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## Working Party on Globalisation of Industry

# LOCATION FACTORS IN THE ACTIVITIES RELATED TO INNOVATION OF MULTINATIONALS: A LITERATURE REVIEW

**Meeting to be held at the OECD Headquarters in Paris on 9-10 October 2008**

*This document, prepared by Fabrice Hatem and Loriane Py, will be discussed under item 5 of the draft agenda.*

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**TABLE OF CONTENTS**

**Executive summary**

1. *A significant amount of literature* has already analysed the internationalisation trends and location determinants in activities related to innovation. In addition to scientific works by academics, a large share of the available literature stems from studies carried out by consulting companies and public reports. Studies are especially numerous regarding internationalisation motives and location determinant for R&D activities, and to a lesser extend, headquarters. Analyses are scarcer regarding location determinants in high-tech industries.

2. *Regarding the motives for R&D internationalisation*, two major driving forces have traditionally been identified. Firms invest abroad either *i*) to adapt their product and process to foreign consumer's requirements or *ii*) to augment their specific capabilities by tapping into foreign knowledge and techniques. The recent expansion by MNEs of their international R&D activities outside the Triad, particularly in emerging Asian countries, suggests that cost and availability of large pools of scientific personnel are becoming important motives for R&D internationalisation as well.

3. *Regarding location determinants in R&D activities,* the most frequently mentioned general factors are market size, agglomeration forces, access to scientific and technical capabilities, and, increasingly, cost considerations, while there is more uncertainty about the impact of intellectual property right regimes. Beyond these general determinants, location behaviours differ depending on the nature of activity carried out abroad. Adaptive R&D facilities are more prone to locate closer to the final market, while the location of innovative R&D is driven by proximity to poles of technical and scientific excellence. Besides, while firms are prone to locate their adaptive R&D close to their existing production facilities, this effect is much more limited in the case of innovative R&D activities.

4. *High-tech industries* as a whole are particularly sensitive to the availability of high-quality resources (skilled labour, scientific infrastructure, etc.), while factors relative to labour cost considerations appear less influential than in the average of other industries. Studies on location determinants in high-tech activities, however, remain too heterogeneous and incomplete to allow us to point to definitive conclusions, especially at a detailed industry level.

5. *Regarding headquarters,* some studies on international location determinant rely upon comparisons between countries. The most frequently location factors mentioned by these studies are the presence of an environment favourable to business, the proximity to markets and production capabilities, the availability of skilled labour and the costs associated to corporate tax rates and wages. Many authors, however, prefer to implement their studies at the city level, as location decision for headquarters are based on direct comparisons between the major competing metropolitan areas. These studies show that firms locate their headquarters in cities featured by good transport facilities, high quality and diversity of business services, and by a large presence of other headquarters. However, the question of headquarter location determinants seems to have only limited links with the rest of the issues reviewed in our study.

6. *The question of territorial attractiveness for innovation-related activities* can be divided into three main issues. Regarding the actual *performances*, a large set of data is now available on the presence of foreign companies in various OECD countries. Data however are scarcer on emerging countries. Regarding the attractiveness *potential,* despite the existence of a large set of comparative data, there has not been yet an organised census and analysis of these data for the production of an "attractiveness scoreboard" for innovation-related activities. Finally, evidence on the nature and impact of public *policies* remains fragmental and limited.

7. Regarding the future working programme of the WPGI, four priorities have been identified, by order of importance: *i*) carry out some additional econometric works on location determinants, based either on the AFA and FATS databases, or on international investment projects databases, in order to produce findings more adapted to the needs of the OECD project; *ii*) collect information and elements of benchmarking regarding the attractiveness policies carried out by OECD members (and by some major non-members countries); *iii)* implement systematic comparisons between OECD (and some major non-OECD countries) regarding their attractiveness potential; *iv)* improve the knowledge on internationalisation trends in innovation-related activities, especially regarding international investment flows and outsourcing.

**Introduction**

8. It is now well recognised that investment location decisions by MNEs strongly affect the development dynamics at both the local and country levels. For the OECD members, the question of attractiveness has thus become a major issue of the policy agenda. This is why the CIIE launched in 2006 a project dedicated to the analysis of the attractiveness of OECD member countries regarding foreign direct investment.

9. Of particular interest is the question of the internationalisation of innovation-related activities by MNEs, for three main reasons. First, these activities appear to be a key factor of growth and competitiveness in OECD countries. Second, their local development dynamics are largely dependent on location decisions taken at the international level by MNEs[1]. Third, and consequently, there is a growing interest among OECD member countries on the implementation of policies aimed at fostering territorial attractiveness for high-tech and R&D activities. This is why the Working Party on the Globalisation of Industry, which has been charged of the development of the CIIE project, decided to give priority to the analysis of international investment patterns and attractiveness issues in innovation-related activities.

10. In the framework of this project, three types of activities have to be integrated and analysed separately: *i*) high-technology industries, defined by the OECD (1997) as those where the R&D effort is the highest, and which are thus supposed to be the most innovative; *ii*) R&D corporate function, which constitute the main driving force for technological innovation in all industries; *iii*) headquarters, which are supposed to play a determinant role in the innovation strategy of multinational enterprises.

11. Three axes of analysis were defined: *i*) identify the geographic distribution of these activities; *ii*) examine the factors that could influence their location; *iii*) analyse the effective impact of attractiveness policies. The first point has already been examined by the Working Party and a measure of foreign-owned innovation-activities activities in OECD countries was presented by the OECD secretariat (OECD, 2007b and 2008a).

12. Furthers work must naturally take steps on the findings of the existing economic literature in order to identify fields where additional researches and studies might efficiently complement this knowledge corpus. A literature review has thus been launched in order to be used as an input for the definition of the future work.

[1] According to OECD (2006), multinational enterprises (foreign and home-based) account for 85% of total private R&D in the United States. According to the UNCTAD (2005), among the 700 firms with the largest R&D expenditures, more than 95% are multinational enterprises. Ambos (2005) finds that 49 German multinational firms accounted for two-thirds of German's nations/privately funded R&D expenditures in 1999. Gassmann and von Zedtwitz (1999) find that 44% of the Triad R&D spending was made by the world's 50 largest firms (all MNEs) in the mid-90.

13. Not surprisingly, there exists a large and varied literature on internationalisation motives and location determinants of innovation-related activities. This variety stems from two major reasons. First, the definition used by OECD mixes a sectoral with a functional approach, which implies that the research review has to collect studies from a broad range of thematic fields. Second, given the very policy-oriented nature of the subject, a large part of the existing literature - especially regarding the question of territorial attractiveness - has not been produced only by academics, but also by public bodies, professional organisations and specialised consultants. These works have been extensively included in this literature review.[2]

14. The rest of the paper is organised as follows. Chapter I presents the main driving forces behind the internationalisation of innovation-related activities, with a focus on R&D. Chapter II consists in a review of the literature on location determinants for the three types of innovation-related activities defined above (R&D centres, high-tech industries, headquarters). Chapter III presents the literature on territorial attractiveness, with a distinction between its three main components (performances, potential, and policies). Chapter IV consists of a critical analysis of the methods, data and concepts presented in the first three chapters. Finally, Chapter V makes proposals for future orientations of the project.

[2] It should be noted, however, that only studies strictly focused on the central theme of the literature review are mentioned. Consequently, some very well-known articles or books related to our subject, but with a very general scope, have been excluded from the list of references.

