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Towards a better understanding of multinational enterprises' R&D location choices

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Introduction

Economic globalization and the emergence of attractive new regions for the location of economic activities have led many multinational enterprises (MNEs) to review their location strategies, in order to optimize their global value chain. In particular, recent years have seen a growing internationalization of Research and Development (R&D). Historically, R&D has typically been based close to the center of the firm's operations, because it is considered a highly strategic activity. Recently, there is growing evidence that MNEs are moving to a more dispersed approach to the firm's innovative capacity, and are increasingly locating R&D units abroad (Doh *et al.*, 2005). According to the United Nations Conference on Trade and Development (UNCTAD, 2005), MNEs, which account for half of all worldwide expenditure on R&D, now conduct 28 percent of their R&D abroad. This movement towards internationalization is emphasized by the fact that emerging countries are becoming increasingly attractive destinations for the location of R&D activities. Researchers and specialists expect this trend to become more marked in the coming years (Cantwell and Janne, 1999; Dunning and Narula, 1995), with these activities increasingly based in emerging economies (UNCTAD, 2005). This recent development in the R&D function raises the question of how MNEs manage their high value-added innovative activities, particularly their location choices.

Researchers have identified firm-level and industry-level characteristics that guide the Foreign Direct Investment (FDI) decisions of the world's largest firms (Nachum and Zaheer, 2005; Terpstra and Yu, 1988). However, as Dunning (1998) notes, this stream of research is now being complemented by an interest in the spatial aspects of

FDI, taking into account the characteristics of the host regions. Porter (1990) suggests that the competitive advantage of a company operating in more than one country stems not only from its activities, but also from its location. Further, various surveys have demonstrated that MNEs seek locations that offer the best economic and institutional facilities for the efficient utilization of their core competencies (Dunning, 1998). Along with the economic and institutional factors, MNEs are also attracted by the presence of other foreign investors in a particular region, and this leads to agglomeration within particular clusters, defined as “geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in linked industries, and associated institutions . . . in particular fields that compete but also co-operate” (Porter, 1990: 197). This location within clusters is particularly interesting in the case of R&D activities, because it has been argued that co-location facilitates knowledge spillovers between firms (Sorenson *et al.*, 2006).

In this chapter, we study how the host-country and the region-level characteristics affect MNEs' R&D location decisions. The regional level in our analysis refers to regions within countries and not to regional blocks (Europe, Asia, etc.). Our aim is to identify the greatest number of factors that MNEs take into account when they select regions in which to locate their innovative activities. To do so, we analyze different streams of both the theoretical and the empirical literature. We also consult ten experts (eight French and two British) on this matter. The study results in an extensive list of factors that determine R&D location choices, on the basis of three sources of evidence: surveys of R&D practitioners that were reported in the literature; academic research in several disciplines (international business, management, economics, geography, sociology), and the opinions of experts. We evaluate the relative importance of each of the factors distinguished, and then highlight seven factors to which particular importance can be attributed. The contributions of this study are twofold. On one hand, the study contributes to the advancement of our understanding of the interplay between location characteristics and MNEs' location decisions. On the other hand, it provides insights for policy makers who aim to enhance the attractiveness of their territories (cities, regions, countries) for the location of foreign R&D activities.

The chapter is organized as follows: the first section highlights recent trends and motives in the internationalization of corporate R&D. The

second focuses on the factors influencing the location activity of MNEs. The third presents the data and the methodology of the research. The fourth presents the analysis and the findings of the study, that is, the location-specific factors that influence R&D location choice. The concluding section outlines the limits and contributions of the study, and its managerial and policy implications, and suggests future research directions.

International location of corporate R&D: trends and motives

For many years, R&D was a function kept at headquarters and therefore internationalized very little, mainly because of its strategic character. However, in recent years an increase in the internationalization of R&D has been observed. This phenomenon is in large part the consequence of the internationalization of production, and it is now an important dimension in economic globalization. Some aspects of this process have been documented and discussed, and its existence is now accepted, but its underlying mechanisms remain poorly understood, particularly because of their complexity (OECD, 2005).

