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Regional innovation systems and the global location of innovation activities: Lessons from China

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Keywords: : R&D centres, MNCs, developing countries, China, Regional Innovation System

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Abstract

The global location of R&D centres by MNCs is a rather new phenomenon; especially when it comes to establishing R&D centres in developing countries. The existing and rather limited literature on globalization of innovation provides four possible explanations of why multinationals locate R&D departments in developing countries: reduce research costs, access large markets, tap into a large pool of qualified human resources or benefit from knowledge spillovers available in the local/regional system of innovation. The empirical research presented in this paper reveals that none of these arguments can fully explain the increasing location of R&D departments in China. The in-depth study of MNCs R&D centres in Beijing and Shanghai, China, reveals that specific aspects of market, technological and political uncertainty provide more adequate to explain the increasing presence of R&D labs from MNCs in developing countries such as China and thus calls for an integration in the regional innovation systems framework.

Regional innovation systems and the global location of innovation activities: Lessons from China

1. Introduction

Since IBM first established their wholly owned IBM Research facility in Beijing in 1995, well-known Multinational Corporations (MNCs) such as Intel, Microsoft, Nokia, Ericsson, SAP, Samsung and Matsushita started to set up their research labs and/or research and development (R&D) centres in China. Understanding why and how China, a developing country in terms of GDP, has been able to attract this form of knowledge-intensive FDI is the empirical purpose of this paper. The empirics are used to draw implications on how to conceptualize and integrate the emerging phenomenon of globalization of MNCs R&D centres in the regional innovation systems framework.

For several decades research on developing, emerging or transition countries has been the domain of development studies. The research focused initially on decoupling strategies and later on the implications of the Washington consensus on the degrees of freedom of developing countries in choosing their own development trajectories. In this context, multinational corporations were either conceptualized as agents that exploited the developing countries or as agents that *could,* under certain conditions stimulate growth and development through the transfer of capital, knowledge and technology to the indigenous industry. Independently of the approach taken, the general understanding was that developing countries were, at best, followers or imitators. That is, even the successful countries, such as Korea, based their catching up strategies on exploiting their laggard advantages and learning through reproducing (reverse engineering) what the industrialized world had already developed (Hobday, 1995). The literature that emerged from the analysis of these successful cases, primarily focused on the role of central governments in fostering – and to a minor degree hampering – this process.

However, this dominant conceptualization has been recently challenged. The last decades have witnessed a rapid growth of certain industries and regions in developing countries, particularly in China and India, which are quickly moving from low-cost production sites to knowledge-intensive centres attracting a large proportion of R&D FDI which was previously canalised to developed countries (Unctad 2005). Innovation (as opposed to imitation) and regions (as opposed to nation

states) have emerged as central drivers for the indigenous firms to take advantages of the windows of opportunities opened by economic globalization. This has spurred a lively debate on how to conceptualize these new transformations, giving the limitations of existing literature.

Research applying the Regional Innovation Systems-approach (henceforth, RIS) has contributed significantly to this rapidly growing stream of research, trying to understand the role of regions as knowledge hubs in the global economy (Chaminade and Vang, 2006a). Hitherto, most attention has been dedicated to the role of MNCs as facilitators of knowledge and technology for production and the potential spillovers to the local or indigenous firms (i.e. incremental innovations) and the role of the RIS supporting the accumulation of capabilities at regional level. The pioneering research on globalization of innovation and RIS has propelled five complementary and/or competing explanations to why MNCs relocate or establish R&D centres in developing countries. The early studies conducted by Reddy during the nineties (Reddy, 1997) emphasized – based on studies of India – the oversupply of technical skills and possibility for MNCs to reduce the costs of research by relocating or establishing R&D centres in developing countries. Later on, the 'older' Reddy (2000) – looking to Singapore's development experience – included the increased importance of science-based innovations and thus the oversupply of cheap scientists (as opposed to technicians mainly) and again the derived cost advantages. Reddy's arguments were challenged by Amsden and Tschang (2001, 2003) who, in their seminal work illustrate for the case of Singapore as well that the Singaporean case could not only be explained by cost issues or the oversupply of scientists but rather by the specific innovation policies that the government put in place, thus highlighting the role of the government. Chaminade and Vang (2006a) depart from the oversupply thesis but add the time dimension to highlight that the factors explaining how regions move from being providers of standard goods and services to become innovators change over time. They emphasize the role of the local-global linkages facilitating interacting learning and the accumulation of competences over time, and in co-evolution with the strategies of the firms located in the region. Finally, a fifth stream of literature, in international business studies draws attention to the importance of the (size of) the local market and the need to adapt to local standards, customs and tastes in the decision to locate an R&D department in another region (not particularly a developing country region).