# CHAPTER I. WHY INNOVATION-RELATED ACTIVITIES INTERNATIONALISE? THE CASE OF R&D

15. Before analysing the location determinants of activities related to innovation, it is important to understand the driving forces behind their internationalisation trend. Indeed, location criteria are largely predetermined by the motives for conducting activities abroad.

16. The analysis is here limited to the case of R&D activities, because they represent the largest share of the existing literature regarding internationalisation motives in innovation-related activities. The first section is aimed at a general presentation of the major driving forces behind the internationalisation of R&D. The second section assesses the respective importance of various kinds of activities (adaptive, innovative, etc.) in total R&D abroad. A third section addresses the question of complex R&D internationalisation patterns.

## 1.1 Internationalisation of R&D: a global view

### *1.1.1. Some stylised facts about R&D internationalisation*

17. Three features are particularly important for this study. First, as pointed out by the OECD (2008a), while internationalisation is still more limited in R&D than in other corporate functions such as production, it is now growing rapidly. Second, R&D is very concentrated in developed countries and among firms. According to the UNCTAD (2005) the top spending countries[3] accounted for 86.9% of global R&D in 2002. In the same year, the 700 largest spending firms accounted for 46% of world total R&D and 69% of the world business's R&D. Finally, while OECD countries remain the first receivers of R&D investment, emerging countries, particularly from Asia, have attracted a growing share of R&D investment.

### *1.1.2. Why is R&D less internationalised than other corporate functions?*

18. The internationalisation levels of the various functions of the corporate value chain are uneven. Production and distribution are the most internationalised, while R&D and headquarters have lagged behind for a long time (UNCTAD, 2007). Several researchers tried to understand why R&D was less internationalised than other corporate functions (Patel and Pavitt, 1991). Three major categories of "centripetal" factors have been identified by researchers.

19. First, a well developed national innovation system can push firm to keep their R&D activities centralised at home (Narula, 2002), especially when they can benefit of a strong cooperation with the local research communities (institutions, firms) sharing similar interests and specialisation. These advantages can also take the form of economies of scale stemming from the exploitation of talents and resources available at home.

20. Second, several researchers emphasised the importance of close interaction between R&D and other corporate functions, as well as the desire to control and manage the R&D process. For instance,

[3] In 2002, the top R&D spenders were, in that order: the United States, Japan, Germany, France, the United Kingdom, China, Republic of Korea, Canada, Italy, Sweden.

Granstrand (1999) finds that the need for close supervision and control is the most inhibiting force against R&D internationalisation in the case of Japanese and Swedish companies.

21. Finally, some researchers pointed out that costs related to coordination and communication with R&D centres abroad could also be strong deterrents against the internationalisation of R&D activities. Jones and Teegen (2001), as well as Fisch (2003) find that the costs of cross-border exchanges of knowledge rise with distance.

### *1.1.3. Why is R&D increasingly internationalised?*

22. This pattern however is changing gradually, as R&D activities are now internationalising at a sustained pace (OECD, 2008a and b). This new trend is first of all, made possible by some favourable evolutions in the general business environment. Cheng and Bolon (1993) identified three of these evolutions: the improvements in information and communication technology, the increasing availability of scientific infrastructure in foreign countries, and the growing degree of uniformity in international patenting. They also identified some factors that could accelerate this trend, such as the increased involvement of multinational in overseas production and the success of a number of multinationals that have already internationalised R&D. Another major driving force is the growing segmentation of the R&D value chain, which allows to carry out separately each of its components in different locations (CAS, 2005).These enabling factors open the way to R&D internationalisation strategies based on two main motives or "centrifugal forces" (Criscuolo, 2005):

- Demand-driven factors. One the most traditional view in the literature on MNEs is that firms create R&D centres abroad in order to exploit the parent companies' specific advantage and stock of knowledge. Their mission is to adapt the new products and processes first developed on the home market to the preferences of the foreign consumers and to the characteristics of the host country. This kind of R&D centres is thus not very much involved in generating edge-cutting innovation. Various other concepts developed in the literature pertain to this broad category: adaptive R&D, home base exploiting R&D, support-oriented R&D.

- Supply-driven factors. These can take two major forms; *i)* firms may need to get access to skilled scientific personnel and to tap into foreign capabilities in order to acquire new knowledge, complementary techniques and finally increase their overall innovation potential[4]; *ii)* firms may need to rationalise R&D cost by getting access to low-cost supply of R&D personnel or benefit from incentives provided by foreign governments.

## 1.2. Demand-driven strategies are quantitatively dominant, but supply-driven strategies gain momentum

23. The literature tried to assess the relative importance of each of this motive by examining the nature of the mission assigned to R&D facilities abroad. Empirical evidence, mainly based on surveys, point out to the fact that demand-driven strategies have long been a dominant factor of internationalisation, but that supply-driven strategies have been gaining momentum in the recent years.

### *1.2.1. Demand-driven strategies have long been dominant*

24. Many studies, often based on questionnaire surveys, found that the adaptive strategy was the major motive for locating R&D abroad. Kuemmerle (1999) addresses this issue through a survey on labs

[4] Various other concepts in the literature refer to this strategy, such as innovative R&D, home base augmenting R&D, or research-oriented R&D, capability theory.

established abroad by 32 multinational companies. The results show that 68% of the laboratories in the sample followed a home-base exploiting strategy while only 32% aimed at acquiring new capabilities (home base augmenting strategy). Gerybadze and Regger (1999) conducted interviews among 21 MNEs pertaining to the Triad. Respondents indicated that they located R&D activities on the most dynamic markets in order to adapt product to sophisticated customers requirements, acquire impulse for innovation process through direct presence, and learn in lead markets. Based on a survey of the senior officers of the world most technology-intensive corporation, Edler et al. (2002) find that the first motive for R&D internationalisation is the adaptation of products to local requirements. Roberts (2001) finds similar results on a survey of 209 multinational enterprises from Japan, Western Europe, and North America. Patel and Vega (1999) analysed the patenting activities in the United States of the 220 most internationalised firms in terms of technology. They find that firms invest in R&D abroad in areas where they are strong at home and that in more than 75% of cases, the strategy followed by firms is supportive. Finally, Iwasa and Odagiri (2004) tried to identify the contribution of R&D at home and abroad on Japanese firms 'inventive activity by distinguishing support-oriented R&D and research-oriented R&D. They find that in their sample of 137 Japanese multinational companies that reported to conduct R&D activity in the United States in 1998, less than one quarter enter in the category of research-oriented R&D.

### *1.2.2. Innovative R&D is gaining momentum in firm's strategy*

25. Other studies, however, have pointed out the fact that firm increasingly invest in R&D abroad in order to acquire new knowledge and to augment their capabilities[5]. In a quite old study, Florida (1997) tried to assess the relative importance of market-oriented and technology-oriented R&D centres on the basis of a survey of 207 foreign-affiliated laboratories in the United States. He found that most of the laboratories in the sample adopted a technology-oriented posture and that they particularly aimed at gaining access to foreign human capital and developing links with the scientific community. Serapio and Dalton (1999) also address the question of the motives of foreign direct investment in R&D in the United States. They find that most of foreign companies invest in this country in order to gain access to foreign science and technology and to augment their innovation capabilities. Authors find that this trend is particularly striking in technology-intensive sectors such as pharmaceutical, biotechnology, and electronics. Ambos (2005) examined the motives of R&D internationalisation on the basis of a survey of 49 German multinational companies. Results show that over the last years there was a shift towards capability-augmenting investments (innovative R&D) as opposed to market-seeking ones (adaptive R&D).

