has only risen marginally from 10 in 2001 to 25 in 2010 (Fig 8).

Fig 7 about here

Fig 8 about here
The three most significant exporting companies in 2012 included Futiahua Industrial (Shenzhen) with exports of USD 25.2bn, Dagong Computer (Shanghai) with USD 23.9bn exports and Hongfujin Precision Electronics (Zhengzhou) with USD 15.7bn in exports (Table 1). Both Futiahua Industrial and Hongfujin Precision Electronics (Zhengzhou) are among the 11 subsidiaries of Foxconn, a Taiwanese company and one of the world’s biggest contract manufacturers, which appear on the list of top exporters and which are shown in Table 1 with their rank and total of exports. Taken together, the total value of exports of the 11 Foxconn subsidiaries was USD 79.3bn, accounting for 17.3% of all exports from the top 200 exporters. The subsidiaries of Taiwan’s Quanta Computer Group and of Inventec Computer are also major exporters from China, although with lower values than in the case of Foxconn. Among the top Chinese exporters were Huawei Technologies at number seven with USD 8.5bn in exports, ZTE Corporation in fourteenth place with USD 5.1bn in exports, Huawei Devices in twenty fifth place with USD 0.9 bn in exports. A notable feature of these top exporting companies is the extent to which they have begun to move some of their manufacturing away from the established coastal regions towards more inland locations such as Chonqin and Chengdu, because of the pressures associated with rising labour costs. Foxconn, which is a subsidiary of Taiwan’s Hon Hai, assumes a sub-contractor role as an assembler or contract manufacturer for large technology brand companies such as Apple, Amazon, Nokia and Motorola, thus becoming part of a trans-Pacific supply chain. Such companies derive low levels of profit in their subordinate contractual position (Froud et al, 2012). In 2010, Foxconn entered a period of crisis, being forced to increase wages by around 30% and experiencing falling productivity. By leveraging their ownership of key intangible assets such as product brands and key designs, the lead companies maintain a monopolistic position within the value chain and also appropriate much of the value added (OECD, 2012).

Table 1 about here

Among the top importing companies are included Taiwanese ICT Original Equipment Manufacturers such as Futaihua Industrial (Shenzhen) with imports amounting to USD 162.1bn, and many firms involved in petroleum, iron and steel and the automotive sector. Among the largest are China International United Petroleum & Chemicals with imports worth USD 101.9bn and China International United Petroleum with exports of USD 30.7bn.

The general trend reflected in these indicators is one of the continuing dominant role of FIEs, with some involvement in JVs, in China’s value added and industrial output, and particularly in China’s processing trade, particularly in relation to high technology products. The SOE sector has been showing obvious signs of declining participation in China’s trade in the post WTO period, while trends in the private sector despite its modest share of activity to date is clearly upwards. Although foreign companies continue to dominate China’s high technology sectors, there is also some evidence of peaking in that dominance and some decline in more recent years,
which may reflect some level of modest success in China’s indigenous innovation policy. Disaggregated data reveals both the dominant role of Taiwanese contract manufacturer, Foxconn, which plays a leading role in manufacturing for global technology companies, and also the rise of a number of significant Chinese companies.

7. FIEs and indigenous innovation

With China’s relatively recent shift in focus towards a greater emphasis on promoting indigenous innovation, it might be expected that multinational companies operating in China would have some concerns about the implications of this evolving policy for their activities. Since a major thrust of this new policy was to reduce the dominant role of foreign companies particularly in high technology areas, around 50 hours of interviews were conducted with senior multinational management in Shanghai between 2009 and 2011, to provide some insights into how these companies saw the evolving relationship between the Chinese state and foreign companies. It would not be too surprising to find that some tensions exist between the objectives of multinationals, who seek to use factors of production in China to continue their relatively dominant position in value chains, and the objectives of the Chinese state which seeks to benefit from the presence of these companies through technology transfer and which seeks to promote ownership and control of intellectual property and technological innovation over time. Perhaps the most fascinating aspect of these interviews is the very nuanced perspectives of these managers towards the challenges faced by their companies to increase their market share in this new policy environment, but also the surprising level of empathy expressed by many of them in relation to China’s own objectives. The interview material with these foreign company case studies allow us to go a little deeper into the processes behind some of the trends already outlined.