This research has provided valuable insights into the increasing role of innovation in growth in developing countries, providing detailed case studies (and occasionally quantitative evidence). Based on an exploratory study of the motives and determinants for MNCs to relocate or establish

R&D centres in Beijing and Shanghai, China, this paper attempts to test if the aforementioned factors can explain the increasing presence of MNCs R&D labs in two regions in China. It concludes that the five explanations provided in the literature do not seem to be completely relevant in the Chinese case. The analysis suggests that market uncertainty (product standards, and uncertainty about classes of consumers and local competitors' strategies in coping with these), technology uncertainty specific to the country context and political uncertainty are much important factors shaping MNCs decisions to locate R&D centres in regions in developing countries. The paper is based original data collected by one of the authors through a combination of surveys, semi-structured interviews with 33 MNCs R&D centres (not headquarters) in the ICT industry in Beijing and Shanghai (see details in the methodological section below) in 2002.

The paper is structured as follows. First, we introduce RIS and the current research on the MNCs' location choices concerning establishing R&D centres in developing countries while highlighting the central omissions in the dominant framework and empirical research. This is followed by a methodological section describing how the data was collected and the introduction to the case. Thirdly, we turn to the case. The case starts with providing some stylized facts about the two regions and it is followed by and in-depth analysis of the (different) motives and determinants behind MNCs location of R&D centres in Beijing and Shanghai. The paper is rounded off with a concluding section that inserts the case-based findings in the more general literature.

2. Understanding the location of MNCs R&D labs in developing countries

As indicated in the introduction, the global location of R&D departments has a strong regional component. Certain regions have been able to rapidly accumulate capabilities and attract global R&D flows. The research on Regional Innovation Systems (RIS) has long tried to understand the innovation dynamics at a local or regional level. The purpose of this section is to introduce the concept of RIS while focusing on and underscoring the limited conceptual relevancy and empirical contribution of RIS in explaining why MNCs locate R&D centres in certain regions and extending it by incorporating some additional explanations provided by other streams of literature. This provides the point of departure for final re-conceptualization of RIS.

2.1. Regional innovation systems and the motivations for MNCs to locate R&D departments in developing countries. Possibilities and constrains

Regional innovation systems can be defined as "constellation of industrial clusters surrounded by innovation supporting organizations" (Asheim and Coenen, 2005). There are basically two types of actors whose interactions shape the functioning on the RIS. First, the companies in a region's main industrial clusters, including their customers and suppliers which represent the production component of the regional innovation system or the knowledge exploitation subsystem (Porter, 1998; Pietrobelli and Rabellotti, 2004; for a critique, see Martin and Sunley, 2003). Second, the research and higher education institutes (universities, technical colleges, and R&D institutes), technology transfer agencies, vocational training organizations, business associations, finance institutions, etc which represent the knowledge exploration subsystem and the business support subsystem (Asheim and Coenen, 2005)[1]

RIS research has long stressed the endogenous factors associated with localized growth such as local learning, local spillovers or knowledge dissemination throughout the local networks in which indigenous firms are engaged. These endogenous factors have been used to explain how regions and firms upgrade. More recently this almost exclusive focus on the endogenous factors has been substituted by a growing interest in the intersection between local and non-local/global agents. This local-global interaction is even more relevant for developing countries. The attention has been however mainly on what regional-global conditions facilitate or hamper the upgrading of indigenous firms in developing countries to higher value activities in global value chains. Despite an increased interest on the intersection of the strategic coupling between the region and indigenous firms on the one hand, and MNCs on the other, the literature is almost devoid of suggestions as to when or why MNCs decide to relocate or establish an R&D centre in a certain region in a developing country.

[1] The inclusion of the second type of actors represents a main difference from traditional cluster studies in developing countries. Universities and other knowledge providers are considered crucial in correcting or changing systemic failures in clusters which might prevent them from upgrading or engaging in radical innovations. Traditional industrial districts and clusters research is more concerned with the propensities in local systems that support incremental innovations, thus 'Schumpeterian' systems failures are not theorized.

2.1.1. What RIS brings: the importance of interactive learning, proximity and social capital

RIS main focus of attention has traditionally been the upgrading of the – often small and medium size - indigenous firms. The RIS literature claims that upgrading is only possible when there is an environment (i.e. institutional setting) that supports *interactive learning* and innovation (Malmberg and Maskell, 2004; Maskell, 2004; Marshall, 1920; Piore and Sabel, 1984). *Interactive learning* is defined as the acquisition of knowledge and competences through interactive collaboration with firms and knowledge providers.