### *1.2.3. A new motive: resource-seeking and cost control?*

26. The motives described above are consistent with the stylised facts that R&D is very concentrated among developed countries. But on the recent years, there was an expansion of R&D investment outside the Triad. Firms from developed countries are increasingly establishing R&D sites in emerging and transitions economies, particularly in Asia and in Eastern Europe (UNCTAD, 2005; Zhao et al., 2004; OECD 2008a). The share of R&D activities carried out in these countries, albeit still low, it thus on the rise. This suggests that a new motive is driving R&D internationalisation patterns: the costs and availability of R&D resources.

27. Many researchers argue that firms increasingly set up R&D facilities in countries featured by a high availability of scientific personnel and lower labour cost. This is the reason why such developing countries as China have become very attractive in this field (Armbrecht, 2003; Zhao, 2004). A survey conducted by Thursby and Thursby (2006), also finds that countries such as India and China will continue to be major beneficiaries of R&D expansion in the coming years. However, their results generally indicate that while conventional wisdom suggests that lower cost would be the main consideration behind this

[5] Some of their findings are apparently conflicting with those mentioned in the previous paragraph.

trend, other important factors include the quality of R&D personnel available as well as adaptation of products to local markets.

28. The growing importance of supply-driven factors as motives for the internationalisation of R&D involve a more open and intense competition between host countries for the location of these activities. As a matter of fact, in the case of adaptive R&D, location is mainly driven by the presence of a final market. The direct competition between potential host countries for the location of this kind of projects is thus limited or inexistent. But in the case of supply-driven motives, a wider comparison of all the characteristics of the local innovation systems (costs, skills, scientific infrastructure, etc.) is implemented by decision-makers in order to select the best location for their project (see Chapter II).

#### *1.2.4. Specificities linked to home country, industry or firm's characteristics*

29. Various researches have pointed to the fact that the motives of R&D internationalisation could differ depending on various home country, industry and firm's characteristics.

30. Regarding the influence of the home country, some studies suggest that companies from Asia (either Japan or developing Asia) are more prone to invest abroad in R&D in order to tap into local technological capabilities existing in the main advanced countries. Granstrand (1999), on the basis of a survey among 50 large Japanese and Swedish MNEs, finds that access to foreign science and technology is the strongest driving force behind the internationalisation of Japanese R&D, while the internationalisation of Swedish R&D appears to have been more demand-led.

31. The influence of the firm's characteristics has also been outlined by many authors. For instance, Ito and Wakasugi (2007) analysed a sample of Japanese multinational firms and find that both firm's and host country characteristics affect the motive of R&D internationalisation. They find that the higher export-propensity of the firm's affiliate in a given host country, and the relative abundance of human resources for R&D in this country, have a positive effect on the expansion of both adaptive and technology sourcing R&D there.

32. To end with, industry-related specificities have also been pointed out (see also Chapter II, section 2). Florida (1997), on the basis of a survey on foreign-affiliated R&D laboratories in the United States, finds considerable differences in the type of activity carried out depending on the industry. In particular, biotechnology is more motivated by and oriented to science and knowledge-augmenting activities than others industries.

### 1.3. Complex and evolving internationalisation patterns?

33. So far, the various motives for R&D internationalisation have been studied separately for each other, as if they did not interfere. Some researchers have suggested to by-pass this static dichotomy by taking into account the complex nature of internationalisation strategies and their possible evolution over time.

#### *1.3.1. Complex internationalisation patterns*

34. Many researchers have pointed out the fact that firms need at the same time to adapt their product, to learn from lead markets and to augment their global capabilities in order to keep competitive. These various strategies are thus complementary rather than opposed to each other. Criscuolo et al. (2005) find, in a study based on patent citation data from the European Patent Office, that most multinational companies tend to undertake simultaneously both asset-exploiting and asset-augmenting R&D. Ito and Wakasugi (2007) also observe that Japanese firms have affiliate that conduct innovative R&D and other that conduct adaptive R&D. Von Zedtwitz and Gassmann, (2002) analyse the motive of R&D

internationalisation of 81 companies based in the Triad by origin country and industry. They conclude that two factors affect simultaneously the location of R&D units: the access to local market which is driven by the need for proximity to local customers and the technology motive which is driven by the need for proximity to centres of excellences.

35. Le Bas and Sierra (2002) suggest that adaptive and innovative R&D are two extreme cases and that firms are susceptible to implement intermediaries strategies. Based on the analysis of an index of revealed technological advantage of both investing firms and host countries, they distinguish four types of strategy: *i)* technology-seeking aims at offsetting the parent company's and/or home country's weakness in a particular field by locating in a foreign country that is strong in the field; *ii)* home-base exploiting strategy is the opposite and is directed towards exploiting the existing firm specific capabilities in a foreign environment which is weak in the field ; *iii)* home-base augmenting consists in investing into a country as strong as the firm to complement the existing knowledge; *iv)* finally, the so called "market seeking strategy" corresponds to a situation where neither the firm nor the home country has a comparative advantage. They conclude that the strategies ii) and *iii)* are dominant: firms invest in foreign countries both to take advantage of their home-based advantages through the adaptation of their products to foreign markets, and to complement this advantage by tapping in foreign technological and scientific capabilities.

### *1.3.2. A sequential process*

36. Another finding is that the R&D internationalisation patterns might be evolving over time. Serapio and Dalton (1999) find that, while demand factors have traditionally been the major driving force in foreign direct investment in R&D in the US, supply consideration have played an increasing role over time. A survey by Pearce (1999) on the motives of foreign-owned R&D in the United Kingdom shows that product adaptation is the major motive, but that the development of new products is gaining momentum. This evolution has also been analysed in terms of the firm life cycle. Johansson and Lööf (2006) have found that, for many companies, the globalisation of R&D starts with a need to adapt product for foreign environment and then move to more fundamental research activities as the company grows.

# CHAPTER II. WHAT ARE THE LOCATION DETERMINANTS OF INNOVATION-RELATED ACTIVITIES?

37. A large literature has emerged in the recent years regarding the location determinants of MNEs[6]. Many of these studies, albeit providing interesting insights on the subject[7], have a very general scope and will not be analysed on this literature review. A more limited number of studies, however, are focused on the specific case of innovation-related activities. This chapter, divided in three sections, presents the major findings of these studies, respectively for R&D, high-tech industries and headquarters.

## 2.1. Location determinants in R&D activities

38. As compared to others innovation-related activities, R&D is by far the field of research in which the literature on location determinants is the largest and provides the most accurate answers to the questions raised by the Working Party.[8] This section is divided in three parts: *i)* overall findings, *ii)* analysis of specific location determinants depending on the nature of R&D activities; *iii)* findings on the question of co-location with other activities of the firm.

### *2.1.1. General R&D location determinants*

39. Five main group of determinants linked to host country characteristics affect the location of R&D units: *i)* market size, *ii)* scientific infrastructure, *iii)* agglomeration forces, *iv)* costs considerations, and *v)* legal environment such as intellectual property rights regimes.

*Market size is an important location determinant*

40. As a large share of R&D activities abroad aims at adapting products and processes to the foreign local conditions, it would seem natural that market size be a major R&D location determinant. This is actually what is found by the studies which have tested this hypothesis. Based on the analysis of the location of R&D affiliates of Japanese corporations, Shimizutani and Todo (2008) find that host country GDP has a positive effect on the probability to conduct innovative as well as adaptive R&D. The survey made by EIRMA among R&D executives on the behalf of the French Strategic Analysis Centre (2005) identifies the market size of the host country as a major location determinant. Jones and Teegen (2003) find that foreign direct investment in R&D by MNE from the United States is related to the host country market size and to the "purchasing power of its citizens". Kumar (2001) finds similar results: both the

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6 This literature beneficiated from recent theoretical development in the framework of "The New Economic Geography" (see for instance Fujita *et al*.,1999; Fujita and Thisse, 2002; Head and Mayer, 2004).

