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Towards a New Wave in Internationalisation of Innovation? The Rise of China's Innovative MNEs, Strategic Coupling and Global Economic Organisation

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Abstract

This paper examines the changes in the internationalisation of innovation created by the recent surge of Chinese innovative firms and the resultant effects on global economic organisation. Drawing insights from the international business, economic geography and development studies literatures, it investigates the rise and internationalisation of Chinese innovative firms from the perspective of strategic coupling, decoupling and recoupling. This novel approach provides a first glimpse into the potential impact of the Chinese innovative firms on global business leadership, power relationships in global value chains and ultimately into global economic organisation.

Key words: emerging economy multinational enterprises, internationalisation of innovation, strategic coupling, global economic organisation, global value chains, China.

INTRODUCTION

A growing number of studies now regard China as having the potential to become a leading global power in R&D and innovation terms (*e.g.*, Shi et al., 2014; Sigurdson, 2005; Peerenboom, 2007), thus creating a growing challenge to Triad innovation hegemony driven by U.S., Europe and Japan. This trend is now beginning to be realised as evidenced by the increasing number of Chinese firms that are now becoming global innovation players in their own right, enabling them to challenge developed country multinational enterprises (DMNEs) for the leadership of global value chains (GVCs) and global markets (Henderson and Nadvi, 2011).

However, despite these indications that China is rapidly drawing closer to the heart of the world's technology and R&D networks (Von Zedtwitz, 2004; Walsh, 2007), there seems to be insufficient understanding of the nature of the new Chinese *démarche* in innovation and its consequent impact on global economic organisation. This apparent gap in the literature stirs us to investigate the nature and extent of the rise of innovative China-origin MNEs and their changing roles in global economic organization.

Despite the focus on Chinese firms, we would argue that the discussion is relevant to the wider debate on emerging economic multinational enterprises (EMNEs). Indeed, there is an agreement amongst scholars that the spread of global production networks (GPNs) (Henderson et al, 2002) has created new opportunities for EMNEs, facilitating the transfer of R&D and technological knowledge away from traditional Triad locations to leading new centres, particularly in the Asia Pacific Region (Bruche, 2009; WIPO; 2012). A number of scholars believe that this trend has been reinforced by a process of 'strategic coupling' between EMNEs and global lead firms, usually supported by national and regional governments (MacKinnon, 2012; Yeung, 2009), helping EMNEs to become significant participants in GVCs. However,

other scholars (such as Altenburg et al., 2008; Awate et al., 2012) seem to have doubt about the nature and significance of these trends and the innovation capabilities that rising EMNEs are developing. It is therefore not yet clear what kinds of ‘power’ these EMNEs will exert in the future global economy (Sinkovics et al., 2014; Yamin and Sinkovics, 2015), notwithstanding evidence to the effect that some EMNEs have already emerged as co-leaders of GVCs or strategic partners of lead firms (Azmeah and Nadvi, 2014; Gereffi, 2014; Choksy, 2015).

With these debates in mind, this paper studies the rise of innovative Chinese firms and seeks to gauge the resultant impact on global economic organisation, drawing on cognate academic literatures from international business, economic geography and economic development as a means to this end. Our analysis of Chinese innovative firms indicates that their rise and internationalisation is associated with a series of ‘strategic coupling, decoupling and recoupling’ (Coe et al., 2004; Horner, 2013) processes which have resulted in their accumulating significant innovation capabilities, enabling them to play an increasingly prominent role in GVCs. In addition, the rise and internationalisation of these Chinese innovative firms will create new strategic coupling, decoupling and recoupling opportunities for firms and regions at home and abroad.

The contributions that this paper makes are twofold. First, in a response to recent calls (Mudambi, 2015) for a dialogue between international business, economic geography and innovation, it explains the catch-up and internationalisation process of Chinese innovative firms from a unique lens of ‘strategic coupling’. Second, it contributes to the literature of international business, economic geography and developments studies by analysing the resultant changing position of Chinese firms in GVCs/GPNs and therefore in future global economic organisation. The ‘strategic coupling-decoupling-recoupling’ framework allows us to ‘zoom in’ in order to

focus on the catch-up and internationalisation process, but also to ‘zoom out’ in order to gauge the resultant change in global economic organization.

The article is organised as follows: first we provide a conceptual background to the inter-related phenomena of the internationalisation of innovation and the catch-up process of EMNEs, explaining the strategic coupling perspective. Thereafter, our methodological strategy and research context are presented. We then selected two potential Chinese innovative firms to analyse in detail their rise and internationalisation and the role of strategic coupling in these processes. We then discuss the resultant challenges to GVCs/GPNs and global economic organisation. Finally, the paper concludes with some suggested directions for future related research.

INTERNATIONALISATION OF INNOVATION, THE RISE OF EMNEs AND STRATEGIC COUPLING

Internationalisation of innovation and the role of emerging markets

There is a strong consensus amongst scholars that economic globalisation involves not only the internationalisation of production networks but also the internationalisation of R&D and technological innovation (Dunning and Lundan, 2009; Buckley and Ghauri, 2004; Huggins et al., 2007). MNEs make a major contribution to the internationalisation of innovation, by means of the internationalisation of corporate R&D, as well as by international cross-patenting, technological and scientific collaborations, and their exporting, international licensing and FDI activities (Narula and Zanfei, 2003; Lew and Liu, 2016). The internationalisation of innovation and the role played by MNEs in this process are, however, changing substantially over time (Howells, 1990; Matthews, 2006). A wave pattern has been followed, involving changes in the

location and characteristics of innovation activities, and the successive emergence of innovation-intensive MNEs based in the Triad regions and then emerging economies such as the BRIC countries.