Scholars in the RIS tradition argue that interactive learning benefits from *physical proximity* (Gertler 1995; Morgan 2004) as physical proximity is considered pivotal in the emergence of the cognitive social capital (for a critique, see Amin and Cohendet 2005). Physical proximity implies that the firms are embedded in the same institutional setting and thus share certain norms, conventions and mindsets. Hence, a shared institutional setting facilitates the transmission of complex tacit knowledge needed for innovation. As opposed to the externalities that might emerge by the simple co-location of firms in related activities in one region (Marshall, 1920), the deliberate cooperation between actors leads to interactive learning and increased innovation (Nadvi and Schmitz, 1999; Schmitz, 1995).

Interactive learning is considered a function of the soft infrastructure (increase qualification of the human resources, organizational capital and inclusive *social capital*) (Chaminade and Vang 2006a and 2006b, Lundvall et al 2006, Fukuyama 1995, Bourdieu 1983, Coleman 1988). "Social capital refers to the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions. Social capital is not just the sum of the institutions which underpin a society – it is the glue that holds them together" (World Bank 1998, Portes, 1998). Social capital refers both to "structural social capital" and "cognitive social capital" (World Bank 2002). Structural social capital refers to "relatively objective and externally observable social structures, such as networks, associations, and institutions, and the rules and procedures they embody. Cognitive social capital comprises "more subjective and intangible elements such as generally accepted attitudes and norms of behaviour, shared values, reciprocity, and trust[2]. The literature argues that

[2] Although these two forms of social capital are mutually reinforcing, one can exist without the other. Government-

unless there is a high degree of generalized social capital (i.e. non-discriminating social capital) and a high degree of absorptive capacity cooperation, communication and thus interactive learning is usually limited (Nooteboom, 2000). In the absence of trust, the fear of opportunistic behavior will prevent the exchange of valuable knowledge (Fukuyama 1995, Putnam, 1993, Maskell, 2000, Lundvall 2002).

2.1.2. Is this enough to explain why MNCs might be attracted to certain regions to locate their R&D labs?

Arguably, the aforementioned arguments on the importance of interactive learning, proximity and social capital for the upgrading and growth of firms located in a certain regions is of limited relevance when trying to understand why MNCs locate R&D departments in a certain region.

First, MNCs are very different from indigenous SMEs. SMEs external relations are more confined to the region than those of large firms (Asheim et al., 2003; Cooke and Morgan, 1998). One of the reasons for this is that SMEs are more dependent on complex, tacit knowledge and less capable of searching for and using codified knowledge. This forces them to rely more on personal ways of transferring (tacit) knowledge and on learning-by-doing and interacting as opposed to relying on globalized (and more codified) modes for knowledge acquisition. However, MNCs are not confined to local search and are more capable of tapping into the global sources of codified knowledge (see Reddy 2000) or in their own in-house sources of knowledge. In Bangalore, for example, some MNCs, have established their own training and research centres to compensate for the scarcity of qualified human capital and research capabilities. This makes them less dependent of the local environment and local interactions than, for instance, the local SMEs.

Second, none of the recent countries attracting MNCs R&D centres – India and China – are characterized by a high degree of trust (Asheim and Vang 2007, Vang and Asheim 2007, Chen 2008a, 2008b), thus questioning the importance of social capital for MNCs. For example, some of the most successful regions in attracting global R&D such as Bangalore, show very low levels of social capital and interactions with other local firms does not seem to have had a major impact on the location of R&D labs by MNCs in the region (Chaminade and Vang, 2006a and 2006b). The (lack of) importance of trust for MNCs can be partly explained by the power over the value chains

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mandated organizations represent structural social capital in which the cognitive element is not necessarily present.

the MNCs posses. Power over value chains makes MNCs less vulnerable to opportunistic behaviour. In addition, MNCs can often modularize their R&D and keep central critical dimension outside the reach of the indigenous firms. This further supporting that they are less likely to become victims of opportunistic behaviour.

Thus, RIS arguments on the importance of engaging in interactive learning with local firms (suppliers, competitors, etc) or local sources of knowledge (universities or research centres) seem to be limited to explain why MNCs would locate R&D labs in regions in developing countries. Other streams of literature might provide some alternative explanations.