7 Among the major finding of this general literature, on can mention: the very positive impact of the size of the market (Head and Mayer, 2004, Crozet et al., 2004), the existence of agglomeration effects (Head et al. 1999, Head and Mayer, 2004); the negative influence of taxes (Devereux and Griffith, 1998, Bénassy-Quéré *et al.,* 2005); the generally negative but often not significant impact of wages (Liu and al, 2006); and the marginal impact of subsidies (Crozet *et al*., 2004).

8 The large availability of data relative to R&D facilities abroad might be one of the possible explanations for this fact.

R&D expenditure of US and Japanese companies' affiliates are strongly and positively affected by the wealth of the host country.

*Scientific infrastructure has a major impact*

41. As seen in Chapter I, another important motive of R&D investment is to tap into foreign technologies and to benefit from foreign scientific infrastructure and human resources. This naturally leads to the idea that this kind of activities would preferably locate into countries well endowed with advanced scientific infrastructure. This hypothesis has been confirmed by many studies, encompassing a large array of explanatory variables.

42. First, some studies examined the role played by the availability of R&D skilled personnel. Kumar (2001) finds that the proportion of scientists and engineers in the host country has a strong positive effect on R&D expenditure for both Japanese and US affiliates. Florida (1997) finds that firms which adopt a knowledge-oriented posture are especially keen on investing into countries endowed with highly skilled scientific personnel. Jones and Teegen (2003) find that educational capabilities are an important factor in determining foreign R&D site locations of US MNEs.

43. Other researchers examined the influence of the host country involvement in R&D activities. Kumar (2001) finds that the ratio of R&D expenditure to GDP in the host country affects positively the R&D expenditures of affiliates there. Shimizutani and Todo (2008) find that the same ratio affects positively the expansion abroad of innovative R&D, but that it has few impacts on adaptive R&D.

44. Finally, several researchers examined the influence of the presence of universities and centres of technological excellence. Based on a survey among 249 United States and European companies, Thursby and Thursby (2006) find that the quality of universities and the possibility to cooperate with them is a major location determinant for business R&D abroad. The previously mentioned survey by EIRMA for the French Strategic Analysis Centre (2005) also points out a similar result. Abramowsky, Harrison and Simpson (2007), based on a study on the United Kingdom, finds that the scientific level of university research department has a very positive impact on the location of private sector R&D labs in the same fields of expertise. This result is particularly strong and significant for innovative activities in pharmaceutical.

*The role of agglomeration forces*

45. Recent studies pertaining particularly to the "New Economic Geography" framework, have emphasised the fact that a local concentration of similar or complementary activities could be a source of positive externalities and spill-over. Many studies have thus tried to assess the existence of a positive "agglomeration effect" on the location of international investments by MNEs. The existence of strong sectoral agglomeration forces is for instance outlined by Head et al. (1999) or Head and Mayer (2004) on the basis of econometric studies using discrete location choice models.

46. A large amount of literature has also been dedicated on the recent years to the role of clustering and scientific districts as a location determinant (see a literature review in Brain et al., 2008). Based on case studies, OCO Consulting (2005), shows how clusters can be used as promotion tools. Pecqueur (2005) describes the progressive emergence of the Grenoble agglomeration as a major cluster in microelectronics through both local development dynamics and the attraction of foreign investors.

47. Recent works pertaining to the field of Urban Economics have also highlighted the existence of urban functional specialisation patterns (Duranton and Puga, 2005), with some cities specialising in innovative or decision-making activities, while other specialise on more routine functions (production or administrative back-office). Hence, the location of headquarters or R&D would be more sensible to the

presence of activities pertaining to the same function rather than to the presence of activities of the same sector. Defever (2006), Py and Hatem (2008), compare these two kinds of agglomeration forces[9] and find that functional forces are more important for R&D centres than sectoral ones.

*Cost considerations and availability of skilled manpower have an increasing impact*

48. As innovation becomes an increasingly strategic factor of competitiveness, companies tend overall to increase their R&D effort and expenditures. Cost control thus has become a growing issue (UNCTAD, 2005). The increased segmentation of R&D value chain and the decrease in transaction costs allowed companies to relocate some specific segments of their R&D activities in low-wages countries offering large pools of skilled scientific and technical labour force.

49. Many recent studies have thus supported the idea that the cost-efficiency ratio of labour was gaining momentum as a location criterion. Kumar (2001) finds that the cost of R&D personnel negatively affects the global distribution of this activity among affiliates abroad, especially for Japanese multinational firms. This result is confirmed by the survey carried out by EIRMA for the French Strategic Analysis Centre (2005).

50. This trend goes together with an increased share of emerging countries in the location of international R&D mainly due to the availability of skilled and cheap labour force. Armbrecht (2003) finds that cost reduction is a major driving force of the location of R&D in China. Ernst (2003) reaches to a similar conclusion regarding the location of chip design in Asia. But some studies (see for instance, Jones and Teegen (2003)) pointed out that if cost of labour is gaining momentum, managers are more interested in the skills and capabilities of the potential workforce, than the in mere R&D costs of conducting R&D in this location. According to a survey carried out by Thursby and Thursby (2006), developed countries are still favoured by the higher quality of the academic research and the possibility to collaborate with universities, especially in new sciences. But if respondent companies expect their overall R&D to grow in emerging countries and decline in developed economies, it is not only for reasons of cost, but also because of the large availability of skilled labour force, and for market issues. Reddy (2000) analyses the reasons for firms to locate in India. Among the main determinants are the low labour costs, the abundance of skilled workers and fluency in the English language.

51. However, trends to relocation in R&D activities might be inhibited by the remaining of still high transaction costs. These costs may be related to geographical distance. Shimizutani and Todo (2008) find that the geographical distance between Tokyo and the host country affect negatively the probability for Japanese corporation to set up innovative and adaptive R&D facilities abroad. These costs can also be related to cultural distance (Jones and Davis (2000)). For instance, Py and Hatem (2008) find that firms are more likely to invest in R&D in countries which share the same common language.

*Legal environment and intellectual property rights regimes*

52. Finally some authors examined the role played by the legal environment and Intellectual Property Rights regimes. The underlying hypothesis is that, due to the risk of leakage, firms might be reluctant to locate in country characterised by weak intellectual property rights. The evidence on the effect of efficient IPR however seems rather conflicting. While Ito and Wakasugi (2007) find that a strong IPR regime affects positively the expansion of Japanese innovative R&D, Kumar (2001) finds no significant effect. Besides, in recent years, many firms established R&D units abroad in countries such as India, or China, where the protection of intellectual property rights is known to be weak. Zhao (2004) gives a rather

[9] It should be mentioned that recent studies pointed out some limits on the definition of agglomeration forces, see Brain & al. (2008).

convincing explanation to this apparently counter-intuitive fact. In countries with weak IPR regimes, human capital is under-used and under-priced. So these countries can be attractive for multinational firms, provided that these firms are in a position to protect their specific knowledge. This can be the case if their R&D effort in the country is aimed at developing an isolated component, the value of which is weak if disconnected from the whole system into which it will be integrated.

### *2.1.2. The impact of the nature of R&D activities*

53. The global approach presented above is too general to describe the diversity of strategies, motives, and consequently location criteria at work behind the internationalisation of various types of R&D activities. This is why many researchers have tried to integrate the nature of R&D activities in the analysis of location determinants. Results show wide differences depending on the lab's mission and kind of activity.

