

**From Innovation *to* Emerging Economies to Innovation *from* Emerging Economies:
The Historical Evolution of A Global Pharmaceutical Corporation in China (1993 - 2014)**

Abstract: The internationalisation of firms is increasingly concerned with locating innovation activities in the most appropriate locations, particularly for more strategic research and development projects. This paper reviews the historical development of AstraZeneca (AZ) in China since the 1990s and the recent establishment of one of its key global innovation centres in the country. The case confirms a newly emerged development in the internationalisation of innovation and knowledge sourcing by MNEs from advanced economies to emerging countries – the ‘South’ originated waves. A review of previous and recent literature reveals the growing trend towards ‘unconventional’ knowledge-seeking strategy of MNEs. This paper refines and extends current research on global innovation strategy by providing a contextually-rich and analytical narrative of a longitudinal case study. We identified and explained a historical pattern of evolution of AZ’s operation in China from innovation to the country to innovation from the country. This paper concludes with recommendations and limitations.

Keywords: Internationalization, Emerging Economy, Innovation, Knowledge Seeking.

1. Introduction

The internationalisation of firm has been a major topic in international business studies. The well-established internationalisation theories (Johanson and Vahlne 1977, Kogut and Singh 1988, Xu and Shenkar 2002) argue that multinational enterprises (MNEs) usually start expanding in neighbouring countries with similar business systems, or countries with similar cultures, then gradually move to some less-advanced economies (Vernon 1966).

Departing from Vernon's product cycle (Vernon 1966) where innovation was analysed as a centralised activity normally located at the home country of the MNE, Ronstadt's (1977) seminal work provided evidence of a different strategy to innovation i.e., that of decentralisation where MNEs, through a network of overseas R&D units, adapted and generated existing or new knowledge respectively. By moving innovation to strategically important locations which were either geographically-close or contextually-similar countries, MNEs can have close control over key activities whilst benefiting from locational advantages (Porter 1989, Dunning 2000, Johansson and Vahlne 1977, 2009). This knowledge sourcing activity is viewed as the 'North-North' development. In this context the extant literature focuses on the varied roles of R&D units which in turn is closely associated with the differentiated roles of MNEs' subsidiaries (Cantwell and Mudambi 2005, Pearce 1999, Ronstadt 1978) resulting in a mixture of Global Innovation Strategies (GIS) pursued by MNEs. The core assumption of MNEs' GIS is evolving around a North-North and North-South paradigm where the South, being emerging economies, were viewed at best as augmenters of existing MNE knowledge which in turn was developed within a North-North nexus of countries (Pearce and Papanastassiou 1997; Papanastassiou and Pearce 2009; Jha et al. 2015).

Challenging the dominance of this traditional paradigm, a rather different phenomenon has emerged in recent years, which is the increasingly apparent trend of the internationalisation of innovation to dissimilar and distant less-advanced or emerging countries (Altenburg et al 2008; Haakonsson and Ujjual 2014; Haour and Jolly 2014). A recent World Investment Report (2005) published by United Nations Conference on Trade and Development provides statistics which indicate a significant growing number of R&D units in emerging economies. Similarly, McKinsey in its 2011 survey confirms the growth of overseas MNE R&D units in emerging economies (McKinsey, 2011). What makes this phenomenon intriguing is that a quite large number of these overseas R&D units depart from traditional technology adaptation roles and evolve into generators of new knowledge, a role that so far has been considered to be restricted to, as discussed above, a handful of North i.e., developed economies. This invites debate on whether and how MNEs source knowledge from emerging economies, i.e., the South-North trend. Whilst there has been an increasing number of research exploring this new trend (e.g. Altenburg et al 2008, Aubert, 2004, Balachandra 2006, Haakonsson and Ujjual 2014, Haour and Jolly 2014, and Li and Yue 2005), yet, detailed research remains scarce to date.

Hence, the purpose of this paper is to contribute to the understanding of the internationalisation of innovation by advance-economy MNEs in emerging economies. More specifically, it attempts to take a historical case-study approach to review, describe, and analyse the development of innovation activities undertaken by AZ in China over the last two decades. Whilst the majority of the advance-economy MNEs have had a long tradition of maintaining close control of critical innovation activities by locating in close-by or similar markets, e.g., economically developed, politically stable, and legally protected (Porter 1989, Dunning 2000, Johansson and Vahlne 1977, 2009), the new phenomenon and the case of AZ in China strongly 'contradict' with the long-established

norm. Against this background, the paper aims to address a number of key research questions: *What is the evolutionary process of AZ's R&D activities in China? Whether and how can existing theories explain the case of AZ in China? What are the practical lessons which can be learned from the case of AZ in China for others?* In doing so, this paper aims to make a number of important and timely contributions. First, it intends to challenge the conventional wisdom of innovation internationalisation in existing literature and empirically investigate the growing trend of emerging economies in offering knowledge sourcing opportunities for MNEs, including those embodied in new products aimed at the global markets. Second, this study aims to make an empirical contribution by investigating the potential evolutionary pattern of knowledge sourcing in the country by MNEs originated from advanced economies. While the waves of internationalisation of innovation, which can be modelled as 'North to North' (wave 1) and 'North to South' (wave 2), have been the more accepted developments in existing literature, it is argued that there has been a gradual shift towards 'South to South' (wave 3) and 'South to North' (wave 4), with the fourth one being the most recent (Altenburg et al 2008, Aubert, 2004, Balachandra 2006, Haakonsson and Ujjual 2014, Haour and Jolly 2014, and Li and Yue 2005). Yes, this is still largely under acknowledged and not properly investigated.

2. A Theoretical Review of the Internationalisation of Innovation

There is a range of theoretical perspectives in interpreting the motivations of internationalisation, which so far has reflected three waves of developments. The earliest wave was around WWII and thereafter, when sending products and expanding production to outside the home country was the first step in internationalisation (Jha et al. 2015). For instance, Williams (1985) and Hennart (1988) focus on the behavioural related theories of internationalisation'. They draw upon the concept of 'transaction cost economics' and argue that firms entering foreign markets through certain strategic methods are based on the transaction cost level for transferring knowledge to a foreign organization. Similarly, Reid (1983) argues firms internationalise their operations in order to minimise costs incurred during organizational activities. Reversely, Hymer (1976) and Caves (1982) put forward the monopolistic advantage theory where a superior advantage of a firm developed in the home country can be transferred overseas at no additional costs due to its established knowledge. Moreover, Knickerbocker (1973)'s oligopolistic reaction theory suggests that firms imitate each other's internationalisation actions to reduce the risk of being different and causing failure. Lastly, Dunning (1977, 1979) develops his 'eclectic theory' and suggest that foreign direct investment occurs when the home firm possesses a unique set of assets and the host country is relatively advantageous in location. Other researchers include Vernon (1966) who argued on the product cycle process, and Johanson and Vahlne (1977) who presented their incremental process view – the Uppsala Model – to demonstrate that firm internationalisation goes through four key stages as a result of accumulated experiential knowledge and increasing commitments: from irregular exports, to export via independent agents, to established overseas sales offices, and to building overseas manufacturing facilities.

Whilst these established theories have strong explanatory power for various aspects of the internationalisation phenomenon, and therefore hold high level of recognition in international business research, it is fair to conclude that little direct attention or detailed explanations have been given to a more recent and strategically-important firm movement, i.e., innovation internationalisation. It is also reasonable to argue that those theories have not fully captured this development as they advocated that the benefits of keeping strategic

innovation at home significantly override the benefits of internationalising innovation activities. This view was particularly supported by Porter (1989) who sees innovation as a core business unit of a firm, and believes that home-country innovation could bring strong international competitive advantages, whereas allocating innovation overseas forgoes such a benefit. In support of Porter's view, a number of scholars (Vernon, 1966, Vahlne and Johanson, 1977 and Casson, 1992) generally argue that, while many foreign countries are ideal targets for market expansion and/or production, they are viewed as less attractive locations for innovation activities due to reasons such as lack of skilled labour for sophisticated operations, dissimilar country factors, barriers in information flows, and potential loss of management control of strategic activities. Hence, innovation activities are kept in close distance (Dunning, 1993).

The second wave emerged as the critiques of those established theories came afloat later when the wider international business environment witnessed significant changes, such as the increasing international competition and the rapid advancement in information and communication technologies (Yamin and Sinkovics, 2010, Yu 2011). To survive and succeed in this ever more challenging and open environment, firms gradually became more agile when it came to creating and sustaining competitive advantages as evidenced by the emergence of new organisational forms such as heterarchy, hierarchy, and the matrix (Bartlett and Ghoshal, 1989, Hobdari, et al 2012). In particular, industries saw a tremendous change since the 1980s which challenged the conventional wisdom of keeping strategic development and innovation nearby. It was believed that such a centralised approach to innovation was no longer sufficient and appropriate (Kuemmerle, 1997). Instead, firms needed to develop global innovation networks that excelled at tapping new centres of knowledge and at commercialising products in foreign markets with the speed necessary to remain competitive. Consequently, the internationalisation of innovation became critical for many advanced-economy firms. However, it was not an overnight experience. Many researchers found that firms tended to start with exploiting home-based knowledge (adaptors) in foreign locations as the first step in the internationalisation of innovation. As local subsidiary's involvement deepened, knowledge exploitation gradually advanced to local knowledge generation for the local market based on subsidiary experience. Finally, many of these subsidiaries became the ultimate global competence creators as their unique R&D capabilities developed overtime (Kuemmerle 1999). At the same time, differing national innovation systems provided the ideal multiple learning environments for dispersed subsidiaries (Nelson 1993, Porter 1990). Subsequently, innovation was seen as a process of leveraging strategic knowledge resources from multiple locations and integrating into global products (Gassmann and von Zedtwitz, 1999, Granstrand et al, 1993, Kogut and Zander, 1993). Hence, the building and maintenance of a sustainable GIS and an effective global innovation network became a top priority for knowledge-intensive firms.

Moreover, most of these internationalised innovation activities at the time were located in developed countries, particularly in USA, Japan, and Europe, and extremely limited investments were made in emerging economies such as the BRICS nations (Altenburg et al 2008, Aubert, 2004, Balachandra 2006, Haakonsson and Ujjual 2014, Haour and Jolly 2014). Academically, research in this tradition paid most attention on the magnitude of this phenomenon (Cantwell 1995; Patel and Pavitt 1991), and converged on the idea that international knowledge sourcing was a 'North to North' phenomenon with innovation investments departing from advanced economies and destined to other advanced economies (Arvanitis and Hollenstein 2011; Cantwell and Piscitello 2000). Therefore, international knowledge sourcing was mainly concerned with locations of advanced economies on the basis of knowledge-related advantages (Dunning and Narula

1995; Florida 1997; Pearce and Papanastassiou 1999). In contrast, a consensus among these researchers is that emerging economies were characterised by low innovativeness and therefore were least interested by MNEs when internationalising strategic innovation.