During the 1980s, technology was transferred by large technology multinationals to their joint ventures in China at a very high cost to China in the form of royalties and license fees. From the mid-1990s, many of these companies began to offshore some manufacturing to this low-cost location, and in more recent years, they have made some investments in R&D activity in China. But the global model of R&D and innovation which multinationals have traditionally developed seeks to contain intellectual property within the boundaries of their organisations without providing any advantages to potential competitor companies. The reaction of interviewees to China’s evolving policy environment was, however, quite nuanced, with considerable understanding of the objectives involved, even when this made competing in the local market more difficult. While China still needed the contribution of multinationals, this dependence had declined more recently, and it was understandable that China should seek to move urgently up the value chain. Previously, multinationals were privileged with tax and other incentives, but now there was a more level playing field, with multinationals under more pressure to negotiate and bargain with policymakers to gain market access. Thus while there were obvious sources of tension in the relationship between China and foreign companies, it was clear to many interviewees that China was in an unprecedented powerful position in this relationship because of its market size, and it was necessary to work out some form of acceptable sharing of benefits over time through negotiation and compromise.
There was general agreement that multinationals could not change China in a fundamental way and must operate within the new rules, and that their challenge was to seek to identify how the market was evolving and to outpace local competition through higher levels of innovation. It was acknowledged that considerable dissatisfaction had been expressed by multinationals about perceived special treatment given to State Owned Enterprises (SOEs), and that while the market was ‘open in theory’, the products of multinationals, which might be of higher quality, could be excluded from the market because of the higher costs compared with local competitors. While there was agreement that with the continuing significant role of the state in the economy through SOEs, that China was not a ‘market economy’, yet they felt that there was no going back to the previous era after accession to the WTO, whose rules provided some comfort for foreign investors. Obviously China is not unique in the role that SOEs play in particular sectors of the economy that are deemed critical in terms of security and defence, but the extent of state involvement in China continues to be quite significant, and despite announcing plans to develop a more mixed ownership economy over time, the pace of change has been quite slow. Multinational companies were experiencing particular difficulties in areas such as public procurement, where the state had greater control over market access.

Some interviewees described the new policy environment in China in more dramatic terms, with the manager of a medium-sized US technology multinational saying that China had come up with ‘a brutally new way – a new paradigm for doing things, telling everyone, this is the way we are doing it and everything has to change. This is a revolutionary new paradigm, which involves evolutionary change, causing things to be done better in a gradual way. Everybody must jump on board and follow this approach and we will get a big market that way’ (2011 interview). This view was echoed by a manager from a large US technology company, experiencing growing competition from local companies who said: ‘Yeah, I think that right now the Chinese government is reasserting itself and saying either my way or the highway’. The same manager expressed an understanding of the Chinese approach by saying: ‘If I was the Chinese government, I would do the same thing, because I would also want to make sure that I am not paying royalties to multinationals. So I would want to create my own standards. But I think you might shoot yourself in the foot because the standards might only be applicable for the China market’. At the same time he was somewhat critical of the Chinese government insistence on indigenous innovation for firms who sought to sell into the Chinese procurement market. He regarded the requirement to build your IP in China as ‘welcome coppiers’ and ‘so, I don’t think that any multinational would actually do it’ (2011 interview). This while local managers appreciated what China was trying to achieve, they did not necessarily agree with the approach being taken such as focusing on domestic technology standards, which not only would create additional challenges for their own operations, but could also in the view of some inhibit local companies from being globally competitive.

