Chapter 10
Boarding the high-speed train of China: the upgrade journey of a British engineering firm after acquisition by a Chinese train company

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1. Introduction[1]

There has been a surge in recent years in the study of emerging-economy multinational enterprises and their swelling outward foreign direct investment (outward FDI) activities (Mathews 2006; Luo and Tung 2007; Hennart 2012). Most of the research has focused on understanding the internationalisation of emerging-economy multinational enterprises. However, we still know very little about the impact of these companies' outward FDI on the businesses of their host countries (Clegg and Voss 2012). Indeed what emerging-economy multinational enterprises tend to face, particularly when they invest in developed countries, is a combination of the so-called 'liabilities of foreignness and the liabilities of emergingness'. The public tend to be fairly dubious about their investment intentions and impact, as expressed, for example, by the vice-president of the German-British Chamber of Industry and Commerce in a mainstream newspaper:

> 'I think there's every reason to be worried. Very often the R&D goes abroad and the rest follows … It's a recipe for disaster and a slow hollowing out of our industrial base here' (Sharman 2013).

This typical worry about investment from emerging economies, however, is not supported by solid research evidence. We therefore think there is an urgent need to study the impact of emerging-economy multinational enterprises on host country businesses. In light of China's increasing engagement in acquiring firms in developed economies (UNCTAD 2014), we chose a recent Chinese acquisition in the United Kingdom in order to examine the influence of Chinese firms on the capability upgrading of their acquired subsidiaries.

Given the lack of research on this topic, we chose a single-case-study approach to examine the evidence on and process of upgrading. We managed to build a good relationship with the companies that we are studying and therefore were able to undertake 'elite interviews' (Welch *et al.* 2002) with senior managers, which provided very rich data. Additional data were collected from publicly available secondary sources including media reports in both English and Chinese, as well as news archive and company reports. In this chapter we focus on the capability upgrading of the acquired British subsidiary and discuss the implications.

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2. Chinese investment in the United Kingdom

China has been one of the leading emerging economies in terms of outward FDI activities over the past decade. It recorded USD 124 billion outward FDI in 2014, becoming the second largest investor after the United States (UNCTAD 2015). The United Kingdom is one of the leading destinations for Chinese outward FDI in developed countries (Clegg and Voss 2012). According to figures from the Chinese Ministry of Commerce, in 2014 there was a mere USD 0.84 billion Chinese investment stock in the United Kingdom. However, the rapid increase in 2015 saw that figure rise to USD 12.4 billion.

The surging outward FDI from China has progressed in tandem with the rapid rise of many Chinese firms to become global leaders in their respective industries. Huawei, for example, is now the world's largest telecom-equipment maker, while Lenovo is the largest PC maker and Haier the largest household appliances manufacturer. Similarly in the railway equipment industry, CSR China and China North Locomotive have both surpassed Siemens to become the world's third and fourth manufacturers by sales (BCG 2014). One of the most dramatic changes has happened in the wind turbine sector, in which no Chinese firm made its way into the top 10 in 2005, after which four did, occupying second, fourth, seventh and tenth places (Lema *et al.* 2013). Many of these Chinese lead firms are now in the position to lead global value chains and have substantial investment and operations in developed countries such as the United Kingdom, much of which aims to acquire knowledge and access and develop strategic assets (Chen *et al.* 2012; Rabbiosi *et al.* 2012).

In the past few years there have been a number of acquisitions by Chinese firms in various UK industries, including Shanghai Automotive Industry Corporation's (SAIC) takeover of MG Rover, Bright Food's acquisition of the cereal maker Weetabix and Dalian Wanda's purchase of the yacht maker Sunseeker International. In many of these cases, the acquired British firms were internationally well-known and renowned brands. Many had a long and proud tradition and they were technology leaders in their sector. Most were medium-sized enterprises, considerably smaller than their Chinese suitor. This is also the case with the acquisition of Dynex in the UK by CSR China, the focus of this chapter.

3. Boarding the high-speed train of China

3.1 The expansion of CSR China

CSR China is a state-owned enterprise that has become renowned for its design, engineering and production of electric multiple units (EMUs) for China's high-speed railway network. The company was formed in 2000 as a spin-off of China South Locomotive and Rolling Stock Industry Corporation (Group) and renamed CSR China in 2007. It is a major force behind China's impressive expansion of its high-speed railway network, producing EMUs that run at a speed of 350 km/ hour. In December 2010, its CRH380A EMU set a world record of 486.1 km/hour in trial operations

(Chuang and Johnson 2011), powered by an EMU convertor with the highest powered single unit in the world.