However, a number of most recent studies reveal a rather different picture where a growing proportion of the investment from firms of developed economies has been devoted to innovation-related activities in a number of emerging economies, particularly Asia, indicating a 'North to South' trend (Altenburg et al 2008; Balachandra 2006; Li and Yue 2005). Moreover, pictures of 'South to South' and 'South to North' are painted by increasing number of studies (Contractor et al. 2010; D'Agostino et al. 2013; Hadengue et al 2015; Haakonsson and Ujjal 2015). Both 'South to South' and 'South to North' phenomena upgrade our view on the internationalisation of innovation as per extant literature. This evidence demonstrates that emerging countries are no longer viewed by firms from developed economies as only targets for market expansions and production, but also increasingly important locations for knowledge sourcing. Thus, the emergence of 'non-traditional' locations has pushed innovation internationalisation to a truly global phenomenon. A study by Hadengue et al (2015) discusses the reverse innovation and knowledge transfer from China to the rest of the world. Similarly, Altenburg et al (2008) and Haakonsoon and Ujjul (2014) argue that emerging countries such as India and China are quickly becoming the latest attractive destinations for R&D investments as the countries have been going under national transitions from a hotspot of production to innovation.

In spite of this recent development in international business and limited recent studies, there is fairly scarce research so far in attempting to explain the development of innovation internationalisation to emerging economies (Li and Kozhikode 2009; Mahmood and Zheng 2009; Tsai, et al. 2009; Fu, et al. 2011; McMahan and Thorsteinsdóttir 2013; Qu, et al, 2013; Ponomariov and Toivanen 2014; Kafouros, et al 2015; Watkins, et al 2015). This paper extends the traditional view of 'North to North' and 'North to South' styles of innovation internationalisation as an increasing number of 'traditional' players have sourced knowledge from 'non-traditional' locations (Balachandra 2006; Haakonsson and Ujjal 2015; and Li and Yue 2005). While these new locations have recently experienced an advancement in its innovation capabilities with a large pool of talents and expertise (Athreye and Cantwell 2007; Lewin et al. 2009), the possibility to generate important knowledge still remains an open question for both researchers and practitioners (von Zedtwitz and Gassmann 2002; and Altenburg et al 2008). The narrative in this paper clearly shows that, although the consensus is that emerging economies generally present a unique and unknown operating environment in terms of political and legal context relating to innovation (such as strength of intellectual property right protection), in the most recent years, the role of these economies is changing drastically perceived by firms from advanced economies due to a number of changing factors, such as the increasingly internationalised standard of national education system and therefore the emergence of a large pool of skilled labour, a better legal framework, a converging national culture, and the widespread of foreign languages spoken (OECD 2008, 2014; UK Trade and Investment 2010). All of these developments provide latest support to the scholar view that creation of important knowledge is not the sole 'privilege' of the advanced economies but emerging markets knowledge-seeking has become the latest trend in global innovation strategy formulation (Haakonsson and Ujjal 2015; Hadengue et al 2015; and Haour and Jolly 2014).

3. The 'Transitioning' China: From Production to Innovation

Although China has long been recognised as the ‘world factory’, in more recent years, the local environment witnessed a significant gradual shift towards greater focus on innovation (China Statistical Yearbook 2014; UNCTAD 2006, 2012). In fact, a large number of companies in China from different industries have begun mounting challenges in sectors which were traditionally preserved by American, European, Japanese, and South Korean businesses. For example, Beijing Genomics Institute, which is the world’s biggest genetic-sequencing company, now claims to account for roughly 50 percent of global capacity and probably sequences more genetic material than Harvard University and the Massachusetts Institute of Technology combined. It also develops some of the world’s most advanced biologic-computing models (McKinsey Quarterly 2013]. In information and communication technology sector, Huawei developed its own innovative new smartphone platforms which are built on chips and software designed in-house. Its competitor Xiaomi, founded in 2010, is frequently compared to Apple for its marketing strategy. The sales of Xiaomi mobile phones were more than 15 million units in 2013 (Bloomberg Business 2014). In the consumer electronics industry, Midea announced a highly efficient 1-hertz variable speed air conditioning compressor which was, surprisingly, ahead of foreign rivals. Finally, YY.Com, a voice-based communications and gaming service provider, has captured growing attention with its mass online karaoke, which is a highly popular activity locally (McKinsey Quarterly 2013).

A number of key factors have been identified to contribute to this seismic change. First of all, the changing business mentality among many local companies in China. For instance, John Oyler, CEO from a three-year-old Chinese biotech company BeiGene, underscored the attitude: *“Anything is possible, we can make it happen. There is no challenge we cannot conquer, and we will surprise the world.”* (McKinsey Quarterly 2013). Second, the ever-closer collaboration between Chinese universities and companies. Chinese universities have gone through some significant changes. One of which is the huge interest in recruiting world class experts. When Fudan University in Shanghai planned to develop a waste water treatment science programme, it hired a world class academic from Singapore. Hence, as Chinese universities raise their games, they are becoming increasingly attractive innovation partners for companies. Many local and global firms have taken this opportunity, e.g., Intel has long collaborated with Chinese universities to sponsor research projects. Increasingly, these partnerships are seen as a means of outsourcing research and development. An extreme example is a local Chinese packaged-goods company which has conducted food science research almost entirely through a local university lab (McKinsey Quarterly 2013). Meanwhile, BeiGene’s spokesman describes Chinese universities as *“underappreciated treasure troves of innovation pockets”* (McKinsey Quarterly 2013). This finding is in line with Balachandra (2004)’s work who notes that the availability of a pool of skilled labour can be a crucially attractive factor to encourage Western firms to internationalise innovation activities.

Apart from providing companies with top talents and research assistance, partnerships with universities can also benefit the companies in that these market players can gain access to any upcoming changes in policy direction and market rules, as Chinese professors often have close relationships with government officials and can pick up valuable information.

Third, the availability and utilisation of young generation of Chinese talents. A McKinsey’s spokesman noted his experience with young Chinese talents. For instance, Guosheng Qi is a 28 year old Tsinghua University graduate and the founder and CEO of Gridsum, a cloud-based web-analytics company. The company’s customers range from Baidu, which is the largest search engine in China, to multinational firms such as Coca-Cola. Additionally, in 2012, it beat out companies from around the world to be titled one

of Microsoft's most innovative new software partners. Another example is Lenovo's intense recruitment of fresh talents straight from Chinese universities, which makes up roughly 70 percent of its company. This has enabled the company to sustain its innovativeness and a strong corporate culture (McKinsey Quarterly 2013).

Last, increasing government support for intellectual property protection and the transformation of China's national innovation system. For intellectual property protection, the Chinese government has attempted to make it a core part of its innovation culture by being more supportive (Anderson et al 2009). For instance, the ministry of the Chinese government charged with prosecution of intellectual property violations announced the handling of 2,347 cases in 2012, which was up by 40 percent in comparison to the previous year (Orr and Roth 2013). Another example of active government support is the building of a 500,000 square metre facility next to Suzhou's innovation park. The intention behind this move is to bring together intellectual property related agencies and leading technology companies to elevate important protection issues. In addition, it also improves the processing and quality of patent approval and protection. These examples reflect a growing appreciation of the importance of intellectual property protection in China.

At the same time, the Chinese government has actively reformed the Soviet style innovation system since its inception in the 1950s. Prior to the 1980s, the Chinese system was characterised by the complete separation of science and technology activities in public research institutions from manufacturing in state-owned enterprises. The reform was then carried out to connect the two. In order to do so, the Chinese government pushed research institutions to adapt to the market environment and to conduct research that had industrial implications. The government took three specific steps between the 1980s and the 1990s in this regard (OECD 2008, 2009): 1) advocating the merger of some research and development institutions with companies in the 1980s; 2) offering financial incentives to commercialise research results through various programmes in the 1980s, including the well-known Torch Programme; and 3) transforming the established research centres into institutions with economic functions, such as production and consultancy organisations, from the 1990s. Meanwhile, MNEs and new technology firms have become more involved in the new national innovation system whereby more research has been conducted in China. Consequently, companies of various sizes have grown to become major contributors of national innovation system, where spending in research and development jumped from RMB 14 billion in 1995 to 44 billion in 2001. AZ PLC was at the forefront of these developments (Data Monitor 2005, Bernstein Research 2009, KPMG 2011).

4. A Brief History of a Global Pharmaceutical Company: AZ PLC

The very beginning of AZ can be traced back to 1913 when Astra was an independent company based in Sodertalje, Sweden. However, it was not until the 1930s that the company started its first set of research activities on a very small scale. The company since acquired a couple of factories in 1939 and 1942, making Astra the largest Swedish pharmaceutical company. Since its research and production extension, Astra established two product families and introduced them to the Swedish market in 1948. The profits from these families were then used to fund new drug development. To increase the chance of success, Astra relocated its Hassle research division to Gothenburg in 1954 in order to be near to Gothenburg University Medicine Faculty for collaborations. The collaborations were considered very successful as a number of blockbuster drugs were developed and sold (AstraZeneca: Our History, n.d.).

Since the early 1990s, Astra witnessed increasing costs for developing new drugs and believed that the company needed a more international platform for the future. Hence, Astra started to eye for partners. It was not long before Zeneca became the ideal partner (The Independent 1998). Zeneca Group was formed by Imperial Chemicals Industries (ICI) in the 1990s to focus on the group's pharmaceuticals business. The demerger of ICI later led to the merger of Astra and Zeneca in the late 1990s (The Independent 1999). This was considered as one of the largest-ever European mergers at the time and made them into the fourth largest pharmaceuticals company in the world. Tom McKillop, the new CEO for AstraZeneca noted:

“Astra and Zeneca are a perfect fit in terms of highly complementary product portfolios as well as sales and marketing organisations. A similar management philosophy together with a strong science-based culture makes the companies natural partners.”

(BBC News 1998)

The merger clearly indicated the company's intention to strengthen its innovation and world market share in the long run.

The integration of the two companies' worldwide organisational activities post-merger called for some major structural changes and consequently, led to the formation of a new group arrangement whereby a much widened geographical scale was realised. Specifically, the USA, Canada, and Europe remain the three largest and more mature markets for the group whilst Asia Pacific (excluding Japan), Japan, Latin America, and the Middle East are seen as the younger markets with greater growth potential in the long run. Across these seven markets, three worldwide strategic innovation centres are established in Sweden, UK, and USA, responsible for the most advanced drug research for the global market. They are supported by four other important global innovation centres which are based in Poland, Russia, Japan, and most recently, in China. These centres are further complemented by clinical development at over forty sites around the world. Furthermore, the restructuring and expansion also involved the establishment of a number of manufacturing sites worldwide for the purpose of meeting regional and/or global needs. Sales and marketing divisions are also located near manufacturing sites to ensure rapid and responsive product supply (BBC News 1998).