2.2. Extending the RIS framework – the contribution of international business literature

As suggested by Reddy the access to a surplus of relevant human capital has become over time a crucial factor attracting MNCs R&D centres to developing countries. Based on his analysis of MNC R&D investment in India, Reddy (1997, 2000) concludes that there are four waves of R&D globalization. In the first wave (up to 1960), MNCs globalize their R&D to enter local markets abroad. In the second wave (in the 1970s), they do so to build market share in the local markets aboard. In the third wave (in the 1980s), they are driven by the need for worldwide learning and new technology inputs. In the fourth wave, they are aiming at accessing cheap and highly skilled R&D personnel and lowering R&D cost. In his later work Reddy (Reddy, 2000) compares the MNC R&D investment in India and Singapore. He stands by his original argument that "huge reservoirs" of scientists and engineers are the pull factors for the location of MNC R&D centres. However, he also discovers that the technology level involved is more complex than merely the assumed low-end routine software decoding capabilities. He argues that some new technologies are more prone to go global because they are closer to basic science. The best example is the research in pharmaceuticals, chemicals, microelectronics, biotechnology and new materials, which have become more science-based and research-intensive. He goes on to argue that the increasing role of scientific knowledge in major technological developments increases the number of fields relevant to innovation and thereby the necessity for companies to depend on external sources, especially the academic system, for basic science-based knowledge inputs.

This is in line with studies on international business that consider production and innovation as more dynamic processes. They argue that during the earlier periods of global expansion (the

1960s and 70s), MNCs build up foreign sales and manufacturing operations in foreign countries. In later phases (the late 1970s & early 1980s), efforts are directed toward supporting foreign subsidiaries with limited complementary design and engineering capabilities, in order to adopt product and process technology to host countries. Since the mid-1980s however, there has been a clear third tendency towards strengthening R&D in foreign locations, resulting in a new pattern of trans-national flow of innovation. Large MNCs increasingly extend or diversify their field of technological competence through their use of internationally integrated networks for technological development. In each location, MNCs' integrated networks tap into specialized sources of local expertise. In other words, MNCs reach out to different places for the most competent version of each needed complementary technology.

This argument of the oversupply of scientists could be adequate for some developing countries. Despite the fact that some developing countries are not highly industrialized, they have internationally reputed academic establishments, such as India and China. The proximity of new technologies to basic science allows MNCs to utilize the talents in such academic establishments in developing countries for their R&D requirements either by sponsoring research, subcontracting R&D, or through research collaboration. For such R&D functions in new technologies, pure basic scientists and even theoretically trained personnel with little or no industrial experience can be employed. However, among the two countries in Reddy's research, 2000, only India has this special "over-supply of skilled labour" phenomenon. Singapore has always lacked sufficient skilled labour. They actually had to liberalize their immigration policy to import skilled labour from other Asian countries. Therefore, the premise of over-supply of skilled labour can not be applied to developing countries in general. Rather, it is a special case in a handful of large developing countries.

An alternative explanation is provided by Amsden and Tschang (2003). In their analysis of Singapore, the authors point out to the major role of the pro-business Singaporean government policy, that included services provided by the government labs; protection of IP and financial incentives[3]. Subsidies for training personnel in the firms address their shortage of skilled labor. Services address their design-cum-manufacturing problems associated with incrementally improving products. What is more interesting is that they find from their interviews with MNCs that

[3] For every US dollar invested in R&D by a MNC, the Singapore government invests roughly 30 cents.

wage is rarely mentioned as a motive for localization of R&D in Singapore. Thus, the cost of the skilled labour did not seem to be an important issue either for the location of R&D in Singapore.

Finally, the most traditional streams of literature on international business, have long stressed the importance of accessing local markets. While this might be a classical relevant argument to explain the location of production facilities, it doesn't seem to be so relevant to explain the location of R&D activities, unless some other considerations are taken into account (such as the quality of the market or the degree of technical sophistication of the local customers). As we will argue later, this will become crucial in the Chinese case.

The extent to which the previous arguments (the importance of local linkages -access to local suppliers or other local firms, access to local universities-; of accessing R&D personnel; of reducing R&D costs; of benefiting from local government incentives or of accessing the market) hold true to explain the location of MNCs R&D labs in China, will be analysed in the next section.

3. Understanding the location of MNCs R&D departments in China

3.1. Data collection

This section introduces the methods used for identifying the motives and determinants of the MNCs in relocating or establishing R&D centres in China[4]. Data was collected through a survey followed by semi-structured interviews with selected key actors in Shanghai and Beijing.