Triad-based MNEs began the first wave (which continued from 1945 to the 1990s) by performing overseas R&D in a significant way (Reddy, 1997), and aggressively engaging in OFDI in order to keep the control of key technologies inside the firm (Buckley and Casson, 1976; 1999). Many of their direct investment activities took place predominantly within the Triad regions. The majority were initially linked to the adaptation of existing technologies, products and processes developed in home countries (Pearce, 1990), and to gaining entry and increasing their shares of foreign markets (Reddy, 1997). While this home-base-exploiting (HBE) R&D related investment still continued, the 1980s and 1990s witnessed the increasing development of home-base-augmenting (HBA) investment in Triad locations (Kuemmerle, 1999). Many MNEs therefore undertook knowledge-seeking R&D abroad with the aim of generating new knowledge and competencies of value to their global strategies and operations (Cantwell and Mudambi, 2005; Pearce, 1999).

While the first wave in the internationalisation of innovation was almost exclusively confined to Triad countries, the second wave (continuing from the late 1990s up to the present day) has seen the increasing location of Triad-controlled R&D in emerging economies (UNCTAD, 2005b). Several key factors have driven this trend, including the favourable inward investment policies pursued by many such countries (Lundin and Schwaag Serger, 2007); the growing need for technology transfer from the Triad to emerging market countries, which locally based R&D can facilitate (Walsh, 2007); the availability of large numbers of highly qualified and skilled, yet low cost scientific and engineering personnel that these countries offer (Von Zedwitz,

2004; Reddy, 1997; UNCTAD, 2005b); and their development of fast growing domestic markets for technologically advanced products contributed by local R&D centres (Bruche, 2009).

The growth of R&D related investment from Triad-based DMNEs into emerging market countries has gathered pace phenomenally over recent years, resulting in China and India, for example now becoming the world's leading destinations for such activities (OECD, 2006; UNCTAD, 2005a) and increasingly important locations for foreign corporate R&D (Bruche, 2009; Lundin and Schwaag Serger, 2007). Early R&D investment in these new host countries focused initially on 'adaptive R&D', involving the one-way transfer of technology from the Triad, facilitating the customisation of DMNEs' established products to meet local market needs (Krishna *et al.*, 2012). 'Global R&D centres' have, however, been increasingly established in China and India, with their mandates going beyond mere product adaptation to include developing new products for the global market (Lundin and Schwaag Serger, 2007; Walsh, 2007; Krishna *et al.*, 2012).

GVCs continue to be dominated by DMNEs, which have played the leading role in organising and controlling production and the diffusion of knowledge in most sectors, based on their superior, knowhow-related capabilities (Ernst and Kim, 2002; Ernst, 2009; Khan and Nicholson, 2015). However, the growing geographical dispersion of R&D has also created opportunities for latecomer firms from China and India to upgrade their knowhow-related capabilities and to gain access to new technologies via the insertion in Triad-led GVCs (Humphrey and Schmitz, 2002; Altenburg *et al.*, 2008). This has helped them to develop as innovators and MNEs in their own right (Yin and Williamson, 2011).

Strategic coupling and the rise of EMNEs

Associated with the increasing scholarly attention to EMNEs, there is also a growing concern that the traditional International Business (IB) framework, developed in the context of DMNEs' activities, may not be sufficient to explain the rise and internationalisation of EMNEs (Buckley and Ghauri, 2004; Mudambi, 2008). In particular, there is a growing recognition that scholars need to better understand the influence of 'location-specific assets' (Narula, 2012) on the development of EMNEs and this where IB can learn from cognate disciplines such as economic geography.

In the economic geography literature, the rapid rise of firms in emerging economies and East Asia in particular is understood in the wider context of regional development that is enabled by the insertion of local firms in GVCs/GPNs usually facilitated by developmental state institutions (Yueng, 2009). In particular, the continuing specialisation and 'fine-slicing' (Buckley, 2009) of value chain activities by global lead firms and the subsequent re-configuration of these activities in geographically dispersed locations have provided a window of opportunity for firms and regions in developing countries to plug themselves into GVCs/GPNs (Yueng, 2009; Schmitz and Strambach, 2009).

The concept of strategic coupling (Coe et al., 2004) was initially developed to bring together regional or territorial dynamics and the GVCs/GPNs dynamics in accounting for regional development (Yueng, 2014). The realignment of regional actors' interests, including those of local firms on one hand and global lead firms on the other can be beneficial to both parties by creating upgrading opportunities for the former but also helping global lead firms to maintain their competitiveness (ibid).

Focusing on the experience of East Asian countries, Yueng (2009), for example, identified three types of strategic coupling between lead firms in GPNs and local firms. Firstly,

there are international partnerships in Taiwan and Singapore where the region is directly articulated into critical GPNs with local firms serving as strategic partners of lead firms or lead firms having a direct presence through FDI. Secondly, there is the case of indigenous innovation led by national champions (such as Samsung and LG in South Korea) who have become lead firms in GPNs as a result of decades of national industrial policy, while undertaking strategic coupling with global lead firms via technology licensing and agreements. Thirdly, there are production platforms coordinated by global lead firms and their local strategic partners as seen in some high-growth regions in China, Thailand and Malaysia.