5. Epistemology and Methodology

Turnheim and Geels (2013:1754) noted: *“the ‘usefulness’ of history goes far beyond a dataset for the testing of hypotheses or history-friendly models. Instead, we suggest that historians practice a particular kind of explanation that has much to offer to innovation studies, particularly for understanding long-term change processes such as...”* Our paper takes this stand to study the development (as a process) of innovation activities of an MNE in an EE.

From historian perspective, the understanding of social life is about ‘process tracing’ which *“takes path dependence seriously and goes ‘inside the black box’ to explain how actions and changing contexts produce event chains.”* (Turnheim and Geels 2013:1754). In order to take into account of tracing the process, we echo the work of Turnheim and Geels (2013) by adopting the commonly used epistemological style by historians – ‘narrative explanation’. It is suggested that such a style is strong in capturing complex social interactions through time and event sequences. Abbott (2001: 227) wrote: *“theorising the social process via narrative is a deep tradition in both history and*

sociology. If there is any one idea central to historical ways of thinking, it is that the order of things makes a difference, that reality occurs not as time-bounded snapshots within which 'causes' affect one another...., but as stories, cascades of events."

In line with Turnheim and Geels (2013), the narrative explanation style which we follow in this paper is not about simply description of separate events but the trace of historical process. Our explanation is guided by previous literature and conceptual framework on the recently emerged pattern of internationalisation of innovation to non-advance economies. This corresponds to the view of Gaddis (2002) that theories are likely to be embedded within narratives. On the other hand, "*historians rarely perform formal tests of theories; instead, they judge theories and conceptual frameworks for their usefulness in writing plausible and interesting narratives.*" (Turnheim and Geels 2013:1755). Consequently, our paper also follows this approach in understanding the trend towards innovation in emerging economies through a longitudinal case study. The conceptual framework identified in recent literature in previous section will be confronted with the chosen case of AstraZeneca PLC in China between 1993 and 2014. Case study strategy is well fitted to exploratory research as it is rich in context, allows for real-life illustrations to explain an identified phenomenon (Eisenhardt and Graebner 2007), and enables 'process tracing' of series of events (Turnheim and Geels 2013; Yin 2003). The objective of our paper is not to tell a 'full' story but to provide an analytical narrative which follows the pattern of innovation internationalisation identified in recent literature.

Within case study, researchers can choose to select either single or multiple cases. The decision to use either is largely dependent on its appropriateness in dealing with the topic (Yin 2003). While Yin (2003) suggests that multiple cases enable the logic of replication, in which the researcher replicates the procedures for each case and data from multiple cases concerning the same inquiry provides a basis for generalisation if patterns or differences are found. This study is not concerned with qualitative generalisation but in-depth longitudinal exploration of the complexity behind innovation FDI in emerging economies. Therefore, we are not concerned with producing results which can be generalised to other cases, industries, or the wider population in any way. Instead, we are simply interested to trace the process of innovation development in emerging economies. This means, any MNE which has established a strategic R&D centre in an emerging country is likely to be considered a 'suitable' case for the simple purpose of providing some initial explanation to the recent trend identified in literature and therefore plausibility of the conceptual framework. UNCTAD's (2005) ranking of innovation FDI shows China as one of the largest inward FDI destinations in terms of R&D activities. In comparison to its major competitors, AZ PLC has one of the longest operating histories in China and was one of the very first to set up a strategic R&D centre in the country (Bernstein Research 2009). Hence, AstraZeneca in China is viewed as a suitable case for exploration.

5.1 Data sources and collection methods

With reference to Turnheim and Geels' (2013) definition of secondary (journal articles and authored books) and primary (newspapers, government reports, and company annual reports) data, we draw on a wide variety of secondary and primary sources to highlight FDI activities AstraZeneca has undertaken during its operations in China. Although these

sources should be taken at face value, they provide interesting details for qualitative analysis which traces the gradual changes in the company's operation. "This variety in data sources enables triangulation, and allows for a rich analysis..." (Turnheim and Geels 2013:1755). A comprehensive list of data sources is provided in Table 1.

Table 1. Primary and Secondary Data Sources

Data (in alphabetical order)	Source
<i>Books</i>	<ul style="list-style-type: none"> ▪ China Medical and Pharmaceutical Industry Handbook ▪ The Asia-Pacific Biotech Directory ▪ International Directory of Company Histories ▪ Foreign Companies in China Yearbook
<i>Company Annual Reports</i>	<ul style="list-style-type: none"> ▪ AZ PLC ▪ Zeneca Group PLC
<i>Corporate News Releases</i>	<ul style="list-style-type: none"> ▪ AZ Global ▪ AZ China
<i>Government Reports</i>	<ul style="list-style-type: none"> ▪ China Food and Drug Administration ▪ Ministry of Commerce, P.R.C. ▪ China Statistical Yearbook ▪ State Intellectual Property Office (China)
<i>Industry Reports</i>	<ul style="list-style-type: none"> ▪ Bernstein Research ▪ Bio Partnerships Asia ▪ Chemical Market Reporter ▪ KPMG Research ▪ McKinsey Quarterly ▪ Thomson Reuters
<i>Newspapers</i>	<ul style="list-style-type: none"> ▪ Asia Pacific Biotech News ▪ CBS News ▪ China Daily ▪ Jiangsu News ▪ Wall Street Journal ▪ The Financial Times ▪ The Independent ▪ The Telegraph

5.3 Data analysis

The data analysis process was partially planned and partially emerged as the collection progressed. Appropriate adjustments were made throughout the study by way of examining emerging pattern from the raw data. Therefore, the process was fairly interactive. The longitudinal case is divided into three distinctive periodic phases using market-seeking, efficiency seeking, and knowledge-seeking definitions of FDIs identified in previous literature. For each period, the narrative traces the type of FDIs undertaken in China. We provide interpretations of the FDI activities undertaken in each period as well as over the course of the three periods in relation to the conceptual framework identified in previous literature. Specifically:

Phase 1: The first phase identifies the earliest forms of establishment of AZ in China when it first entered the country. This period covers from 1993 and 2001 where the entry modes, purpose of entry, and level of FDI are identified from data collected from newspapers, company website, and business publications. The definition of this period corresponds to market-seeking as the conceptual framework identified.

Phase 2: The second phase centres around the analysis of the subsequent development of AZ in China following phase 1 in terms of the changes in the level and nature of investments made in the country, the increasing variety of forms of establishment, and the new purposes of these changes. This stage of analysis covers the period of 2002-2008 and is based on data collected from company sources, newspapers, and business publications. The definition of this second period corresponds to efficiency-seeking.

Phase 3: The final phase focuses on the most recent changes in the development of AZ China operations to date. Based on data collected from industry and company reports, newspapers, and business publications, this stage of analysis covers the period of 2009 to 2014 where further key changes in its investments and forms of establishments were identified. The definition of this third period corresponds to knowledge-seeking.

Overall, the sum of these three phases makes up the whole developmental pattern of AZ in China. The next two sections provide a comprehensive analysis of the research context of China, and the background of the case company AZ PLC.

6. AZ: The Three Phases of Innovation Internationalisation to China between 1993 and 2014

Based on the understanding of R&D internationalisation as analysed by Arvanitis and Hollenstein (2011), and Cantwell and Piscitello (2000), three distinctive phases of internationalisation of innovative activities of AZ in China are identified:

AZ China's first establishment dates back to 1993 by Astra. Since then, the operation in the country has developed tremendously in terms of scale and scope. In particular, it is witnessed that the company is now heavily dependent on China operations for not only global production but increasingly more for strategic innovation. The three key phases of AZ operation in China are reviewed next. The first phase is between 1993 and 2001 when China's first wave of fast economic growth took place. It was seen as a market with huge potential and therefore, gaining market share with existing products was

the top priority for the company – the North to South wave. This is identified in the literature as the ‘knowledge exploitation’ act, which AZ adopted to augment existing products to suit the needs of the Chinese patients. This type of subsidiaries is commonly recognised as the ‘local adaptation units’. Following its successful market expansion in China, during the second phase (between 2002 and 2008), AZ’s focus shifted towards strategic activities – innovation in China for China, which is the South to South wave. This move is commonly defined as local ‘knowledge exploration’ whereby new products are developed using available local knowledge for the local market. This type of activity is often pursued by ‘local R&D units’. During the most recent phase between 2009 and 2014, AZ’s further involvement in China has speeded up and is seen as the most significant to date, with serious efforts to developing global production and strategic innovation centres. This significant development in AZ’s China activities can be related to existing literature as ‘knowledge exploration for the global market’. This type of establishment is commonly recognised to be a ‘centre of excellence’ whereby new science is often discovered there and a key driver of worldwide product development. In other words, China becomes a crucial part of AZ’s global network and performance – the South to North wave (see Papanastassiou and Pearce 1999 for a comprehensive analysis of the types of overseas R&D laboratories).

5.1 “Testing the water”: Initial expansion in China, 1993 – 2001

The timing of Astra’s entry to China was carefully considered. As part of Astra’s global expansion strategy, the company already had an eye for the market for some time, and it was not till the early 1990s that the first step was taken. It was fuelled by a number of key economic changes in China. Since Xiaoping Deng’s introduction of the first economic reform in 1978, China has since set up five special economic zones where private firms are allowed between 1980 and 1994, and opened up fourteen coastal cities for foreign investments in 1984, and many more examples in the 1990s. As part of continuous economic reforms, China started mass privatisation in the following decade to move towards a more market-based system. This shift drastically accelerated the economic expansion and was the deciding point for Astra to establish its first sales and marketing subsidiary in the country. Subsequently, in 1993, Astra took the first step to set up Astra (Wuxi) Pharmaceuticals Co. Ltd in Jiangsu Province, not far from Shanghai (Pederson 2008; World Scientific 2003).

Jiangsu is an ideal location for Astra for a number of reasons. For one, in 1992, many parts of Jiangsu Province were made into economic zones and Wuxi city established Wuxi New District – one of the largest industrial parks in China. The new district was known for providing strong support for international operations. For two, Jiangsu is ideally located next to trade intensive regions such as Zhejiang and is home to hundreds of thousands of businesses. For three, to attract foreign investments, national and local governments offered attractive incentives. Hence, the overall business environment of Wuxi at the time of Astra’s entry was one of the most ideal places in China. This also worked in favour of Astra as its strategy at the time was to maintain full control rather than joint-ventures from the start with a view for the long run despite its lack of local knowledge and experience (AstraZeneca Corporate News Releases, n.d.; Invest in Jiangsu 2006).