The Chinese-born manager of a major global technology company, which established one of the earlier joint ventures in China, and which had restructured its operations more recently to allow for an easier sharing of technology and intellectual property between its Chinese operation and its headquarters, provided one of the strongest defences of China’s policy to develop its own domestic technology standards in areas like 3G for mobile technology. Notwithstanding his own acute awareness of growing competition from local companies and thus the increasing pressure to maintain market share in China, he argues that China’s development of the Time Division
Synchronous Code Division Multiple Access Standard (TD-SCDMA) was successful and provided experience for both Chinese engineers and telecommunications companies, which could in turn be used for developing the 4th generation wireless technology, and allowing China to play a bigger role than heretofore in the development of global standards. Even Chinese scholars such as Liu and Cheng (2011) express some scepticism about the relative success of TD-SCDMA, arguing that even major SOEs like China Mobile were reluctant to commit themselves fully to the project, while Breznitz and Murphree (2011) present a more negative evaluation of this experiment as an example of continuing interference of the Chinese state in the market. This interviewee, however, argues that TD-SCDMA is not a local standard, as some Indian operators were also interested in using it, seeing it as more suitable to their needs. He argues that because of China’s size, it was necessary to design a different standard to suit local conditions, and that part of the reasoning behind it related to its successful deployment in China initially and afterwards internationally. He also mentioned foreign military involvement in telecommunications development which created political issues for China (2011 interview). In this particular instance, it was fascinating to observe those tensions between China’s objectives and those of foreign companies reflected in the views of this Chinese-born manager, who, one the one hand sought to ensure that the company he worked for had the ability to compete and outperform local companies, while acknowledging that his country had every right to pursue its own technological ambitions.

The Chinese-born intellectual property manager of a major European technology company with very significant involvement in the Chinese market argued that it was understandable that the Chinese would try to set up a system which does not allow the market to be flooded completely with foreign products (2011 interview). While this company, like other foreign technology companies had control and ownership over key technologies that were of strategic interest to China, both in the energy and transport sectors, it was necessary for the company to develop a modus vivendi with the Chinese authorities if they were to benefit significantly from major contracts, not only within China, but also working in joint ventures with local companies abroad. Within this evolving relationship of collaboration, Nolan’s (2012) argument that within the current matrix of interdependence, that China needs the outside world more than the world needs China, because of the continuing dominant position of major western corporations.

Also, a Chinese-born manager of a very large US technology company, who had completed her postgraduate studies in the US and also began her career in the company in the US, pointed to the experience in the US where local companies had been prevented by the state from purchasing equipment from Huawei, one of China’s hugely successful telecommunications companies, because of supposedly national security reasons. She went on to argue that it was reasonable that the Chinese state should also have such concerns about the possibility of software programmes gathering intelligence, and thus providing it with understandable reasons for not purchasing the software and hardware of foreign companies’. She went on to express a strong empathy for China’s new policy of indigenous innovation. In addition to the likely nationalistic influences, which affect many people in different countries, who are proud of their nation’s emergence after a long period with low levels of development, these views were also partly influenced by the tensions of management seeking to be successful in a country where the business environment often reflected different cultural values, and the objectives set by their company headquarters, often with little appreciation of local nuances.
A similar level of empathy was expressed by another manager in the same large US technology company. Being a son of Chinese immigrants to the US, where he began his career working for this company, he later moved to the home of his ancestors. He explained that ‘over time, I began to understand the problem that China is dealing with is on a wholly different magnitude, a wholly different scale than any western country has ever encountered, and we don’t know what is the right way of working with 1.3bn people…we have to give people the benefit of the doubt, that the government are trying to do the right thing here. Yes, everybody is trying to get the market, but if you are in somebody else’s house you need to go by their rules, and you figure out ways of helping the government by your own moral standpoint…helping them to become more successful and helping the people at the same time…I mean China does not want to be just the resources and labour of the world…the economy has to move up the value chain…that’s part of the drive for innovation, IP, etc, ...the question is really how to do it?...the policies are for directional guidance’. He went on to be quite critical of the approach taken by many foreign multinationals towards doing business in China: ‘in my personal opinion, most of the multinational decisionmakers have not lived here…they don’t understand the history and the background of the country because it is difficult to relate 50 years of growing up in the West and apply that to China, which has a very different set of values and assumptions, and this explains sometimes what used to work elsewhere does not work here. Well, it is a different world with a very different value system (2011 interview).

A Chinese born manager of another major US technology company explained that the company’s view was that ‘there must be give and take in the relationship with China. It’s about negotiation…if we are not prepared to give anything, we will have to compete with other multinationals from Japan, Europe and Korea as well as a large number of smaller Chinese companies’ (2010 Interview). This willingness to collaborate with China’s government in order to both help the country develop its own industries, while at the same time seeking to help their own corporation to be successful in the Chinese market reflected pragmatism based on experience and familiarity with local conditions. While many of these case study companies continue to dominate innovation in the particular sectors in which they operate, and are therefore part of the western technology hegemony that China wishes to counteract with its policies, in order to reduce its dependence on foreign technology. However, in some cases China is proving to be a much more difficult market for foreign companies than in the earlier period of opening up, and their future expansion in and successful penetration of China’s very attractive market will depend on a pragmatic approach towards sharing intellectual property ( The Economist, 25 January, 2014).