The history of CSR China can be traced back to the establishment of China's first locomotive and rolling stock manufacturer in 1897 and this has since then remained its core business despite a number of restructuring programmes. Working with a number of other firms and research institutions with coordination by the then Ministry of Railways, CSR China managed to design and manufacture China's own high-speed train – the 'China Star' – that set a Chinese record of 321 km/hour (New Financial Observer 2011). But this indigenous innovation was quickly called to an end as the Ministry of Railways turned its sights on foreign technology.

Following an *import, assimilate and re-innovate* strategy regarding technological development, the Ministry of Railways solicited bids from Chinese–foreign business partnerships to make high-speed train sets that could travel at 200–250 km/hour with specific requirements on technological transfer to Chinese companies. CSR China has since partnered with Japan's Kawasaki Heavy Industries and Canada's Bombardier, respectively, and gained access to foreign technologies, which significantly enhanced CSR China's technological development in high-speed trains. CSR China has also made enormous efforts to assimilate foreign technologies, deciding that on top of every dollar spent on these technologies, they would invest an additional three dollars to help assimilate and apply them (McKinsey 2015).

Within a few years, CSR China was able itself to design, engineer and produce EMUs that ran at a speed of 350 km/ hour. The company has also further developed and strengthened its core technological capabilities in engineering and producing high-speed EMUs, particularly in the areas of propulsion and control. For example, in 2010 it developed an EMU convertor with the highest single unit power in the world, helping it to propel the CRH380A.

Feeling confident about its technologies and design capabilities, CSR China felt the need to conquer foreign markets after becoming the biggest supplier of train sets for China's high-speed railways. The company already exported electric locomotives to the Middle East and Central Asia in 1997 and 2001–2002, respectively. Being able to use fast domestic developments in supplying China's domestic high-speed railway and urban transit markets as a reference point, CSR China won contracts to supply modern underground trains to India in 2010. In 2013, it went on to sign a near- USD 1 billion contract to supply EMUs to Argentina, followed by a subsequent contract for technological support and training. From 2011 to 2014, the value of CSR China's overseas contracts increased over 300 per cent from USD 0.89 billion to USD 3.7 billion (Science and Technology Daily 2015). The past few years have seen a series of CSR China's major overseas investments, including its acquisition of Dynex in the United Kingdom in 2008, Emprendimientos Ferroviarios in Argentina and Boge in Germany in 2014, as well as E+M in Germany and SMD in the United Kingdom in 2015. The company has also established joint innovation centres in America and Germany in recent years.

3.2 The struggling Dynex

Dynex can be traced back to AEI Semiconductors in 1956 in Lincoln, which manufactured some of the first silicon-based semiconductor components in the world. The past few decades have seen the ownership of the company being changed a few times under the names of Marconi Electronic Devices, GEC Plessey Semiconductors and Mitel Semiconductors. In 2000, Dynex Power Inc, a small, publicly quoted Canadian company, formed Dynex Semiconductor Ltd to purchase the assets of Mitel Semiconductors. Following the acquisition, all operations of Dynex Group are in Lincoln as part of Dynex Semiconductor Ltd.

Dynex Semiconductor Ltd initially had about 400 employees and five different product lines without much synergy between them. There was therefore a lack of business focus; the company even produced microwave sensors at one stage. In 2003–2004, Dynex decided to focus on power products/semi-conductors, and its workforce was reduced to 140. Nevertheless, the company managed to maintain its expertise in designing and manufacturing high power bipolar discrete semiconductors, power modules including insulated-gate bipolar transistors (IGBTs), and high power electronic assemblies.

IGBTs are today's state-of-the-art power electronics modern traction power control systems. Compared with conventional transistors, IGBTs can achieve higher switching frequency and reduce the current required and therefore the heat generated, giving rise to smaller and lighter units. The high switching frequencies also smoothen the acceleration process and reduce the traction noise. In addition to rolling stock, IGBTs have been used in other traction power control systems.