In the following year of Astra’s China set-up, Zeneca also entered China but in the form of a joint-venture with Sinopharm, which is a state-owned corporation. Sinopharm, also known as China National Pharmaceutical Group Corporation, was the largest pharmaceutical and healthcare group in China, with a very well established network in the

country. It owned 22 subsidiaries and holding companies including research, distribution, and production facilities. The initial agreement between Sinopharm and Zeneca was for the sole distribution of Zeneca's blockbuster drugs at the time (Zeneca Group PLC Annual Report 1994). Similar to Astra, this move was also an indication of Zeneca's attempt to move into the Chinese market early as part of their global expansion of existing products. Following one year into the agreement, Zeneca felt the huge potential of the market and invested further to established sales and marketing operations in 1995. Benefiting from the rapid economic growth in China in the following few years, Astra and Zeneca both had successfully positioned themselves in the Chinese market to be leaders in the sale of specific drugs. They also established offices in over 20 major cities. However, the joint venture demerged for Zeneca around the same time when Astra and Zeneca merged.

Following the merger the new AZ embarked on the most exciting Chinese venture at the time, i.e. an accumulative investment amount of \$270million (in comparison to \$121 million by GlaxoSmithKline around the same time) in building its first world class production facility in Wuxi New District where Astra's previous Chinese operations were initiated (Chemical Market Reporter 2001). The investment decision came through as both Astra and Zeneca were performing well in China. AZ CEO Tom McKippop commented in an interview: *"There are over a billion people in China. It is potentially a very large market. I believe the prospects for new medicines coming into China are very good"*. The project started in early 1999 and by the end of April, 2001, it was completed and opened for operation. The new production plant employed 600 workers and produced 95% of all AZ's products sold in the country. According to an AZ official: *"There are Western manufacturers with plants there [in China], but this is one of the largest investments made by a pharmaceutical company."* (Wall Street Journal 2001; AstraZeneca Annual Report 2001).

During this phase of AZ's expansion in China which can be partly characterised by strategic focus on market expansion, AZ also made their first important step in investing in research in the country – the first step in North to South development. Between 1996 and 2001, AZ undertook nine international multicentre clinical trials in the respiratory field in China with the involvement of over one hundred and thirty domestic hospitals and institutions. By 2001, AZ invested \$35 million in clinical trials and conducted thirty seven clinical research projects involving approximately twenty thousand patients in more than one thousand domestic medical sites (Asia Pacific Biotech News 2001; AstraZeneca Annual Report 2001). The objectives of these investments were to develop drugs that are specific for the Chinese patients with specific diseases. To further AZ's effort in local innovation, its emphasis on the importance of strategic partnerships with Chinese research institutions became evident. For instance, the company and Shanghai Jiaotong University launched a joint research project on genetic links to neuropsychiatric diseases (AstraZeneca Corporate News Releases, n.d.; China Daily 2001).

Although AZ research related investments during this period were not for building own innovation facilities, the company was still one of the first foreign companies to commit to local research at the time. This move was further encouraged by China's entry into the World Trade Organisation in late 2001. This was crucial for the company's business strategy in China as it meant more protection over intellectual property rights and curtailing of counterfeit pharmaceuticals. Hence, this phase of the development process signals a heavy strategic overall emphasis on market-seeking with some elements of efficiency- and knowledge-seeking at the stage of embryo.

5.2 "Resting assured": Second phase of expansion in China, 2002 – 2008

The booming of the Chinese market came into force in 2002 as the country officially became a member of WTO, which further fuelled the already rapid developing economy. Being one of the early movers and building on its existing research-intended investments in the previous years, AZ continued its innovation investment in China on an ever greater scale (Ministry of Commerce, P.R.C. 2005; AstraZeneca Annual Report 2008). Two major categories of developments took place: extensive local partnering and the establishment of own research institutions, despite the fact that this was still the period when China was viewed by most foreign investors as a more attractive destination for production and sales. These are strong indicators of the South to South developmental wave.

In terms of the former category of developments, for instance, in 2003, AZ took a major step in forming the most significant partnership at the time with Peking University's Guanghua School of Management to fund the China Centre for Pharmacoeconomics and Outcomes Research. It was one in a series of research and educational programmes aimed at supporting reform of the country's healthcare system. During the first three years of the partnership, AZ provided over \$360,000 in sponsorship to help set up and establish its research, advisory and training programmes for government officials, hospital executives and pharmacy directors. In particular, the sponsorship helped fund a series of research seminars hosted by international experts, and sponsor of two-year fellowship programmes for trainees, hosted alternatively by the School and AZ, and facilitate short-term training programmes across the country (AstraZeneca Corporate News Releases, n.d.).

Continuing its innovation investment tradition in China, in 2007, AZ took another major step in its local development by forming a strategic partnership with Peking University Third Hospital to set up the company's first Clinical Pharmacology Unit in the country (AstraZeneca Corporate News Releases, n.d.; China Daily 2007). In the same month, AZ and Guangdong Province People's Hospital jointly established a research laboratory with the focus on translational science. The Unit was intended to augment existing clinical research capabilities and undertake Phase I clinical research including clinical pharmacology and safety evaluations – steps necessary for launching new medicines in China. This move fastened the launch and patient access to new medicines in China. As part of the partnership agreement, AZ offered personnel training, system audits, and consulting services. It also invested in the hospital's facility enhancement as required for carrying out clinical research of medicines for infections, diabetes, and cardiovascular diseases. Furthermore, it was set to expand the capabilities of early phase clinical research for local clinical pharmacology organisations, and take China's clinical research capabilities to a new level through further research cooperation and academic exchange with the local medical community (AstraZeneca Annual Report 2007; Ministry of Commerce, P.R.C. 2007).

In 2008, AZ reached further to the Shanghai Institute of Materia Medica to establish the Drug Safety Evaluation Joint Research Centre in Shanghai Pudong Science Park of Chinese Academy of Science. This was also intended to fasten speed to market progress in the country. In the same year, as the agreement between AZ and Pharmatech Wuxi came to an end with the success of achieving targets two months ahead of schedule, AZ decided to extend its contract with the company to continue to synthesise compounds according to AZ's designs in the new arrangement in order to further expand the company's global compound collection. Deborah Hartman, AZ vice president, noted: "*Wuxi had exceeded expectations in the first agreement, delivering value...beyond the cost savings in labour and materials.*" (Jiangsu News 2008).

In addition to these major partnerships, AZ also expanded its clinical research capabilities by increasing the number of scientific collaborations with local Chinese pharmaceuticals firms. For example, it signed a two-year partnership deal worth \$14

million with Wuxi PharmaTech for compound collection synthesis. In the same year, AZ also entered into a license agreement with Cubist Pharmaceuticals, Inc. for the development and commercialisation of Cubicin (i.e., daptomycin for injection) in China (AstraZeneca Corporate News Releases, n.d.; Bio Partnerships Asia 2011).

For the latter category of development, AZ made a number of historical records. For example, in 2002, AZ was the first of its kind to launch a localised Clinical Research Unit for East Asia region in Shanghai. The significant number of high quality medical talent available in the city was the reason for the location decision. The Unit aim was to oversee East Asia clinical research in mainland China, Hong Kong, Taiwan, and Korea, and the clinical research was conducted by more than forty high-calibre Chinese researchers (Pharma Times 2006). This signified that the country would become a critical component of AZ's future global trials and can significantly reduce the time it takes for drugs to be made available to Chinese patients (AstraZeneca Annual Report 2002; Ministry of Commerce, P.R.C. 2005).

Another important development was in 2006 when AZ invested more than \$70 million in the establishment of the Innovation Centre China, which again was the first of its kind in the country (Ministry of Commerce, P.R.C. 2006; AstraZeneca Annual Report 2006; China Pharmaceutical Industry Investment Promotion Report 2014). It was also one of the most advanced scientific research centres of the Group outside of the UK, Sweden, and USA. It evidenced the company's dedication to research in China and the ambition of having a strong innovation presence in the region. Jan Lunberg, executive vice-president of Discovery at AZ PLC, commented: *"It will be an integral part of our global innovation activity aimed to ensuring that the right patients are treated with our oncology drugs and will take advantage of the excellent science base in Shanghai where there is a burgeoning biotech industry."* Balachandra (2004) emphasises that filling gaps in the capabilities of the innovation function is a key consideration for firms to internationalise innovations. Although the beginning of AZ China did not seem to suggest so, the formation of this innovation centre shows its major role in contributing to AZ's global knowledge base.

Other examples include the creation of an in-house business school, known as AZ China Business Institute, for employee development and patient education programme in 2005. In the following year, AZ Academy for Chinese healthcare professionals for medical education and clinical research was opened. It was intended to educate and update current and future generations in the latest advances in scientific and medical knowledge (AstraZeneca Corporate News Releases, n.d.).

Apart from innovation investments, in 2006, AZ announced its commitment to an additional \$35 million investment over the next five years to increase its productivity of the Wuxi site. The site also passed both the China and European Union Good Manufacturing Practice certification and was since authorised to export products to European Union and other countries adopting the same standards. Moreover, AZ's China sourcing centre was founded in Shanghai in the same year as part of the company's effort to strengthen its global sourcing of active pharmaceutical ingredients. These developments further signalled AZ China's increasingly evident global role.

In summary, by 2009, AZ employed more than two thousand and nine hundred staff locally, had a network of more than twenty marketing and sales offices, a world class manufacturing site in Wuxi, clinical research facilities, and multiple collaborations and partnerships with local academic and medical institutions. At the same time, AZ enjoyed sustained business growth with continuous sales increase over the years as it was ranked number one in terms of sales volume of prescription medicines among foreign multinational in China (eleven of its branded products held a Number One position in market share). Much of this is to do with China's rapid economic growth and increasing

demand for better healthcare.). Such an innovation internationalisation motive was found in the literature of Pearce et al (1992) and Balachandra (2004), who suggest that MNEs internationalised their innovation activities to other locations where growth opportunities are apparent. Particularly, major FDIs during this phase reflect a heavy emphasis on not only market- but much more towards efficiency-seeking.

5.3 “Feeling settled”: Third phase of expansion in China, 2009 – 2014

To further its Southern expansion, on 9th September 2009, AZ held the ground-breaking ceremony in Shanghai Zhangjiang Hi-Tech Park (which was known as China’s medicine valley) for its new China site, which included AZ’s new China corporate headquarters for China and Asia Pacific, marketing operations, Innovation China Centre, and Academic training and regional functions. It became one of the only three corporate headquarters of AZ PLC besides USA and UK (AstraZeneca Corporate New Releases, n.d.; AstraZeneca Annual Report 2009; China Pharmaceutical Industry Investment Promotion Report 2014). A solid foundation was finally laid for AZ China for the long run. By the end of this financial year, AZ’s accumulated sales were more than \$800 million (The Telegraph 2010). On the other hand, it was also an important period for AZ as many rivals started to seek big breakthroughs into the market. For the first time, AZ’s leadership position in China was replaced by the merger of Pfizer and Wyeth in October 2009. To reclaim this spot, AZ had its plans. David Brennan, Chief Executive Officer of AZ, believed that, with a population of 1.3 billion in China, a burgeoning middle class and increasing prevalence of Western-style diseases, the Chinese market would offer the most opportunity for growth, and product offerings were the way to regain its position (The Telegraph 2010, Thomson Reuters 2010). This was for a number of reasons: one, when the right drugs became available, they could make into China’s National Reimbursement Drugs List which allowed patients to claim a fifty percent rebate. Two, China was always considered a marketplace where mature drugs could still generate sales long after patent expiration, which was different from the situation in the West. Three, the traditional practice in China for drug selection is that once particular branded drugs were accepted by the doctors and patients, there was a strong tendency to stick to it permanently though the initial acceptance tended to take a little longer (AstraZeneca Annual Report 2010; China Food and Drug Administration, n.d.).