Other scholars have also tried to deepen the conceptualisation of strategic coupling by introducing ‘decoupling’ and ‘recoupling’ to reflect the dynamic two-way selection process by global lead firms and regions for investment and reinvestment (MacKinnon, 2012). Applying this framework, Horner (2013) illustrated the evolution of India’s pharmaceutical industry through a dynamic strategic coupling, decoupling and recoupling process over the last few decades. In particular, the government’s restriction of global lead firms’ dominance of the Indian market in the 1970s and 1980s represented a selective and short-term strategic decoupling process that helped to rebalance power relations between local firms and global lead firms and created opportunities for imitative learning and functional upgrading for the former. Subsequent recoupling has seen large Indian firms partnering with foreign MNEs and some of them have even established their own global production networks.

The usefulness of the ‘strategic coupling-decoupling-recoupling’ framework are twofold: firstly, it supplements the IB’s focus on firm-level strategies with the territorial dynamics. This means that firms can develop and enhance their competitive advantages by tapping into local knowledge base and coordinating knowledge across geographic space in their

internationalisation effort. Secondly, it builds a connection to the GVC/GPN dynamics which enables the possibility to examine the changing role of Chinese innovative firms in GVCs/GPNs and therefore the resultant change in global economic organisation. The application of the ‘strategic coupling-decoupling-recoupling’ framework therefore renders an examination of the rise of the internationalisation of EMNEs from a unique angle. The analysis of the resultant change in the evolution of GVCs/GPNs also enables a contribution to an area that receives little scholarly attention so far.

In the following sections, we endeavour to analyse the catch-up and internationalisation of Chinese innovative firms employing the ‘strategic coupling – decoupling – recoupling’ framework. We view these Chinese innovative firms’ recent R&D internationalisation as taking advantage of a recoupling mechanism. In addition, our focus is not only regarding the influence of GVCs/GPNs on the rise of the Chinese innovative firms, but also the impact of their rise and internationalisation on GVCs/GPNs.

RESEARCH CONTEXT AND STRATEGY

We began by identifying those Chinese firms which are now joining the world’s ‘league table’ of biggest R&D spenders, drawing our data from the EU's industrial R&D Investment Scoreboard, which contains information about the world's most active top R&D companies. Scrutiny of the EU's industrial R&D Investment Scoreboard reveals that a number of Chinese firms have recently been joining this elite list of global innovators; some have been ascending it at a remarkable rate over the last decade, indicating that they are investing increasingly heavily in R&D and innovation.. If we focus on the top 685 biggest R&D investing companies, only two Chinese oil companies, *PetroChina* and *China Petroleum & Chemical*, achieved inclusion in the Scoreboard

in 2003; however the number of Chinese listed firms has since jumped rapidly, reaching 16 in total in 2009 and 30 in 2013.

The majority of these 30 Chinese firms have quickly improved their positions in terms both of their overall rankings (based on the amount of R&D investment) in the Scoreboard (or their ‘global ranking’) and in their rankings against peers within their own sectors (their ‘sectoral ranking’). Further analysis was conducted to examine Chinese firms’ performance (in terms of global and sectoral ranking, R&D investment, its growth and intensity) against the relevant sectoral average – the average performance of Scoreboard firms in a given sector. This procedure helped to identify 19 leading Chinese R&D-active firms which clearly outperformed the sectoral average (see Table 1) and can therefore, on this basis be classified as rising ‘innovation stars’ (with a growing ability to challenge for the future global competitive leadership of their sectors). These firms include: *China Merchants Bank* (in the Banks sector), *China Railway*, *China Railway Construction*, *China State Construction Engineering*, *China Communication Construction*, *China National Chemical Engineering*, and *Power Construction Corporation of China* (in the Construction & Materials sector), *BYD* (in Electric & Electrical Equipment), *CSR China*, *China CNR*, *Shanghai Electric*, *Dongfang Electric* and *Sany Heavy Industry* (in Industrial Engineering), *HBIS* (in the Industrial Metals & Mining sector), *PetroChina* and *China Petroleum & Chemicals* (in the Oil and Gas Producers sector), *Huawei* and *ZTE* (in the Technology Hardware & Equipment sector), and *Ctrip* (in the Travel & Leisure sector).

Insert Table 1 here

In order to further explore their rise and ‘strategic coupling – decoupling –recoupling’ process, we then selected two of the leading firms from this pool, *Huawei* and *CSR China*, for further analysis. These two firms were selected because they are widely viewed and reported as

representatives of Chinese innovative firms both inside and outside of China (Fan, 2011; McKinsey, 2015). Both firms have significant overseas investment and engage in R&D activities overseas. They were therefore well suited to illustrate the rise of Chinese innovative firms and the impact of their internationalisation.

The data that we used were collected from publicly available secondary sources including previous academic research, books, company documentation as well as media reports in both English and Chinese. We followed standard procedures for qualitative data analysis (Eisenhardt and Graebner, 2007; Miles and Huberman, 1994) with the aim to enhance the ‘trustworthiness’ of the research (Sinkovics et al., 2008).