According to a recent study by OECD (2005), the internationalization of R&D is still mainly an intra-Triad phenomenon (Japan – Europe – USA), with the EU and especially the US as the major locations of foreign R&D. US firms, and even more so EU firms, have the largest shares of foreign R&D. In the last decade, the MNEs (especially European companies) have increased their foreign R&D activities, and more recently the trend towards internationalization has increasingly become more truly global, with the emerging markets currently attracting an increasing share of the R&D outlays of MNEs. The high-tech sectors and, in particular, the pharmaceutical industry, come top in terms of having the most internationalized R&D (OECD, 2005).

The internationalization of R&D is a process that can be observed not only in large high-tech firms, but also in Small and Medium-sized Enterprises (SMEs). Moreover, research institutions (universities, public or private laboratories), researchers and policy makers also play a role in this process. Nevertheless, as far as industrial R&D is concerned, studies show that multinational firms are the key actors in the field. They account for almost half of global spending on R&D (\$677 billion in 2002), and for at least two-thirds of industrial R&D expenses (estimated at \$450 billion) (UNCTAD, 2005).

The internalization theory, which can be considered the dominant explanation in International Business, has long taken the view that “subsidiaries exist to extend abroad the firm-specific advantage of the parent firm,” and that they are “arranged according to the R&D of their parents” (Rugman, 1981: 216). Indeed, it has been argued that R&D is conducted abroad in order to adapt products and services to local requirements (Prahalad and Doz, 1987), with knowledge being transferred from corporate headquarters to the subsidiaries. The literature provides empirical support for the notion that manufacturing operations are very often accompanied by R&D operations, in order to support the development of products adapted to local conditions (Doh *et al.*, 2005). Thus, Defever (2006) finds a strong link between the locations chosen for production and those chosen for R&D. Analyzing the location choices of 11,000 companies, Defever argues that production and R&D are mutually attractive, and that the strong vertical links between these activities are capable of generating cumulative effects, such as those described by the New Economic Geography (Krugman and Venables, 1995). R&D is alone among corporate functions in having an attraction effect on production.

More recently, however, there is evidence that an increasing number of R&D outlays have been located in foreign countries for other reasons. Kuemmerle (1997) studies the changes in the R&D function, and concludes that a centralized approach to R&D is no longer adequate, for two reasons. First, there is an increasing amount of relevant knowledge in the world, and companies therefore need to be present in an increasing number of places, in order to gain access to that knowledge, and to absorb the research results generated by foreign universities and competitors. Second, companies selling their products around the world need to progress products from development to the market with ever-increasing speed. For these reasons, the R&D function is more and more independent of production, and requires the creation of global knowledge networks. Companies are currently basing their research centers abroad not only to attain proximity to local markets, but also to ensure that they are near (or in) centers of scientific excellence, and thus able to take advantage of the knowledge generated in these centers (OECD, 2004; Alcacer and Chung, 2007).

According to Patel and Vega (1999), a distinction can be made between two types of strategy, or two types of objective in location choice: “home-base exploiting” and “home-base augmenting.” In the

first case, knowledge is transferred from the home base to the subsidiary based abroad, and the objective is to use this knowledge to adapt products to suit the local market. In the case of “home-base augmenting,” the objective of the subsidiary is to provide new knowledge to the company, thus augmenting its knowledge base. The company will therefore seek to locate its R&D activities in a geographical area rich in knowledge, and favorable to its transfer and circulation. The characteristics and organization of that area therefore become key components in the choice of location.

Dunning and Narula (1995) argue that there should be a trade-off between the transfer to host countries of the knowledge produced in the home country, and the exploitation of the knowledge base of the host country in order to augment the knowledge capital of the MNE.