Hence, in order to widen and better its product offering as the core source of sustainable competitive advantage, AZ continued its aggressive innovation localisation in a number of ways. First, it is AZ’s internal innovation capability building in China. Specifically, by 2011, the Innovation China Centre had already built strong capabilities in translation sciences for oncology research for the Chinese market since its opening over four years ago. Hence, the Centre embraced a new mission, which was to deliver candidate drugs and ultimate Proof of Concepts and valuable drugs to address the significant unmet medical needs of patients in China. This new mission, dedicated by the Swedish research headquarters, signalled a new level for the China centre. The mission required the Chinese research team to focus on the discovery and development of new drugs specifically targeting diseases that were more prevalent. This included working closely with AZ Innovative Medicines Unit to exploit potential drugs to treat liver and gastric cancer and other cancer with high prevalence in China (McKinsey Quarterly 2012).

Second, and more importantly, a strong focus towards more extensive and deepened advance-research collaborations locally. According to Dr Ajay Gautam, AZ’s Executive Director for China and Emerging Markets External Collaborations: “AZ is increasingly focusing on early stage academic collaborations with institutions because we

believe that working with partners across the globe who have fresh, innovative ideas and approaches will help us accelerate the discovery of new medical breakthroughs.” A list of the major collaborations during this period is provided in Table 2.

Table 2 List of Collaborations (between 2010 and 2014)

<i>Year</i>	<i>Means of Innovation Activity</i>	<i>Purpose of Innovation Activity</i>	<i>Target Market</i>
2010	Partnership agreement with Peking University	Discovery and development of new treatment for diabetes, obesity, and atherosclerosis	Chinese and global patients
2010	Partnership agreement with No. 1 Affiliated Hospital of Guangzhou Medical College	Basic research on chronic obstructive pulmonary disease	Chinese patients
2010	Research collaboration with BioDuro Clinical Research	Discovery research in respiratory and inflammatory diseases	Chinese and global patients
2012	Partnership agreement with WuXiAppTec, and with technical and development support from AZ biotech subsidiary MedImmune in U.S.	Development and commercialisation of a novel biologic for autoimmune and inflammatory diseases	Chinese patients
2012	Research collaboration with Ironwood Pharmaceuticals, Inc	Development and commercialisation of linaclotide for irritable bowel syndrome with constipation and chronic idiopathic constipation	Chinese and Global patients
2014	Research collaboration with Shenzhen University Health Science Centre	Pre-clinical research on chronic kidney disease	Chinese patients
2014	AZ China Innovation Centre	Discovery of first AZ pre-clinical candidate drug for oncology	Chinese patients
2014	AZ Global Medicines Development Unit collaborates with China Innovation Centre	Creation of an innovative local portfolio to support local growth	Chinese patients

(Source: www.astrazeneca.com/partnering; China Food and Drug Administration)

Apart from using local collaborations as a way to improve product offerings, AZ also brought in external capabilities that complemented the core internal expertise already available at the China centre in order to bring innovative new drugs to the market faster. One of the examples was an acquisition agreement with a privately-owned generics manufacturing company - BeiKang Pharmaceutical Company Ltd - from Conghua City, Guangdong Province, in 2011 (Chain Drug Review 2012). The deal gave AZ access to a portfolio of injectable drugs used to treat infections which the company aimed to make them available to Chinese patients. This move reinforced the company’s commitment to

bringing original and high quality branded generic drugs to the ‘broader’ market to increase the accessibility and affordability for patients who were previously underserved. Mark Mallon, President of AZ China-Pacific region, commented: *“Our new acquisition further underscores our intention to serve the health needs of Chinese patients through our innovative medicines and, increasingly, high quality branded generic treatments that are locally produced to global standards.”*

Apart from improving product offerings for the Chinese market, AZ China also entered into a number of research collaborations for the purpose of developing drugs which were required not only by local patients but also for the global market. This move signalled AZ China’s first move towards becoming a global contributor of innovation – the start of the South to North wave.

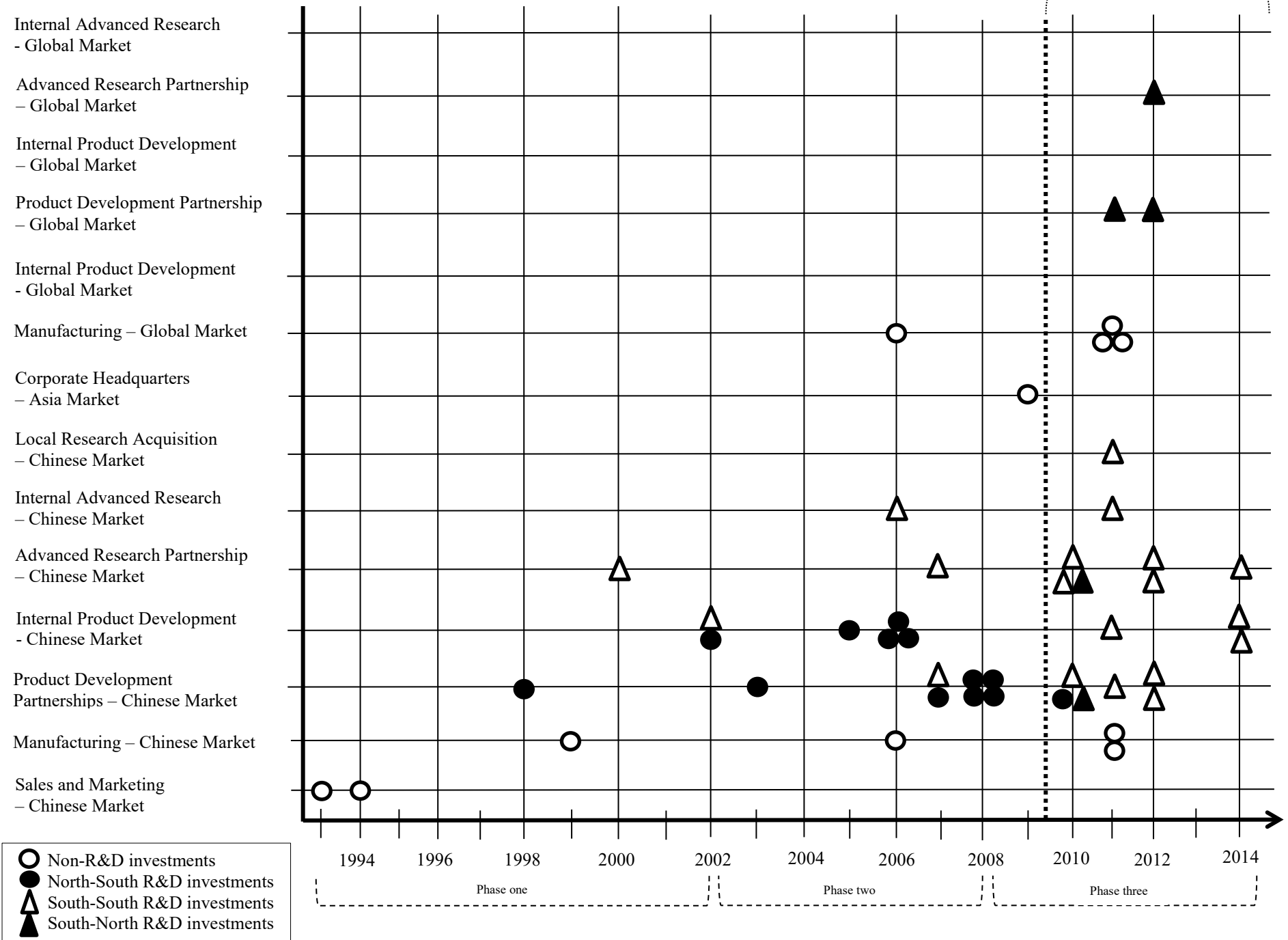
For instance, in 2011, AZ and Chi-Med China co-developed and commercialised a novel cancer therapy called Volitinib. Christian Hogg, Chief Executive Officer of Chi-Med noted: *“We are very much looking forward to collaborating with AstraZeneca around Volitinib. Our collaboration will support the development and commercialisation of this novel oncology innovation, discovered in China, to the global market on an accelerated basis...”* (AstraZeneca Corporate News Releases 2011; Thomson Reuters 2011). In 2014, AZ China and Tianjin Medical University signed cardiovascular research collaboration. The partner university was one of the leading medical and scientific institutions in the country, making it an ideal partner for AZ. The agreement was to focus on exploring novel targets against cardiac fibrosis. This was considered a long-term collaboration as no therapy for such a disease was available globally due to lack of knowledge about its underlying causes.

In support of the research expansion activities, in 2011, AZ made two strategic investments in expanding its manufacturing operations in China. One of these was a group record investment of \$230 million for setting up a world class manufacturing facility in China Medical City - Taizhou, Jiangsu province (AstraZeneca Annual Report 2011; Ministry of Commerce, P.R.C. 2011). The new plant enabled the company to meet the growing demand for its products in China while expanding availability to patients in the urban and rural communities who traditionally had limited access to established drugs. The underserved market was estimated to be more than 900 million people. It also allowed AZ to free up some capacity at the existing plant in Wuxi to bring on more new innovative products that were to be launched in the coming years. The second investment was to construct a new injection solution plant as part of an extension to Wuxi site for producing over 30 million advanced drugs per year and a new hub for receiving and packaging drugs for the China Pacific region, including Thailand, Philippines, and Australia, as demand from these areas were growing. Sheena Behn, manager of Wuxi site, commented: *“You want a hub in the region because you want to be close to the countries you are serving. Geographically Shanghai port is the biggest in the world so you can move stuff around pretty easily.”* Further to the new hub, AZ also moved its production of active pharmaceutical ingredients from the UK to China as the standard of the Chinese site became world class (CBS News 2009). By end of year 2014, AZ has recorded over 1,500 patents with State Intellectual Property Office in China (SIPO, 2015). This third phase shows the greatest emphasis on knowledge-seeking alongside market- and efficiency-seeking objectives. This is in line with previous literature.