HUAWEI AND CSR CHINA: STRATEGIC COUPLING, DECOUPLING AND RECOUPLING

Huawei

Huawei was founded in 1988 with 21,000 Yuan (then equivalent to \$US 4,400). The company has quickly emerged to become a leading global telecom solutions provider with annual sales of US \$60.8 billion in 2015. Over recent years, the company has become one of the world’s top patent applicants under the global Patent Cooperation Treaty (PCT) (WIPO, 2012). Its innovations include the ‘Distributed Base Station’ which was considered a major breakthrough in 3G network construction as it provided telecommunication operators multiple benefits of space saving, site flexibility, high-bandwidth and low installation and operational costs. Huawei also pioneered the development of reconfigurable base-stations with the ability to support different mobile-network technologies or multiple technologies simultaneously (The Economist, 2010). The company is now at the forefront of long-term evolution (LTE) development (the standard for fourth-generation

(4G) wireless networks), based on its leadership of related technologies, and its understanding of customers' needs, enabling it to win nearly half of world's commercial LTE deployment contracts by 2011 (Huawei, 2013). It is also leading 5G development having launched the world's first multi-user 5G testing site in Chengdu, China in 2015.

Early technological development and strategic coupling

Huawei's first business was reselling telephone switchboards (private branch exchange, PBX) imported from Hong Kong. However its senior management team had a clear ambition for R&D and in 1990 it developed its own PBX switching gear led by its in-house R&D team, imitating existing products already available on the market (Zhang, 2009). Collaborating with Chinese universities and recruiting domestic talents, *Huawei* then made a major breakthrough by introducing a digital telephone switch called C&CO8 in 1993. This represented the highest capacity at the time for a device of its type manufactured in China and paved the way for its dissemination throughout China's national telephony infrastructure (IET, 2007). Realising its disadvantages in technology and brand recognition, *Huawei* engaged in a 'encircling the cities from the countryside' strategy, choosing to focus firstly on the rural market before gradually entering urban markets then dominated by foreign multinationals (Zhang, 2009).

Having strengthened its in-house innovation capability, *Huawei* also started to collaborate with global leaders (such as Texas Instruments, Motorola, IBM, Intel and Sun) operating in China in order to access more advanced telecom technology (Fan, 2006; Fan, 2011). This collaboration (which usually took the form of either joint ventures or joint laboratories (Fan, 2006; Zhang, 2009) further enhanced *Huawei's* technological capability, and also helped to shape its commitment to international collaboration and open innovation.

In the meantime, *Huawei* initiated its internationalisation campaign (following an overseas version of its ‘encircling the cities from the countryside’ strategy (Zhu, 2008)). It firstly entered neighbouring Hong Kong, followed in turn by Russia, South America and South East Asia and then developed markets. The major breakthrough was made in 2005 when *Huawei* was selected by BT as one of the eight preferred suppliers of its 21st Century Network. This announced the arrival of *Huawei* into the developed markets. A year later the company obtained a framework contract for mobile softswitching from Vodafone for its various European, Middle Eastern and African (IET, 2007), followed by many other similar contract thereafter across the world.

Decoupling

North America represents the world’s largest telecom market and therefore *Huawei* attached considerable importance to entering and developing it. However, this turned out to be a difficult challenge for *Huawei*. The first blow arrived in 2003 when Cisco Systems accused *Huawei* of patent infringement. Although Cisco later withdrew the lawsuit and both companies resolved all patent litigation, *Huawei* had to compromise by withdrawing all of its products from the U.S. market (Zhu, 2008). *Huawei* tried again by establishing a joint venture with 3COM, but its later acquisition proposal for this company (in 2007) was rejected by the U.S. Committee on Foreign Investment (CFIUS) on the grounds of alleged national security concerns. Despite that *Huawei* promised to open source code to public scrutiny, the same national security concerns blocked its later bid for the Sprint supply contract in 2010 and its proposed \$200 million acquisition of 3Leaf in 2011. In 2012 the U.S. House intelligence-committee report alleged that equipment produced by *Huawei* and its home rival *ZTE*, when employed by U.S. companies, could become a vehicle for Chinese spying in the U.S. which could therefore pose risks to national security. These cases all

indicated that *Huawei* was not welcomed by the U.S. authorities, with the result that it was forced, albeit reluctantly, to focus instead on other markets.

Recoupling

Huawei's recoupling happened in various ways. Firstly, there was a refocus away from U.S. to Europe, China and other markets. In 2013, for example, *Huawei* pledged to invest £1.3 billion in the UK over five years (one of China's largest investments in Europe), symbolising the growing strategic importance of Europe - and its status as a source of technological innovation – to the company following its disengagement from the U.S.. Secondly, *Huawei* has established a significant global innovation network by setting up dedicated R&D centres overseas in addition to the domestic ones. For example, *Huawei* established its first overseas centre in Bangalore, India in 1999 and it now has a total of 22 overseas R&D centres (located in Europe, North America, Asia Pacific and South Africa). The company also operates 36 joint innovation centres across the world.

Thirdly, there has been significant build-up of its capability in the smart mobile phone market. *Huawei's* traditional core business is to supply equipment to telecom operators, the so called 'carrier business'. Efforts have also been made to strengthen its 'enterprise business' – business that provides solutions for business customers. However, the most impressive change in its business relates to the smart phone market. In about a decade's time, *Huawei* has emerged from a small volume, lower-end producer to become in 2015 the world's third largest smart phone producer, closing the gap with leading companies, Apple and Samsung. Unlike most other smart phone producers from emerging economies, *Huawei* has also been able to gain a strong foothold in the lucrative higher-end market for smart phones, relying on its in-house developed chips to support this initiative.

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 high-speed railway network, producing EMUs that ran at a speed of 350 km/ hour. In December 2010, its CRH380A EMU set a world record of 486.1 km/hour in trial operation (Chuang and Johnson, 2011), powered by an EMU convertor with the highest powered single unit in the world.