Firms try to improve their existing technological assets, or to create new ones, by locating their R&D abroad. Labs located abroad provide access to knowledge present in these markets. The recent literature thus suggests that there has been a change in the role of foreign affiliates, which are active in R&D, not only for incremental innovation, based on existing activities, but also for more ambitious innovation, which creates new knowledge. Moreover, affiliates are becoming very active in the development of ties with other knowledge sources.

Location strategies of MNEs

The international location strategies employed by companies, especially multinationals, have received increasing attention since the 1960s. Researchers have sought to understand why multinational corporations are able to effectively extend their operations beyond their home country (Johanson and Wiedersheim-Paul, 1975; Vernon, 1966, 1975), and why they choose one country rather than another as a base for their activities (Buckley and Casson, 1976; Dunning, 1977).

Flores and Aguilera (2007) argue that previous research has identified as determinants of location choice the firm-level characteristics (such as size, performance, and industry), the firm relational linkages, and home-country characteristics and host-country characteristics. For many years, the firm-specific determinants of international economic activity have driven the interest of International Business scholars, but until the 1990s the geographical dimension of location was generally

absent from explanations. However, there has been a shift in the factors influencing the MNEs location, away from those employed in the 1970s: MNEs are now increasingly guided by the characteristics of the locations in their location strategies (Dunning, 1998).

Indeed, the geographical dimension has a major impact on choices as to where to base corporate activities. Location strategies do not depend solely on factors internal to the company: they are also shaped by aspects related to the attractiveness of territories (that is, towns, cities, regions, and countries) as locations for the activities concerned. With the inclusion of such geographical and spatial aspects of the organization of activities, a new stream in location literature came into being, known as the New Economic Geography (Fujita *et al.*, 1999; Krugman, 1991a; Krugman and Venables, 1995). Initiated by Krugman (1991a), this stream of literature examines how industrial activities are organized in spatial terms. It argues that industrial activities tend to agglomerate in certain regions, and it attempts to provide an explanation of the fact that some regions seem to attract more economic activity than others. Indeed, Krugman (1991a, 1991b) explains the agglomeration of activities by pointing to the effects "upstream" (forward linkages) and "downstream" (backward linkages). The first type of effect relates to the search for high demand, and it is encouraged by perfect labor mobility, one of the postulates of Krugman's initial model. Downstream effects result from consumers' search for diversity, and for this reason companies concentrate in locations able to offer the widest variety of goods. In their international location model, Krugman and Venables (1995) argue that the backward and forward linkages between companies (notably because of their interdependence at the intermediate goods level) lead to the choice of nearby locations (in the same region), and thus to industrial agglomeration.

Work taking the geographical or spatial dimension of activity organization into account converges with Porter's thinking (1990) on the competitive advantage of multinational (or global) companies. According to Porter, the competitive advantage for a company operating in more than one country stems largely from two sources: its location (or the nations in which it operates) and its activities. The advantages linked to location arise either from the company's country of origin, or from the other regions (countries) in which the company bases its activities. A multinational company uses the advantages of its home country to penetrate foreign markets. It may also seek advantages

based on the location of specific activities in other nations, in order to reinforce the advantages offered by its country of origin, or possibly to offset its inadequacies. Porter argues that there is therefore a “compelling need to reorient our thinking about corporate strategy in a way that sees location . . . as integral to a firm’s success” (2000: 254).

Among the host-country factors that influence location decisions, Flores and Aguilera (2007) distinguish between economic factors, on the one hand, and institutional-cultural factors on the other. Economic factors are those linked to the profitability that is expected from a host-country market. These factors include the size of the market of a particular country (Contractor, 1991), as expressed by such indicators as GDP, GNP, and growth rates; the number of potential customers; the infrastructure available in the host country (Cheng and Kwan, 2000; Loree and Guisinger, 1995); but also the expected costs of the MNE operations, notably wage levels in the host country (Meyer, 2004). The institutional and cultural factors emphasize the importance of non-economic factors in MNE location choice. They include the political, legal, and cultural dimensions. Flores and Aguilera (2007) argue that MNEs tend to locate their activities in those host countries that are politically, legally, and culturally close to their home country.