8. Conclusion

China’s policymakers continue to seek to steer this enormous country towards some form of hybrid market economy by developing a more sustainable model based around indigenous innovation and domestic consumption rather than the export-led growth model based on FDI which has predominated to date. The impatient push towards technology autonomy, which could be argued to be partly driven by nationalistic and political factors, may, however, prove to be somewhat premature. With demographic change reducing labour supply, and significant levels of environmental problems associated with its ‘world factory’ model, China is under pressure to shift its comparative advantage to more knowledge-based activities. Policy tensions continue,
however, between its nationalistic push for indigenous innovation within the confines of its own borders and the challenge to become more competitively innovative within global value chains in which much of its key economic activity has become embedded. Its current subordinate role within global value chains as a low cost assembler is associated with its on-going high level of dependence on foreign technology, with global lead companies retaining much of the value added and profitability particularly from high technology sectors in China.

During this transition period from its dependence on export-led growth to a reorientation towards a greater emphasis on domestic consumption, it is necessary to consider both trade activity and developments within the domestic economy to evaluate the extent to which Chinese companies have achieved some level of technological upgrading. Ordinary trade, which is primarily composed of lower technology labour-intensive activity and in which Chinese companies account for two thirds of the activity, has grown significantly, with a growing involvement of foreign companies who are increasingly turning their attention to the domestic economy. Processing trade, on the other hand, accounting for at least half of China’s trade activity, and based on the importation of parts and components for final assembly in China continues to be dominated by foreign companies, particularly in the higher technology sectors. Evidence of the dominant role of Taiwanese companies and particularly of Foxconn in China’s electronics sector is striking, and even with such ‘foreign’ companies, their role as low cost assemblers in mainland China continues to be a subordinate one within the value chains of the lead technology companies which are their key customers. Analysis of the trade data, while indicating a dominant, though decreasing role by foreign invested firms in China’s high tech activity, also shows some increased involvement particularly of China’s private sector companies. The level of this increase needs to be somewhat qualified by difficulties with specifying the real increase of privatisation in China. It is clear that major challenges remain for China to transition from playing a relatively subordinate role within global value chains, and rather than focusing on developing a more innovative and globally competitive development model, there are some signs that China’s progress could be delayed by opting for a more inward model of technology autonomy within a relatively protected large domestic market.

The insights provided by the company interviews in China present an impressively nuanced perspective on the part of the managers of foreign subsidiaries towards the objectives of China’s new indigenous innovation policy. While it is clear that their overall objective was to face the challenges of competing for greater market share in China against increasingly competitive local companies, which had growing support of the Chinese state through the use of domestic standards and the public procurement market, they also had a deep understanding of China’s need to move their development model further up the value chain, and to reduce their dependence on foreign technology. The overall impression provided by these interviews suggested that the best way forward for both the Chinese state and indeed for foreign multinationals was to be prepared for more give and take in that relationship: there was an appreciation that China would continue to depend on the contribution of foreign companies for a considerable time to come, but the best way for these companies to increase their market share in China was to collaborate as much as possible with the state in order to help achieve its stated objectives.

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Fig 1(a) Value added (USD bn) for various enterprise types in high tech

Fig 1(b) Gross industrial output (USD bn) for various enterprise types in high tech

Fig 2 Chinese exports by enterprise (USD bn)

Fig 3 Chinese imports by enterprise (USD bn)

Fig 4 Chinese exports-imports by enterprise (USD bn)

Fig 5 Chinese High tech Exports (USD bn)

Fig 6 Chinese High tech imports (USD bn)

Fig 7 Number of top 200 exporting companies (USD1bn or over) by company type
Fig 8 Number of Top 200 importing companies (USD1bn or over) by company type

Table 1 Foxconn subsidiaries among top exporters

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