Early technological development and strategic coupling

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 efforts. In the 1990s and early 2000s, China upgraded its existing railway lines several times, boosting the national average passenger train speed from under 50km/h to nearly 70km/h, with a highest speed of 200km/h being achieved on limited rail lines. The Chinese government believed, however, that the country had reached a limit in upgrading its existing railways and that the construction of a high-speed railway was thus urgently needed. Working with a number of other firms and research institutions with coordination by the then-Ministry of Railway (MOR), *CSR China* managed to design and manufacture China's own high-speed train - the 'China Star' – that set a record of 321km/h (New Financial Observer, 2011). But this

indigenous innovation was quickly called to an end as the MOR turned its eyes to foreign technology.

Following an ‘import, assimilate and re-innovation’ strategy regarding technological development, the MOR solicited bids from China-foreign business partnerships to make high-speed train sets that could travel at 200-250 km/h with specific requirement for technological transfer to Chinese companies. Japan’s Kawasaki Heavy Industries and Canada’s Bombardier both won contracts through their respective partnerships with *CSR China*’s subsidiary Qingdao Sifang. Siemens and Alstom also won similar deals collaborating with *CSR China*’s home rival, CNR China.

The new access to foreign technologies significantly enhanced *CSR China*’s technological development in high-speed trains. Foreign firms helped set up production facilities in China, trained Chinese engineers and assisted *CSR China* in developing its own supply chain for train components. *CSR China* 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).

Decoupling

In a sense decoupling for CSR China already started when foreign giants won their contracts. Foreign firms’ supply contracts with the MOR meant that, initially a limited number of high-speed train sets were directly exported to China, while later on a small number were kits assembled in the country. Subsequent train sets were made in China using transferred technology with domestic and imported parts.

Having the determination to design, engineer and manufacture China's own high-speed train sets for future generations, the MOR, together with the country's Ministry of Science and Technology, coordinated an army of firms, research institutions and engineers from across the country to facilitate the assimilation of foreign technologies and further technology development. Dedicated efforts were made to improve the entire Chinese high-speed railway system including the aerodynamics of high-speed train sets, signalling and control sub-systems, safety mechanisms, propulsion sub-systems and environmental impacts.

What happened subsequently is very impressive: within a few years, *CSR China* was able itself to design, engineer and produce EMUs that ran at a speed of 350 km/ hour. In December 2010, its CRH380A EMU set a world record of 486.1 km/hour in trial operation. Whilst the achievement can clearly be ascribed to the adaptation and development of imported technologies, it also depended for its success on the company's existing technologies and strong absorptive capabilities. 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. Such was the speed of *CSR China's* innovation and that of *CNR China* that when the 1300km Beijing-Shanghai high-speed rail line became operational in 2011, all of the necessary high-speed train sets were supplied by these two firms. China then went on to construct a high speed rail network with over 19,000 km of track in service as of January 2016 (which is more than the rest of the world combined).

Recoupling

Having confidence in its own technologies, *CSR China* felt the need to conquer foreign markets as a way of recoupling with GPNs 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- \$US1bn 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% from \$US0.89 bn to \$US3.7 bn (Science and Technology Daily, 2015).

In order to further strengthen its technological development and support its international expansion, *CSR China* has also made significant efforts to develop its R&D internationalisation. These included its acquisition of the semiconductor producer Dynex in Lincoln, UK (in 2008) providing it with access to technological know-how in terms of insulated-gate bipolar transistors (IGBT) - a core component that represents the 'heart' of the propulsion and control system of high-speed railways. In 2011, *CSR China* went on to establish a global innovation centre at Dynex. The company has also established joint innovation centres in America and Germany in recent years. Other recent overseas expansion included its takeover of Emprendimientos Ferroviarios in Argentina and Boge in Germany in 2014 as well as E+M in Germany and SMD in the UK in 2015.

Lessons from the illustrative Cases

Both of the illustrative cases above indicate that the rise and internationalisation of Chinese innovative firms is facilitated by the increasing fragmentation and geographical dispersion of

global innovation networks, which is creating considerable opportunities for latecomers in China and other emerging market countries to upgrade their know-how related capabilities and gain access to new technologies (Humphrey and Schmitz, 2002). This is being matched and complemented by the significant in-house investments that many are currently making in innovation (Fu and Gong, 2011).

Many of these rising giants are engaging increasingly in overseas R&D activities as a way of recoupling with GPNs. Apart from *Huawei* and *CSR China*, many other such firms have also established overseas R&D centres in recent years. According to a recent multi-agency research study (Veldhoen et al., 2012) more than 70 of the 100 surveyed Chinese companies plan to expand their overseas R&D facilities by the early 2020s. If this occurs, then the R&D internationalisation of leading Chinese innovative firms will be intensified in the near future, thus promoting the continued rise of the Chinese innovative firms and their strategic recoupling.

DISCUSSION

Reconfiguration of global business leadership

Looking at the issue of global industry leadership, it can be seen from our illustrative examples that the Chinese innovative firms' challenge is already well advanced in some sectors, including wireless equipment, which has been dominated until recently by DMNEs (Boston Consulting Group, 2011). This position is now changing, however since, for example *Huawei* has risen from 5th to 2nd place in this sector in overall revenue terms, whilst its Chinese rival *ZTE's* revenues have also climbed from 8th to 4th place (*ibid*). The resultant competitive pressure on their DMNE rivals continues to grow, which can be seen as being largely responsible for a global consolidation across the telecoms equipment industry involving mergers between *Alcatel* and

Lucent in 2006, and between the network-equipment arms of *Nokia* and *Siemens* in the same year, together with the collapse of *Nortel* in 2009 (The Economist, 2009).