In summary of the three phases analysed above, Figure 1 below illustrates all key FDIs AZ has made between 1993 and 2014, where phase one can be characterised as mainly market and production oriented, phase two as partially the same to phase one and partially focuses on localised innovations, and phase three as mainly local to global innovation.

Figure 1. The Investment Pattern of AZ China between 1993 and 2014

Most critical development in knowledge seeking



7. Discussion: A Theoretical Interpretation of AZ Internationalisation of Innovation in China

6.1 The Three Distinctive Phases in China

In light of AZ China's operations over three subsequently distinctive phases, this section provides a theoretical discussion of the identified evolutionary process.

Phase One: The historical analysis of the initial stage of AZ's establishment in China reveals that the growing market size for expansion potential and the abundant availability of cheap labour for low-cost production offshoring were the initial reasons which led to AZ's first entry to the country. This is very much in line with the many established views on firms' motivations for FDIs in less developed economies (Dunning 1993, Johanson and Vahlne 1977). In comparison, the traditional theoretical view of innovation is that it never happens in the 'South' For instance, Porter (1989) and Vernon (1965) both argue for innovation at home or 'nearby' locations in order to maintain control and knowledge advantages. However, the later stage of Phase One shows a few different internationalisation activities undertaken by AZ which can be defined as R&D related adaptation and localisation. This can be argued to signal AZ's first ever investment made in a low-cost country for the purpose of any kind of innovation activities. In this case, the 'South', for the first time, has become a destination not only for market expansion and production offshoring but for R&D related activities though of low level. This in a way challenges the traditional view of Vernon (1965) and Porter (1989). The empirical finding is coherent with the view of Pearce (1999), Pearce and Papanastassiou (1997) and others. For example, Florida (1997) suggests that the non-innovation activities in a foreign location are the main reason behind internationalising some R&D activities. He argues that as production became internationalised, technical support and backup were required to be on-site in order to ensure timely problem-solving, hence, some internationalisation of innovation becomes mandatory. By the end of Phase One, an evolutionary process of AZ's internationalisation activities in an emerging economy starts to emerge, i.e., the 'North to South' wave of internationalisation of innovation (innovations from advanced economies to be adapted for the Chinese market).

Phase Two: The subsequent analysis of AZ's China operations during the second period reveals some further developments in terms of its innovation activities. While the firm continued to invest in non-innovation activities such as marketing, sales, distribution, and production in the country to increase growth and profits, which are very much in line with well-established theories including Casson (1992) and Buckley (2014), its investments in R&D activities in the country have increased more significantly in terms of intensity. This is strongly reflected in the changes of the types of innovations from the identified low-level adaptation in Phase One to more advanced testing and discovery of drugs for the local market as identified in Phase Two. For the very first time, advanced R&D is carried out in an emerging economy despite AZ's global presence in terms of knowledge sourcing. This newly identified development signals another important evolutionary step along the continuum of AZ China's internationalisation of innovations pattern: the 'North to South' wave (as per Phase One) is drifting towards the 'South to South' wave (Chinese innovation for the Chinese market). This finding corresponds to the works of Contractor et al. (2010), D'Agostino et al. (2013), and UNCTAD (2005).

This finding can be explained by Pearce et al (1992)'s work that MNEs internationalise innovation units on the basis of absence of local innovation competitors, as such a move allows firms to derive distinctive new product lines. This enables the firm to

initiate and focus on extending and deepening their innovation activities targeted at the local market. Thus, overseas innovation units are able to bring in local knowledge and design to satisfy the local niche market, which in turn creates further market development opportunities. This is especially beneficial for MNEs in large and growing markets where innovation units can help retaining a secure market share. This is confirmed in the case of AZ China where localised innovation has enabled the firm to be close to Chinese patients to understand the most prominent disease, conduct trials, and produce effective drugs. However, these works were developed in the traditional context of the 'North'. Therefore, the conventional wisdom regarding destinations for innovation FDIs, as supported by Arvanitis and Hollenstein (2011), Cantwell and Piscitello (2000), and Pearce and Papanastassiou (1997), is largely challenged for the first time in this study.

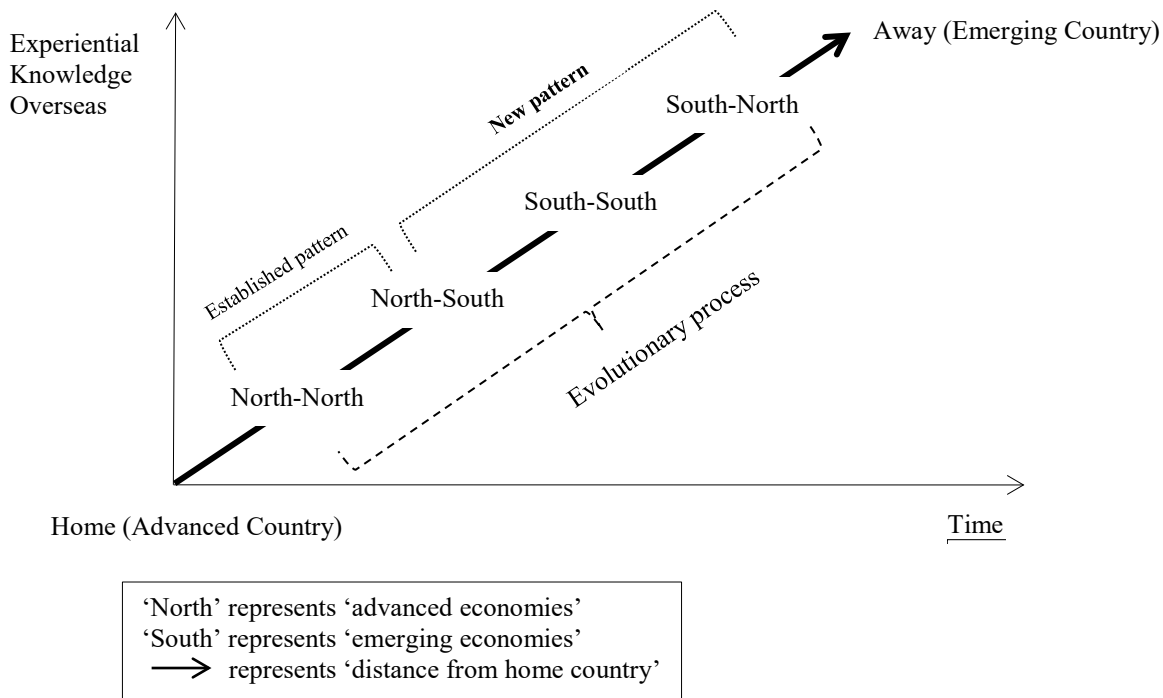
Phase Three: The analysis of Phase Three data indicates the most alarming development of AZ China to date. The findings suggest that apart from further investments to enlarge markets, production, and sales in China and Asia (where corporate Asian regional headquarters is established in China), AZ continued to deepen its involvement with local partners and in its own research centres for the advance research and discovery of breakthrough drugs for dealing with local diseases. The firm also intensifies its 'South to South' commitment by innovating not only for China but also for the Asian region. This finding continues to challenge the traditional view of internationalisation of innovation. Never-the-less, in Phase Three, the most significant development of the company in the country is the undertaking of world-leading R&D for the purpose of addressing knowledge gaps in drug discovery for some of the world's most complex and challenging diseases. The 'spell' is finally broken whereby the 'South' is no longer seen as solely in the receiving end of valuable knowledge transfer but a world class provider of strategic knowledge which can potentially determine an advance-economy firm's success for years to come. This finding is arguably one of the greatest criticisms of the long-established view on internationalisation of innovation (Arvanitis and Hollenstein 2011, Cantwell and Piscitello 2000, Contractor et al. 2010, D'Agostino et al. 2013, and Pearce and Papanastassiou (1997), as none of these studies have addressed the full extent to which innovation focused FDIs have evolved in an emerging economy as presented in this paper. It is evident that almost no research (to date) has empirically answered a similar call to this paper; hence, the significance of the findings from these three phases should be undervalued or taken lightly or down played.

6.2 The evolutionary pattern across the 'North' and 'South'

The theoretical discussions of the three specific phases evidence a progressive evolutionary pattern of AZ's innovation in China, from the early stage of 'North to South' focus, to 'South to South', and now 'South to North'. For the reasons behind the evolution in overseas innovation, Penner-Hahn (1998) and Ito and Wakasugi (2007) take the organizational learning perspective, derived from the evolutionary theory of Kogut (1988) and Kogut & Zander (1993), and suggests that firms initially tend to undertake low level investment in innovation activities until they learn enough to invest extensively in their foreign innovation activities. This is because sequential internationalisation process allows MNEs to learn about its new environment where they are able to obtain understanding of the nature of the research process and the national context in which the innovation takes place (Michell, Shaver, and Yeung 1994). Stopford and Wells (1972)'s earlier work, while not based on organizational learning paradigm, also suggest the gradual process of undertaking more intensive innovation activities as the MNE gains substantial knowledge of the local environment. This is exactly the case in the evolutionary process of AZ China

as the firm learnt about the market by first entering with sales and marketing and later production. When experience and knowledge provided confidence and reduced chances of failure, AZ China started to invest more in innovation. This conclusion is supported by the work of Li and Yue (2005) who identify that innovation in China goes through four types of stages from concentrated to dispersed research and development activities. Similarly, the empirical evidence from Sapelak and Ricalde (2008)'s work suggests that firms go through four patterns of R&D internationalisation, from internationalisation of basic R&D to advanced R&D. Hence, building on the case study of AZ China and in supporting of findings of UNCTAD (2005), Figure 2 below conceptualises the full extent to which AZ innovation has evolved in China during the period of 1993 – 2014 where a new pattern of internationalisation of innovation is suggested.

Figure 2. An Evolutionary Process for the Internationalisation of Innovation



8. Conclusions

The case of AZ's historical development with specific reference to the growth of innovation capability in China over two decades has revealed a new pattern of internationalisation. Although it may be argued that the internationalisation of innovation by MNEs to emerging economies, as indicated in the case of AZ China, is uncommon and too complex to be explained by existing theories which were developed in a different context, an assessment of this new phenomenon is needed to establish where the current theoretical paradigm is lacking in interpreting the new phenomenon. This paper challenges the traditional view ("North to North wave") by suggesting a number of incremental waves including "North to South", "South to South", and "South to North". The detailed case of AZ China has evidenced these new waves and highlighted how an emerging country can become an ideal location for innovation. It indicates that emerging economies are no longer the destinations for only market and cheap labour but have become increasingly important players in global innovation.

This paper makes a number of important and timely contributions. First, it is one of the first to challenge the conventional wisdom and investigate the possibility of emerging economies in offering innovation for the global market. Second, some of the existing theories which are built upon the traditional context are discussed in relation to the emerging economy context whereby support for an evolutionary process is found. Third, the most important contribution this paper makes is the conceptualisation of the four waves of internationalisation of innovation which began with 'North to North' (wave 1) and 'North to South' (wave 2) as the more accepted developments in existing literature, and gradually shifted towards 'South to South' (wave 3) and 'South to North' (wave 4), with the fourth one being the most recent and unconventional development of all.