54. Kuemmerle (1999), on the basis of a survey, finds that "home base augmenting" (*e.g.* innovation-related) sites are more likely to be located near universities while "home base exploiting" (*e.g.* adaptation-related) sites are more likely to be located near production facilities and large markets. Ambos (2005) finds similar results for German multinational enterprises. Sachwald and Chassagneux (2007), on the basis of an econometric analysis of location choices by MNEs in Europe during the 2002-2005 period for three types of R&D labs, finds different hierarchies of location determinants for each of these. Local development centres, which aim at adapting products and support foreign production facilities, are more sensible to the host country market size. The location of Global research laboratories, which aim at augmenting the innovation capabilities of the company, is largely driven by the scientific and technological level of the host country. Finally, Global development centres, which provide routine support services for the other kinds or laboratories, are very sensitive to the price/quality ratio of resources, and notably of the labour force.

### *2.1.3. The question of co-location*

55. In many case, activities by R&D facilities are not carried out in an isolate way, but as components of cross-border innovation networks (Sachwald, 2008). In this context, one of the concerns mostly addressed by economists is to know whether the location of overseas R&D is or not related to that of other activities of the value chain.

56. As pointed out above, several researchers find that firms which invest in R&D abroad to support their foreign production tend to locate R&D facilities near production facilities. As a consequence, as showed by Ambos (2005), market-seeking oriented laboratories have strong links with production units while the location of technology sourcing R&D tends to be more independent of this factor. Defever (2006), using data on individual companies location decisions in Europe, finds a strong mutual attraction ("co-location effect") between R&D and production activities inside the same firm. Py and Hatem (2008) find similar results, but at the aggregate country level, without sorting data by companies. Findings indicate that countries which attracted a large amount of production facilities in a given industry have a higher probability, all things being equal, to attract R&D projects in the same activity. While these two studies do not separate the different possible motives for R&D, results are in line with the fact that most of the R&D projects censed in the databases used for the completion of these works have an adaptive mission. Sachwald and Chassagneux (2007) find that firms tend to establish these adaptive R&D activties in region where they have already established production facilities.

## 2.2. Location determinants in high-tech industries

57. So far, attempts made by the authors of this document to collect publications on location determinants have led to fewer results at the industry level than for R&D facilities and headquarters. Indeed, only few academic publications have been, to our knowledge, specifically dedicated to the question of location determinants in high-tech industries. This sentiment of scarcity, however, can partially be balanced by the facts that many of the studies already quoted on R&D location rely on data on high-tech industries and thus provide some results at the sectoral level.[10] This limited literature on location determinants in high-tech industries can be divided in two strands. In a first paragraph, a presentation of studies examining high-tech industry globally is made. In a second paragraph, studies with a more precise focus on one particular industries are commented.

### *2.2.1. Analysis on high-tech as a whole*

58. Various researchers have tried to identify specific location determinants depending upon broad sectoral classification in terms of technological intensity. So-called "high-tech" industries are thus typically compared in such works to "low-tech" and sometimes "mid-tech" activities.

59. Kumar (2001), based on the analysis of a sample of US and Japanese MNEs, finds differences in the internationalisation patterns by home country and industries. The share of R&D expenditures abroad by US companies is higher in technology-intensive industries than in other. On the contrary, Japanese "high-tech" MNEs are more prone to retain their R&D expenditure at home.

60. Goetz and Rupasingha (2002) examine the geographic patterns of high-tech industry location across all counties in the United States, including rural areas. This study gives many insights into location determinants at a very disaggregated geographical level. Authors find that the availability of college graduates, the presence of other high-tech establishments, the total income of the county, the fact that the county is an urban area, the easy highway access, the level of property tax rate[11], and, to a lesser extent, the quality of educational institutions have a positive impact on the location of high-tech activities.

61. Hackler (2003) aims at identifying the specific location determinants of high-tech industry relative to low-tech industry inside the United States. She first analyses the location of these industries in five metropolitan areas between 1987 and 1994. Results show that high and low-tech industries both benefit from being in an urban area, and prefer to locate where county wage and college attainment are lower[12]. These activities are also attracted by cities where the federal procurement is greater, and which have higher expenditure per capita. When turning to the comparison of low-tech and high-tech industries, some differences are striking. Result shows that high-tech firms are, on average, more sensitive to scientific infrastructure than low-tech industries, but less sensitive to increase in wages, housing affordability and to revenue capacity.

### *2.2.2. Analysis focused on a specific industry*

62. Some studies also provided more in-depth insights on more specific industries.

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10 A very large industry-specific literature has also been dedicated to the spatial organisation the MNEs' international production and distribution networks and its consequences on the geographical location of activities (see for instance, Macher and Mowery (2008), Mc Cann et al. (2008), Midelfart-Knarvik et al. (2000), Sachwald (2005)).

11 Which can be associated with a better perceived quality of public infrastructure.

12 This last unexpected result can be explained by a mismatch between the geographical area of what an establishment considers its labour pool and the local skills which is measured at the city level.

63. Pharmaceutical and biotechnology industries appear as very internationalised, especially in terms of R&D activities. Gassmann and Von Zedwitz (1999) find that the pharmaceutical industry appears to be the most internationalised in terms of R&D, while company in automobiles, heavy industry and oil exploitation concentrate their R&D resource at home. The location of these industries seems also very sensitive to the presence of scientific excellence centres. Serapio and Dalton (1999) find that the foreign R&D presence in the United States is especially high in pharmaceutical and biotechnology, and that the quality of scientific infrastructure is especially influential for the location of these activities. Madhok and Osegowitch (2000) point out the special importance of the home-base augmenting motive in the internationalisation of biotechnologies. Florida (1997) finds that the internationalisation of biotechnology is motivated by the access to foreign science and technology to a greater degree than other industries, such as automotive, where market considerations have more impact. Abramowsky, Harrison and Simpson (2007) find that, in the United Kingdom, R&D pharmaceutical labs are more than others prone to locate near high quality research department active in their field of interest.

64. Regarding Information and Communication Technology, the number of publications on location determinants was found, surprisingly enough, to be quite limited. Some interesting studies, however, have been published on the impact of the European enlargement on the location of these industries. A report by Barrios & al. (2008) for the European commission finds that major location determinants for ICTs inside the EU are: the level of regional GDP, the degree of industrial specialisation, the level of education and the density of SMEs[13] established in a particular region. The level of industrial specialisation appears to be especially important in the case of the computing service industry while the presence of SMEs appear to be more influential for ICT manufacturing. Barry and Curran (2004) find that the computer-assembly activity, very sensitive to labour cost, is likely to relocate from Western towards Eastern Europe, while segments more in need of skilled labour and high quality industrial environment, such as the production of electronic components and R&D activities, are less likely to migrate. Regarding the French case, a study by Le Gall (2008), on the basis of a survey among French subsidiaries of foreign companies, identifies three sets of location determinants in ICT industries: the proximity to market and consumers, the existence of technological and scientific resources, and the possibility to collaborate with local partners on innovative projects.

65. Two conclusions emerge from these studies. First, the high-tech industries as a whole are particularly sensitive to the availability of scientific infrastructure, especially in the same specialised field of research, while factors relative to costs considerations and market appear more secondary than in other industries. Second, some of the studies on high-tech location determinants made at the regional or local level gave extremely interesting results. As a matter of fact, these approaches seem more adequate than country-level ones to capture the impact of some location determinants related to spatial proximity, such as agglomeration forces.