Despite Dynex's technological expertise in IGBTs, the company struggled to survive in this investment-hungry business and by 2004 it was very close to bankruptcy. The sale of its IGBTs was maintained at a small volume, despite their potential use in the railway industry. Dynex's CEO admitted during the interview that, before the acquisition by CSR China and Times Electric, no train company wanted to use its IGBTs because they have no reference in the markets (no track record of application in the railway industry, which attaches enormous importance to reliability and safety). With little growth, Dynex found it difficult to continuously invest in R&D and develop new products, which became a vicious circle.

> 'So we [were] looking for a strategic investor who can help us connect to the market, provide additional technological support and provide the capital investment to invest in plant machinery and R&D' (Interview, Dynex's CEO).

3.3 Acquisition and post-acquisition integration

CSR China is one of the two main suppliers of China's railway equipment alongside its home rival CNR China. One of its subsidiaries, Times Electric, is a leading player in China in electric traction drive technology and used to proudly present itself as the driving force behind the production of the 'heart' of Chinese locomotives. However, it

was not able to design and manufacture its own IGBT modules and silicon chips – the 'heart' of electric traction drives – and had to rely on imports. This constrained not only Times Electric and CSR China's expansion in the railway industry, but also their more recent penetration into the urban transit, wind power and electric vehicle industries. CSR China and Times Electric have endeavoured to extend the application of their core technologies (in propulsion and controls) to develop products in these industries but once again IGBT and its modules are also widely used in these industries.

In 2007, CSR China and Times Electric initiated an '*acquisition – integration – innovation*' strategy in order to develop a core competence in IGBT technology. Once they learned that Dynex's owner wanted to sell the company, they acted quickly and bought a 75 per cent stake in 2008. Their strategic asset-seeking motive and the competence-creating mandate they assigned to Dynex is clear from, for example, the following comments of the president of CSR China after the completion of the acquisition:

> 'We expect Dynex to develop high power technology, R&D capability, and proven reliability and quality, thus to complement the rapidly growing manufacturing capability and power electric system know-how of Times Electric' (Dynex 2008).

Associated with this competence-creating mandate is the great operational autonomy that Dynex has enjoyed since the acquisition. In a recent interview with a Chinese newspaper, the CEO of Dynex greatly appreciated the fact that he is trusted by Zhuzhou CSR Times Electric to run Dynex as he sees fit.

> 'What surprised all of us is the high level of employee care. They genuinely want to make us a part of the company, so they try very hard to make sure they're always very thoughtful in dealing with the people here … *They give us a high degree of autonomy*, and they did not place a Chinese manager at the top after the acquisition' (China Daily 2013, emphasis added).

Indeed, among the eight board members after the acquisition, only four were from Times Electric, despite its majority stake in Dynex. Dynex kept its name and structure after the acquisition. The only senior manager in Dynex that CSR China and Times Electric parachuted in is the sales manager. This autonomy indeed encouraged Dynex to greatly expand its R&D team and improve its engineering skills, which has not only helped to quickly develop new sophisticated products, including the recent 3300v IGBT modules, but also led to significant advances in the fundamental research for thyristors and IGBT technology, which we discuss in more detail in the next section.

It is of course not CSR China and Times Electric's intention to develop Dynex as a separate entity and many integration mechanisms have been put in place since the acquisition. There is, for example, an R&D agreement between Dynex and Times Electric renewed every three years that steers the direction of Dynex's innovation activities. There has been regular staff/engineer exchange between the two sides working on specific projects (for example, when Times Electric arranged and completed field trails to ensure compliance of Dynex's high power IGBT modules with required standards

and therefore suitability for the Chinese railway market). In addition, every year CSR sends to the United Kingdom a team of about 30 managers for training (spending a few weeks in a British university, followed by another few weeks at Dynex). Moreover, there has been an effort to bring together both sides' technologies and know-how in order to develop new products. Dynex's CEO reflected that there has been a change in the balance of flow of knowledge: the initial few years were characterised predominantly by knowledge flow to its parent firm but more recently Dynex also started to learn from Times Electric:

> 'this relationship we have, the win-win, the *symbiotic relationship* between Dynex and our parent company [means] that the *information [know-how] is becoming more and more two directional*' [Dynex's CEO, emphasis added].