One recent trend in the areas of industrial and international economics is the fragmentation of the production process. Krugman (1995) argues that the international breaking down of the corporate value chain is one of the most important aspects of the international economy. Such fragmentation is particularly visible in multinational companies that choose locations in different regions for the activities making up their value chains. The organization and distribution of production and the other activities of the company are conducted at the global level, and this is part of what is called the global value chain (UNCTAD, 2002). This process involves activities such as production, distribution, marketing, and R&D. The logic underpinning the location choices for each of these various activities is not identical, and, for this reason, it is difficult to draw general conclusions as to the determinants of those decisions. In particular, because of their strategic importance and the characteristics of the assets they require, the location strategies of the R&D function present some specificity. The host-country requirements for setting up R&D units should therefore be more demanding and at a higher level than those for the production or marketing function, for example. In addition to the economic

factors that have typically been found to be the primary attractor for R&D units, it has been argued that non-economic factors are also increasing in importance (Florida, 1997).

In this chapter, we focus on R&D activities. We aim to understand which host-country and regional characteristics determine location choices. As R&D is a highly knowledge-intensive and strategic activity, the offshoring of it is a complex strategic decision that requires a careful and detailed examination of potential locations.

Research methodology

The methodology of this research combines an extensive analysis of the literature and qualitative face-to-face interviews with experts. We first identified several relevant streams of the literature, and we asked experts in the R&D management field to confirm the appropriateness of the choice of streams, and to provide suggestions for additional streams that could help us identify the determinants of the R&D location choices. The literature that we analyzed includes the following streams and topics: international business literature, R&D management, clusters, regional innovation systems, geography of economic activities, regional economic studies, economics of innovation, industrial districts, proximity, the international economics literature (in particular the location literature) and the strategic management literature. Both theoretical and empirical papers and books were analyzed.

We also identified previous surveys on location strategies, conducted on R&D practitioners, in which they were invited to evaluate the importance of different location determinants. In fact, some organizations and researchers have conducted this type of study, and have presented their results in academic articles or professional reports. Although we found evidence of a relatively small number of surveys conducted on R&D practitioners regarding location determinants, we decided to include them in our analysis since they reflect the opinion of the decision-makers in R&D location. While they concentrate mostly on specific countries, sectors, and/or time periods, these surveys collect direct evidence on factors determining R&D location. The firms surveyed are generally multinational enterprises, and essentially American or European (see Table 6.1).

The study of the academic work involved a detailed analysis of some 150 academic papers, book chapters, professional reports, and

Table 6.1 *Surveys on R&D practices conducted on R&D practitioners*

Reference	Sample	Industries
Pearce and Singh (1992)	World's largest 167 multinationals across 30 countries	Various
Hakanson (1992)	150 subsidiaries of 20 Swedish MNEs	Various
Florida (1997)	207 R&D facilities in the United States	Electronics, automotive, chemicals and materials, biotechnology
Kuemmerle (1999b)	238 foreign R&D facilities from 32 American, Japanese and European companies	Pharmaceuticals and electronics
DIHK (2005)	1,554 German companies, 33% of which are large firms	Various
UNCTAD (2005)	68 among the world's largest R&D spenders	Various (IT, automotive, pharmaceuticals, chemicals, electronics)
Thursby and Thursby (2006)	229 respondents from US and European MNEs	Chemicals, healthcare, R&D service, food, textile, metal, transportation, paper, genetic engineering, pharmaceuticals
Ernst & Young (2006)	1,019 MNEs (50% European, 38% North American, 12% Asian)	Industry, automobile, energy (40%), B-to-B and B-to-C services (17%), telecoms and high-tech (9%), consumer goods (25%), real estate and construction (9%)

other types of document, and enabled us to identify more than twenty different factors that shape MNEs' R&D location choices. The indirect evidence of motives for R&D location from analyzing the pattern of patents and R&D expenditures across countries, sectors, or time periods was also included in the academic source of evidence.