66. These studies, however, remain too heterogeneous and incomplete to allow us to point out to general conclusions regarding location determinants in specific high-tech industries. Clearly, a cross-industry study on this matter, covering a large sample of firms and countries over a recent period of time seems to be missing (see working proposals in Chapter V).

### 2.3. Location determinants for headquarters

67. Two main reasons explain the inclusion of headquarters in the scope of the OECD project. First, as pointed out by the Working Party on the Globalisation of Industry, headquarters are susceptible to be the place where is decided the strategic orientation of firms regarding innovation. Second, until now, little is

[13] Small and Medium Enterprises.

known by the OECD about the geographic location of headquarters of multinationals, be this information either qualitative or quantitative.

68. The literature review shows that a significant set of analysis, though apparently less abundant and diverse than in the case of R&D, has already been carried out regarding the location determinants of headquarters. However, two major difficulties are apparent: on the one hand, the notion of headquarters covers in fact a very heterogeneous range of activities and firm-specific situations. On the other hand, no clear link appears between the location of headquarters and that of other innovation-related activities, such as R&D centres.

69. This section is divided in three parts. The first one analyses the location determinants specific to headquarters, respectively at international and infra-national levels. The second part examines the possible co-location effects with other functions of the corporate value chain. The third part addresses the problems related to the concept of headquarters.

### *2.3.1. General location determinants*

70. Various researchers have tried to identify some specific determinants for headquarters, defined as the place where the presidents and top managers of the firm have their main office and take the major strategic decisions.

*Studies at the infra-national level*

71. A part of the literature has been dedicated to the question of the location criteria of companies headquarters inside one large country, namely the United States.

72. The most commonly mentioned location determinants are the quality and diversity of business services and infrastructures, headquarter agglomeration effects (especially in the same industry), levels of corporate taxes and wages (albeit not mentioned as significant in all studies). Straus-Kahn and Vives (2005) show that when existing headquarters decided to relocate, they were attracted by metropolitan areas with good transport facilities, low wages and corporate taxes, high presence of headquarters pertaining to the same sector of activity and finally high levels of business services. The influence of these two last determinants is also confirmed by Davis and Henderson (2004). They find that a wide diversity of local service options allows the headquarters to better match their various needs with specific experts producing service inputs.

*Studies focused on international comparisons*

73. One major interest of the infra-national studies reviewed above is the fact that they rely upon analysis made at a local (city) level. This approach is well adapted to the fact that headquarters location decisions are largely based on the comparison of the characteristic of the major metropolitan areas in competition for the attraction of this kind of activities. However, these studies only focus on the question of the location of the central headquarter of a company inside the borders of its home country. They thus only have an indirect link with our major topic: the competition of various countries (or cities on different countries) for the location abroad of second-level decision centres in charge of the coordination of a limited fraction of the international activities of the MNE (for instance at the regional level).

74. Thousand of regional headquarters of extra-european MNEs are for instance presently operating in Europe, where large cities compete to attract new projects or encourage MNEs to relocate their activities from another metropolitan area. A limited academic literature exists on this question, mainly based on discrete choice models approaches. Its main results show that proximity to market, functional

agglomeration effects, good governance, availability of skilled labour, and presence of production sites of the company in the country are among the major location determinants.

75. Defever (2006) as well as Py and Hatem (2008), examine this question in Europe based on econometric analysis. Defever (2006) finds that the quality of judicial system and of the contracting environment is important for the location of this activity. Py and Hatem (2008) find that the abundance of skilled workers and the sharing of a common official language with the investor both affect positively the probability to attract these activities. This last point reflects the fact that for the period 2002-2006, among the headquarters established in Europe, the major part came from the United States and that those have been largely located in the United Kingdom.

76. Other studies have directly focused in international comparisons at the city level. A survey by E&Y (2005), shows for instance that the major location determinants of regional headquarters in Europe are, in that order: proximity to customers, transport and accessibility, quality and availability of labour, and tax issues. As noted above, Duranton and Puga (2005) point out the existence of strong functional agglomeration effects leading to the apparition of cities specialised in superior tertiary functions such as headquarters and R&D activities, while other cities specialise in more routine activities, with a low innovation and decision-making content, such as mass production or call centres.

### *2.3.2. Is the location of headquarter independent of that of other firm's activities?*

77. Quite a large set of studies, most of them focused on the case of the United States, have been dedicated to the analysis of the trade-off between the location of the headquarter close to the main production facility and the creation of a stand-alone headquarter.

78. Several researchers emphasised the benefits associated with the separation of headquarter from production facilities. Davis and Henderson (2004), based on a micro-data set on auxiliary establishments from 1977 to 1997, find that the separation of headquarters from production bring two different kinds of benefits to companies: first, the availability of specialised local services suppliers and second, the proximity to other headquarters located nearby.

79. Other researchers however suggest that the co-location effect between headquarters and production activities remain important. Henderson and Ono (2008) analyse the trade off between locating headquarter close to the production facility and into a large city offering high quality of services. Results indicate that firms prefer to locate their headquarters close to the production facilities, unless cities offer substantial advantages. Among the most important of these advantages is the supply of business services, while rents and congestion effects are dissuasive. The impact of the wages level is limited. Aarland et al. (2006) also show that firms tend to locate their headquarters near production facilities. But the probability of having a separate central administrative office grows with the size and the degree of diversification of the firm. Defever (2006) also examines the co-location of activities but across country. He finds that headquarters have a positive tendency to locate their headquarters in country where they already established production facilities.

### *2.3.3. Some difficulties in the definition of headquarters*

80. Despite some very interesting findings, this literature review also points to a series of shortcomings and ambiguities. In particular, the notion of "regional headquarter" is far from being perfectly defined and statistically measurable (on this question, see also Marini, 2007).

81. First, the question of the "decision-making centre" should be clearly distinguished from that of the "registered office". In many case, those two sites may be located in different cities, as fiscal and legal determinants have different impacts for each of them.

82. Second, the notion of "headquarter" is not clear-cut. A study by AFII (2007) distinguishes various types of situations for regional headquarters of extra-european MNEs in Europe: *i)* small representative office of companies which have not yet set up significant production or distribution activities; *ii)* polyvalent site carrying out in the same place all the major activities of the company (production, sales, R&D, decision-making ; *iii)* weak headquarter only involved in the coordination of regional activities and with no strategic power, the major decisions being taken at the parent company's head office; *iv)* strong headquarter, to which a real strategic autonomy has been given by the parent company. In addition some headquarters concentrate a large share of the back-office administrative functions (such as human resources management, treasury management, accounting, etc.) while other only focus on decision-making, with the other activities being carried out elsewhere, in so called "specialised shared-services centres".

83. Available data on establishments or projects do not always allow a clear distinction between those various categories, whose location determinant may be very heterogeneous. As a consequence, studies supposedly focused on "regional headquarters" also include in fact data on head offices, small representative offices, or shared services centres, which weakens the reliability of their results.

# CHAPTER III. TERRITORIAL ATTRACTIVENESS: POTENTIAL, PERFORMANCES AND POLICIES

84. This question will be addressed through three different approaches. The first section presents the tools available to analyse how the various host territories compare to each other regarding their ability to meet the firm's location criteria, resulting in unequal *attractiveness potentials*. The second section reviews the data available to measure the *attractiveness performances* of host countries in terms of the actual location of projects and activities. A third and last section is dedicated to the *attractiveness policies* implemented by local development authorities to improve both the potential and the performances of the territory.