This symbiotic relationship has started to create a favourable mutual learning environment, so that both the parent and the subsidiary firm are learning from the other's expertise, as well as from third-party organisations, such as universities. What we have observed is the formation of 'recursive, multidirectional, mutual learning relations based in joint reflection and experimentation' (for example, Herrigel *et al.* 2013). Despite being in its early stages, this mutual learning has seen both companies working together, as well as with external institutions (such as UK universities) to produce a prototype of an electric vehicle model, diversifying into industries beyond railway equipment.

4. Upgrading in Dynex after the acquisition

One of the most significant effects of Times Electric's acquisition on Dynex is financial stability and key design know-how related to power converters and electronic design. The acquisition gave Dynex a much improved access to the Chinese market, which has been less affected by the financial crisis. With financial support from Times Electric and CSR China, Dynex built a new GBP 12 million R&D centre to develop IGBT technology. Times Electric also helped Dynex to secure financing to build two new IGBT fabrication lines with GBP 12 million investment, upgrading its production facilities. In addition, the parent company helped to acquire the freehold of land and buildings used by Dynex in Lincoln, giving it greater flexibility for future development of the operational facilities and reducing long-term overhead costs. All these have proved to be transformational for Dynex. The number of employees at Dynex has grown, from below 250 in 2008 to 315 in 2013. Its sales revenues have grown from USD 30.2 million in 2007 to USD 39.6 million in 2012, despite the unfavourable economic environment. Strong demand in China has seen the country's share of revenue increase from less than 10 per cent in 2007 to 38 per cent in 2012, while the share of Europe dropped from 68 per cent to 38 per cent in the same period.

Below we focus on further development or upgrading of Dynex's capabilities after the acquisition. For this purpose we adopt the 'upgrading' concept from global value chain studies and particularly from Humphrey and Schmitz (2002) and colleagues. They specify four types of upgrading: product upgrading, where firms move into

more sophisticated product lines increasing unit values; process upgrading, so that firms produce more efficiently by re-organising the production system or introducing superior technologies; functional upgrading, in which firms move up new functional areas in the value chain such as design or marketing; and inter-sector upgrading, which represents a horizontal move into new sectors with firms moving into new productive activities applying existing competences (Humphrey and Schmitz 2002; Giuliani *et al*. 2005). In this section we present evidence of upgrading in Dynex since the acquisition.

4.1 Process upgrading

Since the takeover in 2008, Dynex has been able to upgrade its production facilities with significant help and investment from Times Electric. Dynex installed a new 6-inch bipolar thyristor wafer fabrication line in 2009, which enabled it to produce high power thyristor products. These products are suitable for use in high voltage direct current (HVDC) converter valves, which are preferred for use in long-distance electric power transmission and for the interconnection of national grid networks (Dynex 2011).

In 2011 Dynex completed a GBP 12 million project to install two new 6-inch IGBT wafer fabrication production lines to upgrade and expand its fabrication facility for silicon chips to be used in IGBT modules. The new IGBT lines replaced its existing production line, which was originally set up over 20 years ago and processed 4-inch diameter silicon. With increased technological capabilities, they enabled Dynex to increase production capacity approximately tenfold, resulting in large volume chip manufacturing for the first time in the company's history.

4.2 Product upgrading

Product upgrading was also evident in Dynex. The 6-inch bipolar thyristor wafer fabrication line installed in 2009, for example, has helped the company to increase capacity and extend power rating of its i2 thyristor products, leading to the release of the larger 125mm 8.5kV HVDC thyristors. The extension of the i2 range of thyristors continued through 2011 with the development of a 150 mm thyristor, which will lead the company into a new generation of high performance products. With the new wafer fabrication facility, the improved thyristor technology and new purpose-built high voltage test centre, Dynex is well positioned to develop leading edge thyristor technology for many years to come (Dynex 2013).

During the second half of 2011, Times Electric transferred production of lower power (and therefore lower margin) bipolar products from Dynex to the parent company. This enabled Dynex to concentrate its bipolar business on the production of higher power, higher margin parts in future (Dynex 2012).

4.3 Functional upgrading

At first glance, functional upgrading seems impossible for Dynex as the company has already had a decent record in R&D and design and already performed functions such as marketing and designing before the acquisition. However, the takeover by Times Electric has also brought changes into how R&D is undertaken in Dynex. A detailed examination of the company's annual reports suggests that prior to the acquisition the company struggled to maintain strong and consistent investment in R&D. The takeover has seen not only the establishment of a brand-new R&D centre, but also significant and stable growth in R&D expenditure. The company spent 3.9 per cent of its revenue on R&D in 2009, but this had increased to 10.6 per cent by in 2012 (Dynex 2012, 2013). Since then the company has also expanded its R&D team, from 12 in 2008 to 40 in 2012.