The *survey* targeted selected companies and aimed to understand the significance of Beijing and Shanghai in the global innovation strategy of the company. The survey was conducted with the help of a local IT magazine – CEO and CIO China (www.ceocio.com.cn). From all identified MNCs R&D centres in IT sectors, around 33 were included in the survey. The survey took place in 2002. The survey had three main purposes. Firstly, to identify the specific nature of the research activity carried out in these MNCs R&D centres in China, as compared to their R&D centres in other countries to determine whether they are production or process innovation related[5]. Secondly, to

[4] Data was collected by one of the authors (Yun Chen) as part of his doctoral studies at Berkeley University, US under the supervision of Prof. M. Storper (see Chen, 2005 for the full dissertation)

[5] For example, Intel's Speech Technology research group was most likely involved in product innovation, because it is the only research group among Intel's global R&D network that develops next-generation Human-Computer Interface.

enquire on the main reasons for the location decision of MNC R&D centres in China (rather than other countries), and particularly the reasons behind a decision to locate in Beijing or Shanghai. Thirdly, to understand the interaction of MNCs with local universities.

The survey was followed by *semi-structured interviews* focused on the R&D activities of MNCs and their collaborators such as joint-research labs in the universities. The director, R&D manager or team leader and the engineers currently or previously working in the centre were interviewed. The interviews were also useful to follow up on some of the issues identified during the survey. The second group of interviewees were the major officials in innovation-related agencies, think-tanks and mayor's offices. They were enquired about their visions and strategies of innovation governance. The third group of interviewees were the key agents who participate in this knowledge-economy building, including professors and students in local universities and research institutes who participate in incubators, university-affiliated technology firms, technology-transfer offices, and human resource offices.

The information collected through the survey and the semi-structured interviews was triangulated with a throughout analysis of existing documents about all the above mentioned firms and institutions, such as corporate annual reports, company news, company journals, reports and presentations, news, critiques, evaluations and reports on university-run high-tech park projects, incubator projects, operation of technology transfer offices, university enterprises, joint research labs of MNCs and alumni networks and on the role of the public and semi-public institutions like the city science committee, the technology exchange agency, the technology transfer promotion center, the national science park authority and the city science park authority.

Next section reports the findings on the reasons why MNC relocate or establish R&D centres in China. The section starts by introducing some stylized facts about the two regions included which is followed by the analysis of the results of the survey and the interviews.

3.2. Stylized facts

China displays a super-normal concentration of regional assets in a few regions. Their ability to create regional assets and exploit assets formed in previous periods was initially the consequence of Deng's market reforms in the early 1980's (for details see Chen 2004). Beijing and Shanghai are the two most important regions in the national hierarchy of RIS (albeit none of them actually

qualify as fully fledged regional innovation systems (Vang and Asheim 2006, Chen 2006)). These two cities have a high concentration of universities, public research institutes, state owned enterprises (SOEs) and public agencies from both the city and the central government. The elites trained in the best universities in these two cities often compete to stay in the work units in the central and city governments in Beijing or the city government in Shanghai because of prestige and better welfare and the proximity to better schools for their kids. The two city-regions became attracting poles of talents as soon as the old restrictive labour mobility systems were abandoned (Chen, 2004) thus gradually accumulating a pool of skilled labour in both regions.

In addition, Shanghai and, to a lesser extent, Beijing have relatively capable city managers. Beijing and Shanghai can cash in on their proximity to the central government to dash forward after a late start in the early 1990s, 10 years after the open door policies were launched in southern China. By recapitalizing their "public assets," such as the privatization of 100% public owned urban land though land leasing, they were able to gain enormous land rent to modernize their urban infrastructure in the shortest possible time. Because of their late start, Beijing and Shanghai has to do more than just another FDI city. Thus, they began their quest to become "proxy global cities" (PBC). PBC 'status' is considered crucial to attract and retain returnee Chinese (including the Chinese diaspora) and foreign managers. The concentration of highly selected assets nurtured at the expense of the unskilled migrant labours – they were not allowed to migrate to the regions earlier - allow these cities to become a magnet to high value added FDI in the service sectors in the mid 1990s. R&D centres, often categorized as one of the most desirable service sector, have become another real and imagined commodity in the marketing plans of the mayor offices in the new century.

3.3 Results of the survey

The survey covered 33 R&D centres belonging to 17 MNCs. The majority of the MNCs have their HQ in the U.S. (11 out of 17). Other nationalities include 2 MNCs from Japan and 1 MNC each from Finland, Sweden and Korea. U.S. firms are highly represented in this survey because they dominate this new form of knowledge intensive FDI in China. The other reason is accessibility. Major employees from the U.S. based R&D centres are more willing to speak to scholars and the media partly because most of them are Chinese returnees who are more willing to entertain the curious (or sceptical) Chinese public through the media or the scholars.