## 3.1. Attractiveness as a potential: which analytical tools?

85. This first concept refers to the capacity of a territory to meet the needs and requests of the investor better than the other territories in competition to attract a given project. This capacity relies on two elements: on the one hand, the nature of resources available on the territory; on the other hand, the hierarchy of major location determinants influencing the investor's decision, which largely depends on the type of project. A territory, endowed with a given structure of resources (and of prices attached to them) can thus be more or less attractive depending on the type of project.

86. This simple two-fold approach could in principle be used as a basis for the implementation of methods dedicated to the measurement of the attractiveness potential. A handful of publications have implemented this approach for innovation-related activities, and are presented at the end of this section. Many studies, however, only focus on one aspect of the question: either the measurement of attractiveness in general, or the assessment of the global innovation potential of a given country. As they also provide useful insights on our central question, we present them in the first two sections.

### *3.1.1. Global measures of the attractiveness potential*

87. Many studies on attractiveness and competitiveness have a very general scope and do not especially focus on innovation-related activities. However, they provide many interesting insights into these activities. For instance, the annual reports on competitiveness published by the WEF and IMD respectively (WEF, 2007a, IMD, 2008) retrieve hundreds of quantitative variables on all aspects of economic performance in order to rank various countries in the world according to their overall degree of competitiveness. Many of these variables are of interest for our project, either because they give insights into some elements of general environment which also impact innovation-related activities, or because they specifically focus on innovation and R&D. A whole chapter of the WEF's *Global Competitiveness Report* is for instance dedicated to innovation, which constitutes the 9$^{th}$ "pillar" (of 12) of the "Global Competitiveness Index" computed yearly by the Geneva institute, on the basis of eight elementary indicators. According to last year's survey, the eight most innovation-ready countries in the world are, in that order: Japan, the United States, Finland, Switzerland, Germany, Sweden, the Netherlands and Denmark (WEF, 2007).

88. Many surveys on issues related to attractiveness also contain questions specifically focused on innovation. For instance, E&Y publishes every year a benchmark study on European countries called "European Attractiveness Survey" (E&Y, 2008a). This report is divided in two parts: *i)* a qualitative analysis of country performances for the attraction of international mobile projects, based on the European Investment Monitor database (see below) ; *ii)* an opinion survey among business executives. In this year's report, two questions to CEO were especially focused on innovation. According to the responses, the most innovative countries in the world were found to be, in that order, the United States, China, Germany, Japan

and India. As for the major sources of innovation inside companies, they were identified to be, in that order: communication channel, supply chains, financial engineering, product support services, product innovation.

89. To end with, it should be mentioned that many surveys and reports, even if they have a very general scope, may give insights on innovation-related activities, if conveniently retrieved. For instance, the yearly worldwide survey by AT Kearney among CEOs, called "AT Kearney FDI confidence Index", ranks the countries according to their overall attractiveness for investors[14] (AT Kearney, 2008). So far, no specific results have been published by AT Kearney depending on the industry of the respondent company. But, if such a sorting were made, an attractiveness indicator specific to high-tech industries could be displayed. The same remark holds for all other surveys among companies, such as those made, among many others, by Ernst &Young (2008a) or UNCTAD (2007).

### *3.1.2. Assessment of the local innovation potential*

90. Other studies try to benchmark the innovation or R&D capabilities of various countries around the world, but with no special focus on the question of attractiveness. For instance, INSEAD has computed a "global innovation index", based on eight groups of indicators,[15] which gives the highest scores, in that order, to the United States, Germany, the United Kingdom, Japan, France and Switzerland (INSEAD, 2008).

91. The "Global Information Technology Report", published yearly by the WEF (2007b) since 2002, tries to benchmark the ITC potential of 127 countries around the world on the basis of three sets of indicators (ICT environment, ICT readiness and ICT usages). In last years' survey, the top-ten countries were, in that order, Denmark, Sweden, Switzerland, the United States, Singapore, Finland, the Netherlands, Iceland, Korea and Norway.

92. The "Science, technology and industry scoreboard" (2007a), published every two years by OECD, brings together over 200 indicators to compare the innovation potential and performances of OECD members and major non-members. The 2007 study highlighted the progresses made by emerging countries, notably China and India, in such fields as investment in research or trade in high-tech industries.

93. The European commission also publishes a so-called "European innovation scoreboard", (UNI-MERIT, 2007) which benchmark 37 countries around the world. According to the "2007 summary innovation index", the countries with the highest scores were found to be, in that order: Sweden, Switzerland, Finland, Israel, Denmark, Japan, Germany, the United Kingdom and the United States.

94. Many studies focus on the benchmarking of universities around the world in terms of research potential and quality of education. The "Shanghai Ranking", published every year by the Jiao Tong University, ranks 500 universities worldwide, mainly on the basis of R&D criteria. In this year's survey, Harvard came first, followed by Stanford, Berkeley, Cambridge (United Kingdom) and the MIT[16] (Shanghai, 2008). A study by Ecole des Mines de Paris (2008) ranks 338 universities in the world based on the criteria of the number of their graduate having reached top positions in the largest companies in the world. Harvard again comes first in this ranking.

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14 In this year's survey, the most attractive countries were said to be, in that order: China, India, the United States, the United Kingdom, Hong-Kong, Brazil, Singapore, The UAE, Russia and Germany.

15 They are: institutions and policies, human capacities, infrastructures, technological sophistication, business markets and capital, knowledge, competitiveness, wealth.

16 The survey also makes specific ranking by broad subject fields.

95. As for the OECD Education outlook (2008d), it provides a large set of comparative data on educational effort and achievement carried out by OECD member countries. Among the major findings of the two most recent studies is the trend to a strong progression of the percentage of university graduates in the young population of some Asian countries such as Korea and Japan, which now rank at parity with the traditional top–performers for this indicator: Russia, Canada and Israel.

96. Regarding the financing of innovation, KPMG has published, in the past years, a series of studies benchmarking European countries on the basis of around twenty quantitative indicators. According to the 2006 issue of this survey, the countries providing the best legal and tax environment for the development of private equity and venture capital in Europe are, in that order, Ireland, France and the United Kingdom (KPMG, 2006).

### *3.1.3. Some specific studies on innovation-related activities*

97. Studies especially focused on this issue are not numerous. They can be divided into two broad categories: *i*) industry-specific approaches and *ii*) benchmarks of large metropolitan areas, which provide insights on the attractiveness of these locations for strategic functions such as HQ and R&D.

*98.* *Industry-specific studies* are quite limited in number. One of the most comprehensive works in this category is the KPMG yearly report comparing the attractiveness of different potential locations in the world (at the country and city level) for various types of investment projects. It uses for this an original method, based on the building of simplified business plan where all components of costs are taken into account. Specific results are presented for a large set of innovation-related projects, such as pharmaceutical and biotech labs, medical devices or electronic equipments manufacturing facilities, R&D and software design centres or clinical trials activities (KPMG, 2008).

99. Among other interesting studies, one can mention the quarterly Ernst & Young survey on "Attractiveness for Renewable Energies", which ranks 25 countries in the world on the basis of a mixed approach (hard data + opinion survey). In the last issue of the report (2008c), the six top countries were, in that order: the United States, Germany, India, Spain, the United Kingdom and China.