The third stage of the research consisted of interviewing experts in the field of R&D management. Eight French and two British experts were interviewed. During the interviews, the list of factors that emerged from the earlier stages was confirmed and completed by the experts. In addition, the experts expressed their opinions on the factors that they considered most important for R&D location choice. The interviews lasted one hour on average, and the data was analyzed using the classic qualitative methodology techniques (Miles and Huberman, 1984). The experts interviewed were from the leading public and private French institutions involved in R&D-related work, such as the Centre National de la Recherche Scientifique – CNRS (National Centre for Scientific Research; the largest public research organization in France), Agence Française des Investissements Internationaux – AFII (French Agency for International Investments), Observatoire des Sciences et des Techniques (Observatory for Science and Techniques), Association Nationale de la Recherche Technique – ANRT (National Association for Technical Research), École des Mines de Paris, Alstom and Schneider Electric. The British experts were from Cambridge University and the University of Birmingham.

The factors that were identified in surveys on practitioners, in the literature, or by the experts were then analyzed to evaluate the importance of each of them, and to highlight the most determinant ones. The factors were thus confronted with the three sources of evidence. We estimated the importance of each factor based on the results of surveys, insights from the existing literature, and the evaluation by experts. Each factor is graded from + to +++ for each source of evidence (academic literature, previous surveys, interviews). The number of mentions and, when available, the level of significance were used as indicators of the importance of determinants. Thus, if a factor was mentioned in at least one-third of the academic papers or surveys or interviews, and if it was not viewed as very important by these sources of evidence it is graded +. The medium-level importance (factors mentioned in from one-third to two-thirds of papers/surveys/interviews) is graded ++. If a factor was mentioned in more than two-thirds of

papers/surveys/interviews, we assumed that its importance was high, and we attributed it a maximal +++ grade. We proceeded in the same manner for the three types of source. Following the analysis of the existing literature and the interviews of experts, the findings were presented to a group of experts and practitioners from some of the largest French companies (such as Veolia, STMicroelectronics, or Areva) and leading public institutions. The great majority of them supported the results of the research.

Nevertheless, it is necessary to note that the validity of this analysis is limited, for two reasons. First, although we analyzed a great number of works, our analysis did not include all existing surveys and academic studies. In addition, we interviewed a limited number of experts. Second, given that it is difficult to provide an objective judgment of the importance of the factors if the judgment is not based on figures (quantified levels of significance), the subjective character of the grading is obvious. Nevertheless, we think that this analysis does provide a contribution to a better understanding of MNEs' R&D location strategies. We believe that this analysis can serve as a starting point for studies of greater scope and complexity.

Findings

Location-specific factors that influence R&D location choice

What are the host-country and host-region factors that influence R&D location choice? Through the analysis of the existing surveys, literature, and interviews with experts, we identified thirty-two location-specific factors that drive MNEs' R&D location. These factors can be grouped into eight categories: human factors; science and technology factors; factors related to the regions, agglomeration effects, proximity effects, and networks; factors related to the market or to demand; factors related to infrastructures; factors related to the overall environment of the R&D; factors related to financial aspects, including the role of the state in the financing of research; and cost factors for the firm.

Human factors

The quality of the workforce (engineers, experienced researchers, young researchers, post-docs, doctoral students, etc.) as a determinant factor for R&D location is highlighted by a large number of

researchers and practitioners. Doh *et al.* (2005) argue that MNEs' R&D units in foreign locations have the same general resource skill mix needs as in their home countries. Consequently, they tend to choose locations in which the scientific workforce has reached the required level of expertise (Cooke, 2001; Doh *et al.*, 2005; Jones and Teegan, 2003; Kang and Lee, 2007; OECD, 2005; Taggart, 1991), and in which it is abundant (Sachwald, 2007), making it possible to meet the future needs of R&D operations (Doh *et al.*, 2005). French experts have also indicated that the international openness of researchers is a determinant factor in R&D location.