Broadly speaking, all of them belong to the IT sector, except one from industrial machinery. Most of them are in the telecommunication hardware sector, which include 5 MNCs in cellphone infrastructure and 2 MNCs in optical networking. The rest are in computer hardware (3), business software (2), semiconductor manufacturing (2), measuring equipment (1) and industrial machinery (1). As China is becoming the largest cell phone market in the world, all major cellphone equipment companies have lined up their factory, distribution networks, after-sales service, and eventually R&D centres in China since the late 1990s. The study included 27 hardware R&D centres and almost all engage in different levels of software development. Due to the increasing weight of embedded software in hardware design, many MNCs are locating their software R&D centres in China. In fact, 7 out of 27 are exclusively embedded software centres. There are 19 individual R&D centres located in Beijing, 12 in Shanghai and 2 in Hangzhou. Most of the ones established earlier are located in Beijing. Shanghai began to gain momentum since 2000 mainly due to the continuing agglomeration of IT hardware manufacturing clusters in the Shanghai city-region since the mid 1990s. Yet, an attractive place does not in itself explain the fundamental reasons for why MNCs locate R&D centres in developing countries.

Table 1 summarises the importance given by the MNCs to different explanations of why they were locating their R&D lab in Beijing or Shanghai. The firms were asked to indicate the degree of importance of each motivation, from 1 (not important at all) to 4 (extremely important). The last column indicates the rank of that specific motivation attending to the average response. Two are the most important conclusions that can be extracted from Table 1:

Firstly, the most important reasons for the MNCs to locate R&D departments in China refer to the access to the Chinese market and the reduction of costs and R&D cycle. These, as argued in the previous section, are the most traditional arguments for the internationalization of production and, as this research conclude, also for the internationalization of R&D. Indeed, while lowering production cost is the prominent explanation that turned developing countries – especially China - into a world factory, increasingly, there is recognition that local market penetration is an even more important reason behind the motive of FDI in emerging markets such as China. Shatz and Venables (2000: 142) claim that "on average, affiliates in developing countries sell a majority of their output in their host economies." Therefore, one could argue that the access to the local market is undoubtedly the predominant reason behind the location of MNCs not only in China, but also in developed economies and developing countries. And that also refers to R&D-related activities.

TABLE 1 MOTIVATION OF SETTING UP R&D CENTERS IN CHINA

Motivation	**Average**	**Ranks**
1. Functioning of the RIS		
Better access to local universities and research institutes	*2.67*	*4*
Support local suppliers/vendors	*2.40*	*7*
Support local production	*2.38*	*8*
Better incentives by local government	*2.14*	*12*
2. Access to qualified human capital (scientists) and related assets		
Access to better R&D personnel with basic research skills	*2.41*	*6*
Access better R&D with applied research skills	*2.33*	*10*
Better access to technology information	*1.62*	*14*
3. Government incentives		
Better access to new policy information	*2.31*	*11*
Better access to central government key agencies & key officials	*1.74*	*13*
4. Cost reduction & related		
Reduction of R&D cost	*2.78*	*3*
Reduction of R&D cycle time	*2.81*	*2*
5. Access to markets		
Close to the Chinese Market	*3.05*	*1*
Better access to market information	*2.35*	*9*
6. Other		
Generate a better public image	*2.53*	*5*

Source: Survey by Chen (2004).

Second, despite the access to the local market is the most important adduced reason, none of the listed motivations was considered to be extremely important in explaining the location of the R&D in Shanghai or Beijing (average close to 4). The in-depth interviews maintained with key managers of the MNCs, revealed that some other aspects should be taken into account. They refer to market, technological and political uncertainties, which are discussed in the following section.

3.4. Finding alternative explanations – the results of the interviews

The in-depth interviews undertaken on-site in eight MNCs (Chen, 2004) revealed that the thrust of the argument as to why MNCs locate R&D centres in China – Beijing and Shanghai – has to do with the multiple uncertainties embedded within the large and emergent Chinese market that go beyond the aforementioned alternative explanations (such as the market size). These are uncertainties caused by (1) the fierce competition from the local firms (market uncertainties), (2) the competition for the technological standards (technological uncertainties), and (3) the state

intervention in controlling market access (political uncertainties). Thus, the localization of R&D centres is driven by all of the three uncertainties (yet, political uncertainty is only relevant when other factors suggest that the MNCs should locate an R&D centre in the country/region).