Practically, the success of AZ China highlights the importance of time and experiential knowledge in understanding and deepening involvement in the local market. It also reveals the increasingly significant contributions emerging economies can make to the strategies and future competitiveness of knowledge-intensive companies. Whilst policy related weaknesses are still apparent, governmental support and availability of expertise and a fast-growing market are important considerations for locating R&D activities in the 'unconventional' regions.

There are some common limitations associated with case study. A single longitudinal case reflects the development of the chosen sample per se and therefore should always be very carefully considered in relation to others. It is likely that a second case may reveal a different picture to the narrative we provide in our paper, however, our initial objective was not to provide generalizable outcomes but to provide a contextually rich analysis of a particular case in light of the recent literature and emerged conceptual framework. Moreover, AZ's evolution is largely a response to the market maturation of the host country which can be viewed as a demand side challenge. To further our understanding of this important topic, it will be of great value if future research can be conducted to explore some of the key success factors to the internationalisation of innovation to and from the 'South'. It will also be insightful to investigate the implications of 'South to North' wave on MNEs, institutions, and countries, as this challenges everything we currently know about the internationalisation of innovation. Next, it would be interesting to see if AZ's evolutional model in China has been followed by other MNEs in China or other emerging markets. While we claim AZ's innovation strategy in China as part of its growth strategy in a host country is not an oddity or outlier, will other MNEs take this following the leader approach and adopt something similar in their engagement with the emerging markets? Lastly, while our earlier discussion acknowledges the different types of R&D units within the evolutionary process, we recommend further studies to formally assess the links in a systematic way to extend our knowledge on this important but complex phenomenon.

9. Reference

- Almeida, P. (1996) Knowledge sourcing by foreign multinationals: patent citation analysis in the U.S. semiconductor industry, *Strategic Management Journal*, 17, 155-165
- Anderson, T., Olson, J., and Sobelman, D. (2009) Assessment of the opportunities for pharmaceutical manufacturers in emerging markets, *Journal of Managed Care Pharmacy*, 15 (5), 396-402
- Archibugi, D. & Michie, J. (1995) The globalisation of technology: a new taxonomy, *Cambridge Journal of Economics*, 19 (1), 121-140
- Arvanitis, S. and H. Hollenstein (2011) How do different drivers of R&D investment in foreign locations affect domestic firm performance? an analysis based on Swiss panel micro data, *Industrial and Corporate Change*, 20 (2), 605-640
- Asia Pacific Biotech News (2001) *AstraZeneca Opens Its Biggest Asian Plant in China*, 5 (10), 179
- AstraZeneca China (2015) *AstraZeneca in China: Overview*, AstraZeneca Online, Accessed on 08/12/2014, Available at [www.astrazeneca.com/cn]
- AstraZeneca China (2015) *AstraZeneca China: Milestone*, AstraZeneca Online, Accessed on 08/11/2014, Available at [www.astrazeneca.com/cn]
- AstraZeneca China (2015) *AstraZeneca China: Key Research Facts*, AstraZeneca Online, Accessed on 24/11/2014, Available at [www.astrazeneca.com/cn]
- AstraZeneca Global (2003) *AstraZeneca Commits to Partnering with Innovative Educational Programme and Supporting China's Healthcare Reform over the Long Term*, AstraZeneca Online, Published on 03/12/2003, Available at [www.astrazeneca.com/media]
- AstraZeneca Global (2006) *AstraZeneca Announces \$100 Million R&D Investment in China*, AstraZeneca Online, Published on 26/05/2006, Available at [www.astrazeneca.com/media]
- AstraZeneca Global (2006) *AstraZeneca Licenses Rights for the Development and Commercialisation of Cubicin in China*, AstraZeneca Online, Published on 04/12/2006, Available at [www.astrazeneca.com/media]
- AstraZeneca Global (2007) *AstraZeneca Enhances Clinical Research Capabilities in China with First Clinical Pharmacology Unit*, AstraZeneca Online, Published on 04/09/2007, Available at [www.astrazeneca.com/media]

AstraZeneca Global (2010) *Public Believe China and India Set to Become World Leaders for Innovation*, AstraZeneca Online, Published on 06/12/2010, Available at [www.astrazeneca.com/research/news]

AstraZeneca Global (2011) *AstraZeneca Increases Investment in China with New \$200 Million Manufacturing Facility*, AstraZeneca Online, Published on 10/10/2011, Available at [www.astrazeneca.com/research/news]

AstraZeneca Global (2011) *AstraZeneca to Acquire Generics Company to Broaden Patient Access to Medicines in China*, AstraZeneca Online, Published on 08/12/2011, Available at [www.astrazeneca.com/research/news]

AstraZeneca Global (2014) *AstraZeneca and Tianjin Medical University Sign Cardiovascular Research Collaboration in China*, AstraZeneca Online, Published on 15/05/2014, Available at [www.astrazeneca.com/research/news]

AstraZeneca PLC (2000 – 2014) *Annual Reports*, AstraZeneca PLC Publications

Athreye, S. and Cantwell, J. (2007) *Creating competition?: Globalisation and the emergence of new technology producers*, *Research Policy*, 36 (2), 209-226

Aubert, J. (2004) *Promoting Innovation in Developing Countries: A Conceptual Framework*, World Bank Institute, July

Balachandra, R. (2004) *Outsourcing R&D*, *Working Paper for Institute for Global Innovation Management*, No. 05-004, North-eastern University: Boston

Bartlett, C. A., and S. Ghoshal. (1989) *Managing Across Borders: The Transnational Solution*, Harvard Business School Press: Boston

Bernstein Research (2009) *Global Pharmaceuticals: Emerging Markets Should Infuse Badly Needed Revenues for Years to Come*, Bernstein Global Wealth Management: Black Book, 99-104

Bloomberg Business (2014) *Xiaomi's Phones Have Conquered China. Now It's Aiming for the Rest of the World*, 04/06/2014

Buckley, P. J. (2014) *The Multinational Enterprise and the Emergence of the Global Factory*, Palgrave Macmillan: London

Buckley, P. J. and Casson, M. C. (1976) *The Future of the Multinational Enterprise*, London: Macmillan

Cantwell, J. (1995) *The globalisation of technology: what remains of the production cycle model*, *Cambridge Journal of Economics*, 19 (1), 155-174

Cantwell, J. and Janne, O. (1999) Technological globalisation and innovative centres: the role of corporate technological leadership and locational hierarchy, *Research Policy*, 28 (2-3), 119-144

Cantwell, J. A., and Mudambi, R. (2005) MNE competence-creating subsidiary mandates. *Strategic Management Journal*, 26(12), 1109-1128

Caves, R. E. (1982) *Multinational enterprise and Economic Analysis*, Cambridge University Press: Cambridge

Casson, M. (1992) *International Business and Global Integration: Empirical Studies*, The MacMillan Press Ltd: London

Contractor, F.J., Kumar, V. Kunduand, S.K. and Pedersen, T. (2010) Reconceptualising the firm in a world of outsourcing and offshoring: the organizational and geographical relocation of high-value company functions, *Journal of Management Studies*, 47(8), 1417-1433

CBS News (2009) *AstraZeneca Moves Drug Production to China, Begging Safety Questions for FDA*, Published on 27/11/2009, Available at [www.cbsnews.com]

Chandra, M. and Neelankavil, J. P. (2008) Product development and innovation for developing countries: potential and challenges, *Journal of Management Development*, 27 (10), 1017-1025

Chemical Market Reporter (2001) *AstraZeneca Opens Plant in China*, 259 (19), 14-15

Chemical Week (2007) *AstraZeneca Expands in India and China*, 04/04/2007

China Food and Drug Administration (n.d.) *Domestic and Imported Drug Database*, China Food and Drug Administration

China Statistical Yearbook (2014) *China Statistical Yearbook*, National Bureau of Statistics of China, China Statistics Press

Data Monitor (2005) *Pharmaceutical Industry Profile: China*, Data Monitor: London, 1-19

D'Agostino, L.M., Laursen, K. and Santangelo, G.D. (2013) The impact of R&D offshoring on the home knowledge production of OECD investing regions, *Journal of Economic Geography*, 13 (1), 145-175

Dunning, J. H. (1993) *Multinational Enterprises and the Global Economy*, Wokingham, Berkshire: Addison Wesley

Dunning, J.H. and Narula, R. (1995) The R&D activities of foreign firms in the United States, *International Studies of Management and Organisation*, 25 (1-2), 39-73

Ernst, D. (2002) Global production networks and the changing geography of innovation systems: implications for developing countries, *Economics of Innovation and New Technology*, 11 (6), 497-523

Eisenhardt, K. M. and Graebner, M. E. (2007) Theory building from cases: opportunities and challenges, *Academy of Management Journal*, 50 (1), 25-32

Firstword Pharma News (2002) AstraZeneca to open clinical research centre in Shanghai, Published on 26/11/2002, Available at [www.firstwordpharma.com]

Florida, R. (1997) The globalisation of R&D: results of a survey of foreign-affiliated R&D laboratories in the USA, *Research Policy*, 26, 85-103

Fu, X., Pietrobelli, C., and Soete, L. (2011) The role of foreign technology and indigenous innovation in the emerging economies: technological change and catching-up, *World Development*, 39 (7), 1204-1212.