Scientific and technological factors

It has been argued that MNEs appreciate the existence, in host countries or regions, of centers of excellence (OECD, 2005; Sachwald, 2007), and of renowned universities and research centers (Alcacer and Chung, 2007; Cooke, 2001; Kuemmerle, 1999a; Taggart, 1991; Zucker *et al.*, 1997). Surveys conducted on American and European MNEs (OECD, 2005; Thursby and Thursby, 2006) show that these companies are also attracted by the technological specialization of the country and the international reputation of the host region. French experts and practitioners have also highlighted this aspect.

Factors related to regions, agglomeration effects, and networks

Cooperation and networks are found to give firms an important advantage in reproducing and building upon the knowledge of other firms (OECD, 2005; Sorenson *et al.*, 2006) located in the same region. Powell (1990) suggests that networks favor the efficient transfer of information. Further, Podolny and Page (1998) argue that networks bring several kinds of benefits to the member firms: learning, legitimacy, status, and economic and other benefits. According to several authors, the tacit character of knowledge ensures that it can be efficiently transferred only through interpersonal contacts and the mobility of the workforce, and these processes are favored by geographic proximity (Audretsch and Feldman, 1996; Buckley *et al.*, 2007; Head *et al.*, 1995). The importance of social interactions is also underlined by Jacobs and De Man (1996), and by Saxenian (1994) in her analysis of Silicon Valley. According to the French "proximity stream" (Torre and Rallet, 2005), there are two types of proximity: geographic and organized. Geographic proximity is expressed by the distance in kilometers

that separates two units in a geographic space. Organized proximity, on the other hand, is not geographic but relational. It reflects the ability of an organization (in a broad sense) to make its members interact. The authors argue that geographic proximity is insufficient to enable firms to engage in cooperation unless it is complemented by organized proximity. The image of the region (Cooke, 1992, 2001; OECD, 2005) may also play an important role in attracting foreign R&D investment, as do also the existence of cooperative relationships between universities and the industry (Alcacer and Chung, 2007; Audretsch and Feldman, 1996; Jaffe, 1986; OECD, 2005; Porter, 1990). The desire to monitor competitors' moves in a particular location (Doh *et al.*, 2005) leads to clustering in regions in which other research teams are located nearby. However, the presence of other (competing) firms in a region may in some cases be a disincentive to locate in that region, since MNEs may consider the cost of outward knowledge spillovers, and decide to locate away from such risky locations (Liu *et al.*, 2008). Lastly, both the regional aid policy towards R&D activities and the quality of regional institutions are also found to affect positively the decision to locate in a particular region (Cooke, 1985, 1992; OECD, 2001).

Market or demand factors

The importance of market factors in driving FDI in R&D is well established (Basile *et al.*, 2008; Jones and Teegan, 2003; Taggart, 1991). Thus, the size of the market of a particular country as a determinant of the location of MNEs has received consistent support in empirical research (Flores and Aguilera, 2007). This factor can be complemented by the growth potential of the market: the number of potential customers (Flores and Aguilera, 2007). Both factors are particularly strong in influencing R&D location, since they are some of the key drivers in the location of production and, as previously mentioned, the R&D function often accompanies production abroad, given the necessity to adapt the products or services to meet local requirements (Prahalad and Doz, 1987).

Factors related to infrastructure

The availability of an adequate infrastructure in the host country has been found to influence positively the location of MNE activities (Cheng and Kwan, 2000; Loree and Guidinger, 1995). Infrastructure

here includes both the transportation and the telecommunication infrastructure. Along with a developed infrastructure, experts and practitioners point out that the international accessibility of a region is also a determinant of R&D location.