3.4.1. Market uncertainty

According to the interviewees, market uncertainties in China are the result of the unusual demand of Chinese urban consumers for the latest high-tech products. MNCs strategies to dump older models on the Chinese market in order to compete on price or to mainly adapt earlier models to the supposedly 'primitive' consumers in developing countries, failed completely. Chinese consumers have unusually high demand for the "newest" and "latest" technology for any given product. They just would not trade off between the price and technology. They want both. For example, the DVD player almost wiped out the VCR after it hit the Chinese market in the 1990s, because of this unexpected demand for "high-tech" goods. Hence, the assumption that a developing country will start off consuming inferior and cheaper products which are obsolete in the developed market (such as the VCR) and upgrade to higher-end products later (such as the DVD), was proven to be wrong, hence MNCs needed to locate R&D labs that could target the specific market preferences and developed technological advanced products for the local market. This was only possible locating R&D labs close to the final consumer.

The need to be present on the local market is further accentuated by the fierce competition from local firms on price and short production cycles. Many MNCs realize the imperative to reintegrate R&D, production, distribution, sales and services in China. Consequently, the market-driven and production-driven R&D centres have to be set up in China to integrate production and sales networks. This is considered the only way to speed up flexible production and gear up competition on high-end products with other foreign MNC rivals, and on low to medium end products with the local Chinese competitors. As a result, almost all the major brand name producers which were interviewed, Motorola, Ericsson, Nokia, Nortel, Samsung, Matsushita, Alcatel, Philips, NEC, Lucent Technologies as well as other communication MNCs, have all set up their R&D centres in China to support their design, production and sales as well as their suppliers and vendors.

3.4.2. Technological uncertainty

By technological uncertainties we refer to both technological standard setting and betting on future technologies for the Chinese market. The former form attracts advanced applied R&D centres while the later form attracts the basic research labs to China in order to compete directly with other MNCs, local firms and leading public research labs.

In the technological standard setting competition in many sectors, many large MNCs have to compete for market share in order to use their market share as a bargaining chip to tilt the standard to their favour. The competition in the Communications sector regarding standard setting is not new. It is a global phenomenon. What is new is that the fight in other continents already have obvious winners and losers (like CDMA2000 in the US, WCDMA in Europe), but in large emerging markets like China, the competition has just begun. Turf fights between China telecom and local broadcasting agencies in the provision of telephone service exert extra uncertainties in the future of the regional market. For example, even though China has entered the WTO, the national firms' monopoly over the telecommunication service sectors will still enjoy 3-6 years of monopoly. Even after the "official" end of monopoly in 2008, most likely, MNCs will still encounter bureaucratic and technical delaying in opening up this monopolized market. Therefore, lobbying for "non-market" special contracts and preferential policies are crucial for their competition in this new market. This is the biggest challenge any telecommunications MNCs face in China. Setting up R&D centres is the first step to show the MNCs long-term commitment in technology transfer. The importance of setting the standards can be illustrated by looking at the 3G standard setting process in China. The Chinese government 3G standard, the so called TD-SCDMA standard, was the most under researched standard at the time when it won the recognition as the third international standard in 2001. Many MNCs tried many ways to "kill" the Chinese government's desire for using their own standard. For example, the WCDMA league led by Nokia proposed a low 3G license fee of 5% per cell phone in order to rally the Chinese service providers on their side in order to bargain with the Chinese government. The attempts failed. MNCs rushed to set up their TD-SCDMA research team in China or they form joint ventures with the Chinese firms in order to develop TD-SCDMA based products before the opening of the 3G cell phone market took place in June of 2005 (now continue to delay to give more time for TD-SCDMA technology to mature). The competencies in these standards were also not developed in the HQ R&D centres as they were initially considered inferior. Hence the specificities of the standard and the standard setting procedure influence the MNCs decision to establish or relocate and R&D centre.

In betting on future technology for the Chinese market, MNCs are locating their basic research labs in China in order to explore new research domains while the windows of opportunity are still wide open. One of the technologies that almost all MNC basic research teams in China are focusing on is speech technology. This is a very complex technology domain that requires long-term research investment and close collaboration with the Chinese Academy of Science; the largest public research institute) (CAS) labs and top university labs. Chinese labs might have some preliminary research in this area. The whole research domain intensifies in China due to the rush of five to six MNC research teams into the picture. The competition and collaboration in this future technology domain have resulted in the rapid accumulation of this technology domain in unprecedented pace, putting China in the forefront of this technology in the world even with its late start.