CSR China and *CNR China* merged in 2015 before when they had already become the two biggest railway equipment suppliers in the world. The rise of new Chinese innovative firms has also made a big impact on the configuration of the global construction equipment industry. According to the annual Yellow Table survey by KHL Group (which ranks the world's largest construction equipment manufacturers), Chinese firms have seen their share of the global top 50's revenues continuously climbing over the last few years. Over just one decade, Chinese firms saw a dramatic increase in their share of these revenues from a mere 1.6% in 2002 to 16.9% in 2011 (KHLGroup, 2012) whilst *Sany* and *Zoomline* have grown from nowhere to become the world's 5th and 6th biggest in their sector by sales revenue in 2012.

Similar changes are arguably under way in other sectors, where, for example China's *Haier* is now the world's largest household appliances manufacturer whilst *Lenovo* is its largest PC maker. One of the most dramatic changes happened in the wind turbine sector, in which no Chinese firm had made its way into the top 10 in 2005, but then four did so in the 2010 rankings, occupying 2nd, 4th, 7th, and 10th places respectively (Lema et al., 2013).

Our analysis indicates that the rise of some of Chinese MNEs have reached such a stage that many of them have upgraded their positions in GVCs/GPNs. This resonates some recent studies (for example, Horner, 2013; Lema et al., 2013; Yueng, 2014) arguing the emergence of EMNEs as global lead firms.

Emergence of a new breed of GVCs/GPNs

Despite increasing fragmentation and geographical dispersion (Humphrey and Schmitz, 2002), most GVCs/GPNs are currently still dominated by DMNEs. They play the leading role in organising and controlling production and the creation and diffusion of knowledge in most sectors, based on their superior, knowhow-related capabilities (Ernst and Kim, 2002; Ernst, 2009; Schmitz and Strambach, 2009; Khan and Nicholson, 2015). However, the rise of the new global innovative firms in China (and in other emerging economies) indicates that this state of affairs is now changing.

The emergence of China's innovative firms, their surging overseas R&D investment, and the resultant, on-going reconfiguration of global industrial leadership beg the question as to whether we are witnessing the creation of reconfigured GVCs/GPNs that may be largely dominated and controlled by some of leading Chinese MNEs. These leading Chinese MNEs, including *Lenovo*, *Huawei* and *Haier*, are now becoming GVC 'flagship firms' in their own right, allowing them to enhance their ability to challenge the leadership of their DMNE rivals (Altenburg et al., 2008; Ernst, 2009).

Indeed, recent research indicates that Chinese MNEs are likely to acquire coordinating power within a number of GVCs (Lema et al., 2013). We suspect, if this is so, that the rise of the Chinese MNEs as lead firms may result in new power relationships within GVCs/GPNs. In existing 'orthodox' GVCs, leading DMNEs set the terms under which other member firms operate, by exercising varying degrees of coordinating power over them (Schmitz and Strambach, 2009). They tend, however, to retain strategic innovation activities in-house, although dispersing non-core activities amongst other companies (ibid). China's emerging lead firms, despite their significant build-up of innovation capability (Zeng and Williamson, 2007), may still lack the ability to create cutting-edge innovations (Altenburg et al., 2008; Awate et al.,

2012) and may not fully own and control strategic innovation. This suggests that new power relationships may well develop within these value chains, involving a hitherto unprecedented separation of control of technology from value chain coordination. Thus the new power relationships within GVCs/GPNs that Chinese firms could lead are therefore likely to be very different from those that currently exist, in which DMNEs enjoy control of technology and coordination of GVCs at the same time.

New opportunities for strategic coupling, decoupling and recoupling

As illustrated by the cases of *Huawei* and *CSR China*, there has also been some decoupling and recoupling associated with the rise of the Chinese innovative firms. In particular, many of them are in the process of building their own global innovation and production networks (similar to the Indian pharmaceutical giants described in Horner (2013), including setting up R&D centres in developed countries. This recoupling has acted as a significant source of opportunities for Chinese firms to learn about advanced technologies and access strategic innovation that are unlikely to be available by purely importing foreign technologies.

Interestingly, the rise and internationalisation of EMNEs from China (and other emerging economies) are likely also to generate new ‘strategic coupling, decoupling and recoupling’ opportunities for firms and regions in developed countries. Their innovation capabilities (Williamson, 2015) and unique understanding of the bottom of the customer pyramid markets (Govindarajan and Ramamurti, 2011), for example, offer potential learning opportunities for developed country firms. DMNEs can learn about ‘new business models, management practices, or technologies from local competitors, suppliers and customers in emerging markets’ (Immelt et al., 2009; Govindarajan and Ramamurti, 2011) following a process of ‘reverse innovation’,

whereby ideas first take shape in emerging economies before trickling-up to the developed world (Immelt et al., 2009). At the same time, DMNEs can also learn from EMNEs with which they come into contact through the latter's investment in developed countries (He and Khan, 2015). A study of Chinese acquisition in Germany (Knoerich, 2010), for instance, demonstrated how an acquisition helped a German firm to access to the Chinese market, enabling it to learn how to compete in previously inaccessible market segments. Another recent study (Pietrobelli et al., 2011) showed how, by investment in Italy, Chinese firms provide their Italian and European partners with entry to geographically wide sales networks, and direct access to the huge and rapidly expanding Asian market.