Factors related to the overall environment for R&D

The innovative character of the environment is found to motivate MNEs to locate their R&D in a particular region. As Maillat *et al.* (1995) argue, some locations can be characterized as an “innovative milieu,” that is, such places are more likely to produce innovations than other locations. Practitioners and experts seem to appreciate the easiness of new firm creations and spin-offs (Thursby and Thursby, 2006), the quality of life and the overall life environment (the pleasant life environment, quality of schools for children, opportunities for entertainment, etc.). A dynamic labor market may also be a driver for locating in a particular region or country (Doh *et al.*, 2005; Head *et al.*, 1995; Krugman, 1991a, 1995; OECD, 2005). If the entrepreneurial spirit of the region tends to favor innovativeness (Becattini, 1987; Piore and Sabel, 1984) that too may be considered a regional advantage for MNEs' location. The protection of intellectual property is also an important issue for MNEs (Doh *et al.*, 2005), which aim to prevent others making unauthorized use of their intellectual assets.

Factors related to financial aspects (including the role of the state in financing research)

State financing of research and science (Feinberg, 2000) may potentially be of interest to firms that might be attracted by subsidies provided by the national government. Firms may also be attracted by favorable taxation policies (Feinberg, 2000). Further, the experts highlight the importance of financial systems and credits for R&D, which the public authorities may provide at both the national and the regional level, in order to attract foreign investment.

Cost factors

Cost factors include the wage level in a region/country, and any other costs incurred by an R&D activity at a given location. It has been argued that lower-wage costs attract MNEs investment (Dunning, 1998; Flores and Aguilera, 2007), including investment in R&D (Sachwald, 2007). Low wage costs have been particularly emphasized

in the studies on investment in emerging economies (Kang and Lee, 2007; Liu *et al.*, 2008; Shimizutani and Todo, 2008). Other costs include the costs of land, buildings, and physical infrastructure in general (Loree and Guisinger, 1995), and they seem to play an important role when the volume of investment is high (for example, establishing large-scale R&D laboratories).

Table 6.2 presents the thirty-two factors that we identified as determinants of R&D location, and the evaluation of the importance of each of them according to the three sources of evidence: the academic literature, surveys of practitioners, and interviews with experts.

We hypothesize that there are strong correlations between the different factors. For example, the costs for the firm should depend on such financial aspects as taxation, access to national and supra-national funds for research, and quality of infrastructure. Given these interactions, the policies destined to attract R&D investment are strongly interrelated whatever the level (national, regional, etc.) or the domain (labor market, infrastructure, financing, etc.) of action.

Among the thirty-two factors that we distinguished, some seem more important than others. Table 6.3 highlights the seven factors that can be considered of particular importance for the choice of R&D location.

Centers of excellence are characterized by several elements that are attractive to firms, such as the possibility of accessing high-level knowledge, and being in the “hot spot” for research. This allows firms to benefit quickly from new technological achievements.

The quality of the workforce is also estimated as very important, particularly because international competition in this domain is becoming very intense, as emerging countries like India, China, and the Eastern European countries are increasingly attractive from this point of view. The proximity of other research teams facilitates knowledge transfer thanks to concentration in a restricted geographic area. Proximity favors interactions and enables teams to combine complementary competencies. The success cases of clusters have shown that the role of universities and renowned research teams is crucial for the dynamism and vitality of these high-technology concentrations.

The importance of the cost factor is growing. In fact, given that new countries are appearing on the research scene, and that they have become increasingly competitive in other important factors (quality of the scientific workforce, renowned universities, etc.), competition in terms of cost is now more and more intense. The scientific offer of

Table 6.2 Analysis of factors that determine R&D location choices

Factors	Source of evidence		
	Surveys	Academic research	Interviews of experts
<i>Human factors</i>			
1. Quality of the scientific workforce	+++	++	+++
2. Abundance of the scientific workforce	++	+	+
3. International openness of researchers		+	+
<i>Scientific and technological factors</i>			
4. Existence of centers of excellence	+++	+++	+++
5. Renowned research centers and universities	++	++	++
6. Technological specialization of the country	+		
7. International reputation	+		+
<i>Factors related to regions</i>			
8. Networks of firms	+	+++	++
9. Proximity of actors		++	
10. Image of the region	+	++	+
11. Cooperation firms–universities	++	++	+
12. Presence of other research teams in the proximity	++	++	+++
13. Regional aid policy		+	+
14. Quality of regional institutions		++	
<i>Market or demand factors</i>			
15. Attractiveness of the market	++	++	++
16. Market growth potential			+

(cont.)