The company's expanded R&D team has not only developed new sophisticated products such as the 3300v IGBT modules and prototypes of a 250 mm x 89 mm module but has also made significant advances in fundamental research on thyristors and IGBT technology for HVDC applications. Research is also being undertaken on new materials for power devices (Dynex 2013).

The investment in R&D not only helped the company to sustain and strengthen research and development activities, but also reflects the parent firm's ambition to develop Dynex into a world leading industrial high power semiconductor manufacturer. In a recent interview, the president and CEO of Dynex commented that Dynex is now able to compete on an equal footing with the world's top semiconductor makers, including Infineon of Germany, ABB of Switzerland and Mitsubishi of Japan (China Daily 2013).

4.4 Intersectoral upgrading

Historically Dynex's power modules mainly found application in the marine drive sector. The acquisition by Times Electric, however, has meant that Dynex is increasingly applying existing competences in new sectors. We reported earlier the staggering growth in the IGBT modules, which itself is a result of Dynex's shift to the railway industry. In 2011, the company successfully qualified and demonstrated, through field trials, the suitability of Dynex high power IGBT modules for use on China national locomotives and urban metro systems. This will open a massive market for the company to exploit for years to come.

The past few years have also seen the strategic focus of the company's R&D activity shift to develop new applications in low carbon sectors, such as railway transportation, renewable energy, smart grids and electric cars. For example, with the support of Times Electric, Dynex now plans to produce IGBT and diode processes and designs using the 8-inch silicon production base recently established in Times Electric. The intention is to increase capacity in order to service higher volume markets, such as electric vehicles, wind turbines and solar power systems (Dynex 2012).

5. Conclusion

Using a recent acquisition in the United Kingdom by a Chinese firm as a case study, this chapter aims to examine the impact of emerging-economy multinational enterprises on their newly-acquired subsidiaries in developed countries, particularly regarding the latter's capability upgrading. Our findings are to some extent counter-intuitive: despite the seemingly obvious knowledge-seeking motive of the acquisition and therefore the expected knowledge flow from the subsidiary to the parent firm, we observed multiple types of upgrading (product, process, functional and inter-sector) in the Chinese firm's newly-acquired subsidiary. One of our main messages is, therefore, that upgrading is not a phenomenon exclusive to developing countries when developed market firms invest in the former, as implied in many extant studies. As emerging-economy multinational enterprises become increasingly competitive and a major force in outward FDI in developed countries, it is important to consider the potential impact of emerging-economy multinational enterprises on the upgrading or '*redevelopment*' of some firms and industries in developed countries. We would therefore like to call for more studies of emerging-economy multinational enterprises as lead firms in global value chains and global production networks in order to understand their impact on host countries. We would also call on governments in developed countries to recognise this upgrading potential associated with investment from emerging economies, keeping in view the positive impact of emerging economy investment in developed markets.

Governments and the public in developed countries tend to view emerging-economy multinational enterprises, when they invest in developed countries, simply as finance providers with little to offer to the companies these firms acquire. Our analysis, however, demonstrates that their role could go well beyond that to also include knowledge provision (for example, when Times Electric transferred their knowledge of train traction systems to Dynex and helped the latter to develop and improve their IGBT modules for Chinese railways) and co-learning (for example, their joint experiments in the area of electric vehicles). It is therefore important, first, for governments and businesses in developed countries to appreciate the wider benefits of emerging-economy multinational enterprises' investments and, in particular, the potential depth and breadth of knowledge spillovers and mutual-learning opportunities. Our case study suggests that, in order to maximise these benefits, it is particularly important for the subsidiary to strike a good balance in its relations with the parent firm and develop a symbiotic relationship: on one hand the subsidiary should embrace the parent firm's integration and therefore market and technological development opportunities arising from the parent firm's strategies (leading to product, process and functional upgrading opportunities); on the other hand it is also important for the subsidiary to maintain a certain degree of autonomy so that it can keep exploring new technology frontiers and therefore further functional upgrading opportunities.

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