With the continuing rise of Chinese innovative firms (and those from other emerging economies) it is not unreasonable to expect that many of them will become 'global pipelines' (Bathelt et al., 2004) serving firms and regions based in other parts of the world. Firstly and as we argued above, their increasingly significant innovation capabilities are based on a superior understanding of bottom of the customer pyramid markets (Govindarajan and Ramamurti, 2011). This often requires the rethinking of complete production processes and business models, necessitating the exercise of distinctive management and organisational skills (Prahalad and Mashelkar, 2010; Yin and Williamson, 2011). This creation of new ideas will therefore represent a new source of knowledge for other firms and regions. Secondly, the rise of new end markets in the global South (Kaplinsky et al., 2011) provide new coupling and recoupling opportunities (Horner, 2013). EMNEs (including those from China) are based in these markets, and are thus in a unique position to help firms and regions in other parts of the world to connect to the expansive market in the Global South (He and Khan, 2015; Knoerich, 2010; Pietrobelli et al., 2011).

Towards a new wave in internationalisation of innovation

The trends discussed in this paper may herald the beginning of a third wave in the internationalisation of innovation necessitating a fresh scholarly debate on the role of EMNEs in global economic organisation. A comparison between this new and previous waves is illustrated in Table 2.

Insert Table 2 here

The new third wave is, arguably different from the previous two owing to the different role that is now being played by emerging economies and EMNEs including those from China. Unlike the situation in the past (Bruche, 2009), where innovation- related FDI increasingly went from developed to developed, or to leading emerging market economies, we believe that the third wave will be characterised by a re-direction of FDI from emerging markets back towards advanced economies (Buckley et al., 2007; Di Minin et al., 2012). Although some of the resultant R&D investments will reflect a HBE motive (Di Minin et al., 2012), most will perhaps prove to be HBA related because of the fact that EMNEs do not control strategic innovation yet (Altenburg et al., 2008; Awate et al., 2012). Nevertheless, these firms' R&D internationalisation will not only represent a recoupling for themselves, but will also create coupling and recoupling opportunities for firms and regions at home and abroad.

We consider that the upgrading of EMNEs' positions in GVCs, bearing the responsibility for their control and coordination is also an unprecedented development in recent times. This begs the intriguing question of who will own what levels of power in tomorrow's GVCs. In terms of the control of GVCs, Table 2 shows that, the third wave in the internationalisation of innovation is likely to see a departure from the established *status quo* (in which DMNEs that coordinate

GVCs also own and control relevant strategic innovations and core technologies). A distributed control structure may, in fact emerge as some of the new EMNEs begin to coordinate GVCs, whilst strategic innovation remains under the control of DMNEs.

Taking the above issues into account, we would contend that this third wave in internationalisation of innovation signifies a significant change of direction for global economic organisation. Neilson et al. (2014:1-2) recently argued that..., “*a key feature of global economic organisation presented in the discussion of GVCs and GPNs is the progressive outsourcing by lead firms in developed countries of their peripheral, and frequently low-value, productive functions to low-cost countries and regions, while maintaining control of core nodes of value creation and retention in their home countries*”. This view is however already being challenged by the new geography of innovation thesis (Bruche, 2009) which argues that DMNEs have also started to outsource some core and high-value innovation functions to the ‘peripheral’ countries and regions. We contend that the third wave in international of innovation will take the organisation of the global economy into an even newer phase as some EMNEs start to assume a coordination role in some GVCs, allowing them to have a bigger say in the future scale and location of value creation, enhancement and retention.

CONCLUSION

In this paper we have examined the rise of Chinese innovative firms and its impact on global economic organisation. Our analysis has indicated that their rise has featured a series of ‘strategic coupling, decoupling and recoupling’ processes. In addition, associated with their rise is the upgrading of their positions in GVCs/GPNs which represents a significant change in global

economic organisation. Although our focus has been on Chinese firms, readers may find resonance for our findings and arguments in the case of non-Chinese EMNEs.

Our contribution has been enabled by the use of inter-disciplinary, cognate literature from the international business, economic geography and development studies fields. In particular, we have contributed to the literature by examining the rise of Chinese innovative firms from the unique perspective of strategic coupling. We have also contributed to the debate on ‘rising power firms’ (Sinkovics et al., 2014; Yamin and Sinkovics, 2015) by our detailed examination of the potential impact of Chinese innovative firms’ emergence on GVCs/GPNs and therefore on global economic organisation. Moreover, the application of the strategic coupling perspective at the micro-level firm-strategies supplements the extant studies in economic geography which tend to focus on the industry (for example, Horner, 2013) or regional level (for example, Yueng, 2014).

Our analysis suggests that it is perhaps naive to view Chinese firms and EMNEs in general as being mere ‘copycats’ since many of their innovations require the rethinking of complete production processes and business models, while also necessitating the practice of unique management and organisational skills (Prahalad and Mashelkar, 2010; Yin and Williamson, 2011). It is important for established DMNEs to recognise this as EMNEs are continuously disrupting global competition in their markets (Sinkovics et al., 2014). It is equally important for firms and regions around the world to realise the ‘recoupling’ opportunities that the internationalisation of EMNEs may bring.

Of course it is difficult to generalise our findings to the entire population of EMNEs or Chinese firms as our focus is on the leading Chinese innovative firms and we only selected two of them here for more detailed analysis. Nevertheless, our investigation suggests that an

important change is taking place in international business and global economic organisation. We believe that there is an urgent need to develop a stronger understanding of the implications of this change (Sinkovics et al., 2014; Yamin and Sinkovics, 2015). Below we outline a few lines for future enquiries.