Table 6.2 (cont.)

Factors	Source of evidence		
	Surveys	Academic research	Interviews of experts
<i>Factors related to infrastructure</i>			
17. International accessibility	+		+
18. Infrastructure	++	+	++
<i>Factors related to the overall environment for R&D</i>			
19. Innovative environment	++	++	+
20. Ease of spin-offs and new firm creation	++		++
21. Quality of life	+		+
22. Life environment	+		+
23. Dynamic labor market	+	++	++
24. Openness to FDI			+
25. Entrepreneurial spirit		++	+
26. Intellectual property protection	+	+	
<i>Factors related to financial aspects</i>			
27. Role of the state in the financing of research		+	+
28. Financing of research centers			+
29. Financial system			++
30. Taxation		+	+
31. Credits for R&D			+
<i>Cost factors</i>			
32. Costs of R&D (including wage and other costs)	++	++	++

these countries is in fact approaching the levels of developed countries, but at lower cost. That is why we are witnessing an important growth of R&D units in these countries.

The attractiveness of the market is a classic factor, and it has consistently obtained support from scholars and practitioners.

Table 6.3 *The most important host-country/host-region factors for R&D location*

Factors	Source of evidence		
	Surveys	Academic research	Interviews of experts
1. Existence of centers of excellence	+++	+++	+++
2. Quality of the scientific workforce	+++	++	+++
3. Presence of other research teams in the proximity	++	++	+++
4. Renowned research centers and universities	++	++	++
5. Costs of R&D (including wage and other costs)	++	++	++
6. Attractiveness of the market	++	++	++
7. Cooperation firms–universities	++	++	+

Cooperation between universities and firms (in particular in knowledge transfer) is particularly important for firms that locate R&D units for “home-base augmenting” (Kuemmerle, 1997; Patel and Vega, 1999). Although small firms are more interested in cooperation with universities, large firms also believe that they can derive advantage from this kind of network.

In total, thirty-two different location-specific factors seem to shape MNEs' R&D location strategies. Of these, seven appear to be critical: the existence of centers of excellence; the quality of the scientific workforce; the presence of other research teams in the proximity; renowned research centers and universities; costs of R&D; the attractiveness of the market; and cooperation between universities and the industry.

Conclusion

In this chapter we studied the host-country and host-region determinants of MNEs' R&D location choice. We showed that several

categories of factors exist, and we estimated the importance of each of the thirty-two individual factors identified. The contributions of our study rest in its scope, since it covered different data sources and benefited from various points of view. The results of the study provide some indications on how MNEs choose the locations in which they set up their R&D activities, and they also offer some important insights for policy makers striving to attract these activities to their regions. Indeed, as Feinberg argues, “although many governments have implemented policies designed to lure foreign R&D, the kinds of policies which would be most effective depend critically on the factors influencing R&D of MNCs location choices” (2000: 1). Our study can therefore provide indications for policy makers regarding the factors that should be targeted by policy measures.

Obviously, this research is not without its shortcomings, which limit the generalizability of the findings, but at the same time suggest directions for future research. The major limit of the study is the lack of empirical confirmation of the results. Several improvements of this work are therefore possible. The first research direction would be to conduct a survey that questions R&D practitioners on their location decisions, in order to empirically validate the importance of each of the location factors. The second research direction would be to test empirically the findings, first on the French MNE data, and then on a larger sample of companies. The third research direction would be to conduct in-depth case studies of R&D location, to uncover the combinations of factors that work together to define the choice of the host region.

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