Generic Drug Report (2012) AstraZeneca buys Chinese generics firm, *Chain Drug Review*, January, 73

Global Sourcing Now (2007) AstraZeneca partners with Peking University Hospital, *Global Sourcing Now*, 09/06/2007

Granstrand, O. Hakanson, L. & Sjolander, S. (1993) Internationalisation of R&D – a survey of some recent research, *Research Policy*, 22 (5-6), 413-430

Hakanson, L. (1992) Locational determinants of foreign R&D in Swedish multinationals, in Granstrand, O. Hakanson, L. & Sjolanders, S., *Technology Management and International Business: Internationalisation of R&D and Technology*, Wiley, Chichester

Hennart, J.F. (1988) A transaction costs theory of equity joint ventures, *Strategic Management Journal*, 9 (4), 361-374

Hobdari, B, Oladottir, A., Sinani, E., Papanastassiou, M. and Pearce , R.D. (2012) Strategic complexity and global expansion: an empirical study of newcomer multinational corporations from small economies, *Journal of World Business*, 47 (4), 686-695

Hymer, J. H. (1976) *The International Operations of National Firms: A Study of Direct Foreign Investment*, The MIT Press: London

Ito, B. and Wakasugi, R. (2007) What factors determine the mode of overseas R&D by multinationals? Empirical evidence, *Research Policy*, 36

Jha, S., Dhanaraj, C., and Krishnan, R. (2015) How does multinational R&D evolve in emerging markets? *Working Paper*, International Institute for Management Development, 2015-02

Jiangsu News (2008) AstraZeneca Sgned A New Contract with Wuxi, 11/08/2008

Jin, J., Wang, Y., Vanhaverbeke, W. (2014) Patterns of R&D internationalisation in developing countries: China as a case, *International Journal of Technology Management*, 64 (2-4), 276-302

Johanson, J. and Vahlne, J. (1977) The internationalisation process of the firm: A model of knowledge development and increasing foreign market commitments, *Journal of International Business Studies*, 8(1), 23-32

Kafouros, W.C., Piperopoulos, P. and Zhang, M. (2015) Academic collaborations and firm innovation performance in China: The role of region-specific institutions, *Research Policy*, 44 (3), 803-817

Kogut, B. (1988) Joint ventures: theoretical and empirical perspectives, *Strategic Management Journal*, 9(4), 319-332

Kogut, B. and Singh, H. (1988) The effect of national culture on the choice of entry mode, *Journal of International Business Studies*, 19(3), 411-432

Kogut, B. and Zander, U. (1993) Knowledge of the firm and the evolutionary theory of the multinational corporation, *Journal of International Business Studies*, 24 (4), 625-645

Knickerbocker, F. T. (1973) *Oligopolistic Reaction and the Multinational Enterprise*, Harvard University Press: Cambridge

KPMG (2011) *China's Pharmaceutical Industry – Poised for the Giant Leap*, KPMG Research: London, 1-98

Kuemmerle, W. (1997) Building effective R&D capabilities abroad, *Harvard Business Review*, March, 25-30

Lewin, A., Massini, S., and Peeters, C. (2009) Why are companies offshoring innovation? the emerging global race of talent, *Journal of International Business Strategy*, 40, 901-925

Li, J., and Kozhikode, R. K. (2009) Developing new innovation models: shifts in the innovation landscapes in emerging economies and implications for global R&D management. *Journal of International Management*, 15 (3), 328-339

Li, J. and Yue, D.R. (2005) Managing global research and development in China: patterns of R&D configuration and evolution, *Technology Analysis and Strategic Management*, 17 (3)

Liu, M., Chen, S. (2012) MNCs' offshore R&D networks in host country's regional innovation system: the case of Taiwan-based firms in China, *Research Policy*, 41 (6), 1107-1120

Madu, C. N. (1989) Transferring technology to developing countries—critical factors for success, *Long Range Planning*, 22 (4), 115–124

Mahmood, I. and Zheng, W. (2009) Whether and how: effects of international joint ventures on local innovation in an emerging economy, *Research Policy*, 38 (9), 1489-1503

McKinsey (2011) R&D strategies in emerging economies: McKinsey global survey results, *McKinsey Insights and Publications*, April

McMahon, D. and Thorsteinsdóttir, H. (2013) Pursuing endogenous high-tech innovation in developing countries: a look at regenerative medicine innovation in Brazil, China and India, *Research Policy*, 42 (4), 965-974

Ministry of Commerce, P.R.C. (2005) China investment guide: Sweden, *Invest in China Serials*, Investment Promotion Agency of Ministry of Commerce Publication

Ministry of Commerce, P.R.C. (2006) I am Jiangsu, *Invest in China Serials*, Investment Promotion Agency of Ministry of Commerce Publication

Ministry of Commerce, P.R.C. (2006) *Drug market: different strategies, same goal*, *Common News*, Ministry of Commerce Publication

Ministry of Commerce, P.R.C. (2006) *AstraZeneca to expand investment in China*, *Common News*, Ministry of Commerce Publication

Ministry of Commerce, P.R.C. (2007) *AstraZeneca China Innovation Centre settled at Zhangjiang High-tech Zone Shanghai*, *Common News*, Ministry of Commerce Publication

Ministry of Commerce, P.R.C. (2011) *AstraZeneca to build \$200-mln centre in China*, *Europe Report*, Ministry of Commerce Publication

Ministry of Commerce, P.R.C. (2014) *China Pharmaceutical Industry Investment Promotion Report*, Ministry of Commerce Publication

Mitchell, W., Shaver, J. M. and Yeung, B. (1994) Foreign entrant survival and foreign market share: Canadian companies' experience in United States medical sector markets, *Strategic Management Journal*, 15 (7), 555–567

OECD (2008) *OECD Reviews of Innovation Policy: China*, OECD Publication

OECD (2009) Different innovation strategies, different results: Brazil, Russia, India, China and Korea (the BRICKs), *Innovation and Growth: Chasing a Moving Frontier*, OECD Publication

OECD (2014) Science and Innovation in China, *OECD Science, Technology and Industry Outlook*, OECD Publication

Orr, G. and Roth, E. (2013) China's innovation engine picks up speed, *McKinsey Quarterly*, June

Patel, P. (1995) Localised production of technology for global markets, *Cambridge Journal of Economics*, 19 (1), 141-153

Patel, P. and Pavitt, K. (1991) Large firms in the production of the world's technology: An important case of 'non-globalisation', *Journal of International Business Studies*, 22 (1), 1-21

Patel, P. and Vega, M. (1999) Patterns of internationalisation of corporate technology: Location vs. home country advantages, *Research Policy*, 28 (2-3), 145-155

Pearce and Papanastassiou (1997) Global innovation strategies of MNEs and European integration: the role of regional R&D facilities, in Pearce (Ed.), *Global Competition and Technology*, St Martin's Press: New York, 123-52

Pearce, R.D. and Papanastassiou, M. (1999) Overseas R&D and the strategic evolution of MNEs: evidence from laboratories in the UK, *Research Policy*, 28, 23-41

Pearce, R. and Singh, S. (1992) *Globalizing Research and Development*, The MacMillan Press Ltd, London

Pederson, J. P. (2008) *International Directory of Company Histories*, St James Press, Chicago

Penner-Hahn, J. D. (1998) Firm and environmental influences on the mode and sequence of foreign research and development activities, *Strategic Management Journal*, 19 (2), 149-168

Pharma Times (2006) China Emerging as Clinical Research Hotspot, Published on 24/01/2006, Available at [www.pharmatimes.com]

Penner-Hahn, J.D. (1998) Firm and environmental influences on the mode and sequence of foreign research and development activities, *Strategic Management Journal*, 19(2) 149-168

Ponomariov, B. and Toivanen, H. (2014) Knowledge flows and bases in emerging economy innovation systems: Brazilian research 2005-2009, *Research Policy*, 43 (3), 588-596

Porter, M. E. (1990) *The Competitive Advantage of Nations*, Free Press, New York

Qu, Z., Huang, C., Zhang, M., and Zhao, Y. (2013) R&D offshoring, technology learning and R&D efforts of host country firms in emerging economies, *Research Policy*, 42 (2), 502-516

Ronstadt, R. (1977) *Research and Development Abroad by U.S. Multinationals*, Prager Publishers, USA

Ronstadt, R. C. (2001) International R&D: The Establishment and Evolution of Research and Development Abroad by Seven U.S. Multinationals, *Research Policy*, 9 (1), 7-24

Sapelak, A. and Ricalde, L.O. (2008) Market versus technology drive in R&D internationalisation: four different patterns of managing research and development, *R&D in Multinationals*, GEST-D-425, Solvay Business School

SIPO (2015) *Patent Database*, State Intellectual Property Office

Stopford, J. M. and Wells, I. T. (1972) *Managing the Multinational Enterprises*, Basic Books: New York

The Independent (1998) *Has Zeneca Chosen Wisely?* 11/12/1998

The Independent (1999) *Corporate Profile: The Arranged Marriage*, 24/02/1999

The Telegraph (2008) *ICI Finally Consigned to History*, 02/01/2008

The Telegraph (2010) *AstraZeneca Answers the Great Call of China*, 05/06/2010

The Telegraph (2010) *AstraZeneca is Well Placed for the Chinese Boom*, 06/06/2010

Thomson Reuters (2007) *AstraZeneca Agrees to Buy MedImmune*, 23/04/2007

Thomson Reuters (2010) *AstraZeneca CEO Sees China Growth Doubling*, 26/06/2010

Thomson Reuters (2011) *AstraZeneca and Chi-Med Enter into Global Collaboration to Co-develop and Commercialise Novel Cancer therapy*, Press Release 21/12/2011

Tsai, Y., Lin, J. and Kuerkova, L. (2009) Innovative R&D and optimal investment under uncertainty in high-tech industries: an implication for emerging economies, *Research Policy*, 38 (8), 1388-1395

UK Trade and Investment (2010) *Opportunities for British and Chinese businesses in science, research and innovation*, Department for Business, Innovation and Skills, Oral Statement to Parliament, published on 08/11/2010

UNCTAD (2005) *World Investment Report: Transnational Corporations and the Internationalisation of R&D*, United Nations: New York and Geneva

UNCTAD (2012) *Technology and Innovation Report*, United Nations: New York and Geneva

Vernon, R. (1966) International investment and international trade in the product cycle, *Quarterly Journal of Economics*, 80, 190-207

Wall Street Journal (2001) *AstraZeneca Invests \$100 Million in China Plant, Its Biggest in Asia*, 29/04/2001

Watkins,A., Papaioannou, T., Mugwagwa,J., Kale,D.(2015) National innovation systems and the intermediary role of industry associations in building institutional capacities for innovation in developing countries: a critical review of the literature, *Research Policy*, 44 (8), 1407-1418

Williams, O. E. (1985) *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*, The Free Press: New York

World Scientific (2003) *The Asia-Pacific Biotech Directory*, World Scientific Publications, New Jersey

Xu, D. and Shenkar, O. (2002) Institutional distance and the multinational enterprise, *The Academy of Management Review*, 27 (4), 608-618

Yamin, M, and Sinkovics, R. R. (2010) ICT deployment and resource-based power in multinational enterprises, *Futures*, 42 (9), 952-959

Yang, S. (2012) Pharmaceutical innovation: AstraZeneca's experience in China, *McKinsey Quarterly*, 1, 93-95

Yin, R. K. (2009) *Case Study Research: Design and Methods*, SAGE: London

Yu, S. (2011) *Information Technology in Multinational Corporations: The Managerial Role of Enterprise Resource Planning System in Headquarters-subsidiary Power Tussle and Local Performance*. LAP Lambert: Germany

Yu, J., Zhang, Y., Gao, P. (2014) Motivation and strategy: MNCs' embeddedness in China's standardization based innovation. *Telecommunications Policy*, 38 (10), 890-901

von Zedtwitz, M. and Gassmann, O. (2002) Market versus technology drive in R&D internationalization: four different patterns of managing research and development, *Research policy* 31 (4), 569-588

Zhang, S. and Pearce, R. P. (2011) *Multinationals in China: Business Strategy, Technology and Economic Development*, Palgrave Macmillan: London