3.4.3. Political uncertainty

The political uncertainties are tricky in China and hold implications for MNCs location strategies. They refer to the explicit but unwritten "market for technology" policies that "forced" many large MNCs to set up R&D centres in China in exchange for market access. However, the interviewees indicated that the political uncertainty can be considered more like the last extra weight in favouring the final decision to locate R&D in China, once that the MNCs discover the advantages of setting up R&D centres in China - that is, the ability to minimize the other two uncertainties – market and technology uncertainties.

For example, Motorola was the only foreign company together with the other 17 local companies to be granted a CDMA cell phone market license in 2001. If Motorola did not set up its cell phone R&D centre in Beijing to engage in the CDMA product innovation and the testing of the CDMA system in a few cities, it would not have passed even the basic requirement for a market access license. Thus, the market access license should be regarded as a reward for their "political commitment to more technology transfer" (from the bureaucrat's point of view), and their first mover advantage of setting up an R&D centre ahead of other foreign competitors.

4. Concluding remarks – rethinking the RIS framework

Unless extended, the Regional Innovation System (RIS) approach seems to be inadequate as a theoretical and analytical approach for understanding the globalization of innovation activities

(represented by MNCs R&D centres). Some regions in the world economy are becoming (or arguably have become) global knowledge hubs and their strategy is partly based on attracting an increasing proportion of global R&D FDI investments. This is clearly the case for Shanghai and Beijing. Yet, the RIS approach has been almost exclusively focused on the local conditions that support upgrading in indigenous firms, hence neglecting almost completely the role of local conditions attracting R&D sites from MNCs. While RIS implicitly incorporates most of the elements that other alternative streams of literature provide, such as the importance of scientists and engineers (implicitly in the knowledge exploitation subsystem), the role of the government, the importance of the institutional framework etc, the approach needs to be lifted up and extended to be fully comprehensible to explain why MNCs might locate R&D departments in certain RIS in developing countries.

For example, the role of the government in the RIS might be significantly different if the purpose is to stimulate upgrading of the indigenous firms or attracting and retaining MNCs R&D activities. While in the first case, the focus might be on developing local capabilities and providing support services and financial support for the local business, in the second case the focus might be more on the institutional conditions in the RIS (tax incentives, IPR regime, standard setting, regulations and incentives for the establishment of R&D centres in the region, establishment of outstanding pockets of publicly financed research) and the market conditions. A clear example of the latter is how the Chinese government obliged foreign companies to engage in joint ventures with Chinese companies in order to get access to the national market.

While (R)IS literature stresses the role of the user-producer interaction, much remains to be said on the role of the lead users, that is, technologically advanced users, as drivers of innovation and attraction poles for global R&D players. The existence of this pool of advanced users has proved to be extremely relevant to explain the location of R&D centres of MNCs in Shanghai and Beijing. This goes beyond the arguments on the importance of accessing large markets.

We would argue that even though it is partly true that the scale of the emerging market matters, the other attributes embedded in this large market actually matter more, when we deal with the issue of innovation. Due to the fact that agglomeration of innovation and large market do not have direct causal relations, we have to find out about the attributes of the emerging market that can explain the agglomeration of innovation activities in China. Uncertainty and competition within emerging markets might be the answer. We argue that it is the high uncertainty and high

competition in the emerging market that attracts the MNCs R&D centres (and potentially hold them down in the future).

The uncertainty and competition comes in different forms in the emerging market. These variables greatly influence the decision among the MNCs to locate R&D centres in developing countries (at least in China).

1) The market uncertainties; being product standards, uncertainties in the different classes of consumers and how local competitors address these challenges.
2) The technological uncertainties being related to especially standard setting (our empirics have a strong bias in countries with a potentially large home market).
3) The political uncertainties. It is easy for a company to turn from a friend to a foe if it is not careful or if it does not spend enough time to nurture their relations with the local governments;

While the systemic aspects of the RIS might be a strong argument explaining the upgrading of – mainly - small and medium sized indigenous companies, it is not a determining factor in attracting MNC labs to a country. Institutional, technological, market and political uncertainties seem to be more important than the systemic propensities of the RIS – which confirms some of our previous findings. However, RIS does play a role in specific location decision of the MNC labs within the country (that explain why they concentrate in Beijing and Shanghai that can *best* facilitate them in minimize multiple uncertainties (Chen 2006; Chen 2008a). In this sense, the RIS literature should expand its focus on not only upgrading the local firms, but also attracting global innovation. More research should be conducted on the institutional and socio-economic and political aspects of the RIS in the context of globalization of innovation.

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