First, there is a need to study, perhaps using more quantitative approaches, the wider population of Chinese firms and EMNEs in general to establish more firmly the extent of the rise that is taking place in the accumulation of their innovation capabilities and their global business power. Second, we believe that future researchers could usefully examine the recoupling opportunities associated with internationalisation of EMNEs for firms, clusters and regions in both emerging and developed economies. Gereffi (2014) and Kaplinsky et al. (2011) have recently called for the examination of the role of emerging economies as new sources of demand and production competencies in the post-Washington consensus global economy. In the light of the emergence of the new wave in the internationalisation of innovation, we would extend their call to include also the examination of leading EMNEs as sources of knowledge and learning. Last but not the least, the rise of leading EMNEs is likely to result in a separation of the coordination of GVCs from the ownership of strategic innovations, resulting in the emergence of different power relations from the ones we observe in traditional, DMNE-dominant GVCs. It would be of interest to investigate the resultant impact on value creation, enhancement and capture.

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TABLES

Table 1: Leading Chinese innovative firms

<i>Industry</i> Company	Scoreboard ranking 2013		R&D investment 2013		R&D intensity 2013(%)
	Global ranking	Sectoral ranking	€m	R&D 3 years growth (CAGR-3y, %)	
<i>Banks (29 companies in the Scoreboard)</i>					
China Merchants Bank	251	9	379.5	26.8 (one year)	2.4
Sectoral average	-	-	281.6	8.4	2.0
<i>Construction & Materials (72 companies in the Scoreboard)</i>					
China Railway	103	1	1011.9	59.8	1.6
China Railway Construction	121	2	912.4	-6.5	1.4
China State Construction Engineering	163	3	650.6	n.a	0.8
China Communications Construction	242	5	401.7	29	1
China National Chemical Engineering	514	11	149.3	79.1	2.1
Power Construction Corporation of China	553	12	138.1	24.3	0.8
Sectoral average	-	-	100.9	5.2	1.0
<i>Electronic & Electrical Equipment (242 companies in the Scoreboard)</i>					
BYD	302	23	298.4	12.2	5.0
Sectoral average	-	-	170.8	5.4	4.3
<i>Industrial Engineering (212 companies in the Scoreboard)</i>					
CSR China	225	11	431	14	3.8
China CNR	277	13	335.7	16.3	3.0
Shanghai Electric	367	21	233.1	9.4	2.5
Dongfang Electric	505	34	151.2	9.2	3.0
Sany Heavy Industry	599	37	127.1	15.2	3.0
Sectoral average	-	-	110.9	7.9	2.8
<i>Industrial Metals & Mining (41 companies in the Scoreboard)</i>					

HBIS	396	5	211.2	18.4	1.7
Sectoral average	-	-	87.5	n.a	0.8
<i>Oil & Gas Producers (27 companies in the Scoreboard)</i>					
PetroChina	64	1	1682.2	6.1	0.6
China Petroleum & Chemicals	151	6	752.7	7.7	0.2
Sectoral average	-	-	353.7	6.0	0.3
<i>Technology Hardware & Equipment (334 companies in the Scoreboard)</i>					
Huawei	26	4	3589.3	23.7	25.6
ZTE	105	17	999.9	5.9	11.2
Sectoral average	-	-	259.2	-1.8	8.0
<i>Travel & Leisure (24 companies in the Scoreboard)</i>					
Ctrip	516	3	148.0	40.0	23.1
Sectoral average	-	-	90.7	n.a	1.59

Source: EU Industrial R&D Investment Scoreboard (2004-2014), authors' calculation.

Note: The sectoral average of R&D 3 year growth is proxied by that of the 633 EU companies included in the 2013 Scoreboard; R&D intensity is the ratio between R&D investment and net sales of a given company or group of companies

Table 2: Different waves in internationalisation of innovation

1st wave <i>Post-war up to 1990s</i>	2nd wave: new geography of innovation <i>Late 1990s up to present</i>	3rd wave: internationalisation of innovation <i>From mid-2000s</i>
<i>Cross-country R&D investment</i>		
Between Triad countries (Reddy, 1997)	Still dominated by between-Triad investment, but also distinctive investment from developed countries to leading developing countries (Bruche, 2009; UNCTAD, 2005b)	Surging investment from leading developing/emerging countries to developed countries (Buckley et al., 2007; Di Minin et al., 2012)
<i>Nature of overseas innovation activities</i>		
Initially home-base exploiting but later to include home-base augmenting (Kuemmerle, 1999; Pearce, 1990)	Predominantly adaptive R&D in developing countries, but more recently also global R&D centres (Krishna et al., 2012; Lundin and Schwaag Serger, 2007; OECD, 2006)	EMNEs' investment in developed countries featured predominantly with home-base augmenting activities (Luo and Tung, 2007; Mathews 2006)
<i>Control of GVCs</i>		
DMNEs dominated	DMNEs dominated, subordinate role for EMNEs (Yueng, 2009; Schmitz and Strambach, 2009)	Distributed control: EMNEs start to take the coordination role, but DMNEs continue to control strategic innovation (Awate et al., 2012; Lema et al., 2013; Altenburg et al., 2008)
<i>Strategic coupling and recoupling</i>		
Between Triad countries	Strategic coupling opportunities for firms and regions in emerging economies (Yueng, 2009, 2014; Horner, 2013)	Recoupling opportunities created by EMNEs for firms and regions in both emerging economies and developed economies (He and Khan, 2015; Knoerich, 2010; Pietrobelli et al., 2011).

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