100. *Many studies aim at comparing the quality of the business environment and the attractiveness of major metropolitan areas*. The Cushman-Wakefield "European Cities monitor", based on some dozens of qualitative indicators retrieved from a questionnaire survey among CEOs, ranks this year London and Paris as the best european locations for business among a set of about 30 cities (Cushman-Wakefield, 2007). It also provides insights into the key location factors, which are, in that order, availability of qualified staff, easy access to markets, customers and clients, and quality of transport and communication infrastructures. Among the many other survey or studies of the same kind, it is possible to mention: the PriceCoopersWaterhouse' "Business readiness indicators for the 21th century" (2007), which benchmarks 9 large cities around the world on the basis of a dozen of quantitative indicators; and the Ernst & Young's "Global Cities Attractiveness Survey" (2008b). In the last issue of this survey, New York appears as enjoying the best image among investors, followed by London, Paris, and, far behind, Tokyo and Peking. Figures also show the growing attractiveness of large cities in emerging countries.

### *3.1.4. Other data available for the construction of an attractiveness scoreboard*

101. Some very comprehensive data bases have been set up by consulting companies in order to help investors to benchmark various territories (either at the country, regional, or city level) on the basis of a very large set of indicators regarding prices, resources, markets, legal and fiscal environment, etc. Among the most well-known ones are the Economist Intelligence Unit's *Market indicators and forecast* and the

OCO Global's *fDi Benchmarke.*[17] Despite relatively high access costs, these databases could prove very useful sources for the would-be making of an "Innovation attractiveness scoreboard".

### 3.2. Attractiveness as a performance

102. This concept refers to the amount of mobile activities[18] that a given territory has been able to attract, either in absolute value, or as a share of the total amount of mobile activities likely to locate there. One of the many problems raised by this definition is that the numerous existing measurements of performances on attractiveness are often conflicting, and that most of them suffer from major methodological shortcomings (for a general analysis of available data, see OECD 2007b and 2008a). It is possible to distinguish two main approaches, based respectively on the flows of new projects or investments and on the level of the existing foreign presence.

#### *3.2.1. Data on inward investment flows*

103. Data on international investment flows by industry are mainly based on three sources: *i*) statistics on foreign direct investment (FDI) retrieved from the balances of payments; *ii*) census of M&A projects; *iii)* census of mobile greenfield projects.

104. Various factors hamper the reliability of FDI data, especially as a basis for studies on innovation-related activities. First, harmonised international FDI data are not so far available at the crossed industry/home country level. If they were, their informative content on real investment location would be problematic, for many reasons (on this subject, see: OECD, 2005; Hatem, 2004): *i*) imprecision in the classification of flows by industry based on a sectoral approach; *ii*) important discrepancies between the definition of FDI and that of gross fixed capital formation abroad; *iii*) no distinction between FDI related to greenfield, M&As, and other operations; *iv*) impossibility to identify FDI flows specifically related to investments in R&D activities. Regarding data on FDI stock, their level may vary a lot depending on the definition used to measure them: historical value, accounting value, etc. (Ramstetter, 1996).

105. Data on M&A operations are regularly collected by consulting firms, especially those operating in the financial sector, such as Thomson Financial.[19] As they are not constrained by the same strict confidentiality rule as are statistics published by public bodies, they can be made available at the crossed industry/home countries level. Their worldwide coverage allows comparisons including non-OECD countries[20]. But they are also hampered by some shortcomings.[21] In addition to the already mentioned imprecision of the industry classification based on sectoral approaches, it should be mentioned that the nomenclatures used by consultants are most of the time not coherent with the usual ISIC ones. The most

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17 OCO has also carried out a census and benchmark of the major clusters existing in Europe and in some other part of the world (OCO, 2005).

18 We only address here the question of the attraction of direct investment flows. Such questions as outsourcing, partnerships, attraction of financial flows for the financing of innovation, or attraction of human resources (researchers, PHD students, etc.) are thus excluded from the scope of this section.

19 The Thomson One banker database also provides extensive information on firms and financial institutions, including structures of ownership, at the worldwide level.

20 In this respect, one of their major findings, is, unsurprisingly, that most of the purchase operations carried out in high-tech industries, both in terms of number and value, regard the acquisition of companies located in developed countries.

21 This paragraph only focuses on statistical issues, and will no include a discussion on the relevance of M&As data for the measurement of territorial attractiveness. This question will be partly addressed in chapter IV.

striking shortcoming, however, relies in the fact that the data collection method is based mainly on announcements made by the companies themselves. A bias with effective realisation may thus appear if the final value of the M&A is different from the one initially announced, if the operation is postponed, and, last but not least, if it is finally not completed[22].

106. Data on greenfield international investment projects are collected by consultants on the basis of press review, web scanning, and information released by companies and investment promotion agencies. Three main data bases are available. While OCO's *fDi Markets* and IBM/PLI's *GILD* have a worldwide coverage, E&Y's *European Investment Monitor* (EIM) only registers inward projects into European countries. They focus exclusively on greenfield (site creation) and brownfield (site extension) projects, and do not include M&As and non-investment projects such as partnerships or outsourcing. Each project is described by about ten parameters (size in terms of employment and investment,[23] host country and sometimes region, industry, function, announcement date, source of information, investor and home country of the investor). Among the major advantages of these sources is that: *i*) they allow real-time analysis[24] based on microeconomic data; *ii*) they provide information at the world-wide level.[25] As in the case of M&As, their major shortcoming is linked to the fact that the collection of information is based on the announcement of projects and not on their effective completion. In addition, they provide no information on the sizing down or closing down of existing locations.[26]

107. According to the information contained in these data bases, emerging countries seem to be already capturing a very large share of international projects and related job creation, including in innovation-related activities (OCO, 2008). For instance, according to OCO data bases, China and India already rank respectively 1rst and 3rd in the world for the number of international projects on R&D centres since 2003 (AFII/IIG, 2008). This diagnosis contrasts sharply with that based on other sources, which show a still massive domination of developed countries for the attraction of innovation-related activities, be it in terms of turnover or employment (see for instance the worldwide breakdown of foreign R&D activities of US companies, in OECD, 2008a).

### *3.2.2. Data on the presence of foreign-owned activities*

108. Due to the methodological limitations of data on FDI, many specialists have argued long ago that the most adequate measure of attractiveness performances might be given by the level of activities of foreign companies in the territory, either in absolute level, or preferably as a ratio[27] (Hatem, 2004). In this

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22 As exemplified by the case of the acquisition of French Eiffage by Spanish Sacyr, announced in 2007, recorded by Thomson for the same year, and finally not completed.

23 In fact, due to the high number of missing information, data on the size of projects are hardly usable for analytical purposes, and most of the studies based on this kind of data bases focus on the number of projects, with no distinction made depending on the size of operations.

24 Information on newly announced project is practically available in real time. Retrieved and checked data usable for analytical purpose are available a few months after the announcement of the operation.

25 This remark is not true, however, for the E&Y's *European Investment Monitor*.

26 It should be added that these databases, of course, are not available free of charges. To give some examples, the cost of a subscription the OCO fDi Markets database is 14 000 euros for two users. The yearly subscription to the EIU's Market Indicators and Forecasts is £ 8 520 for one user; the subscription cost to OCO fDi benchmark (as very detailed database on location determinants) is 119,000 euros for 250 locations and three users. No subscription is possible to have access to the IBM/PLI's GILD database.

27 Different ratios can be considered: either the *degree of openness of a given country for a given activity* measured as the share of foreign presence vs total; or the *international market share of a given country for*

regard, the harmonisation work carried out by OECD has allowed the building of databases (such as AFA and FATS) providing a large set of statistics, at least for OECD countries (OECD, 2007b; OECD, 2008a), for such items as turnover, employment, exports or R&D expenditures.[28] Among the major advantages of this statistical work is that it gives a clear view of the repartition of foreign-owned activities in high-tech and R&D activities among OECD countries at a quite detailed industry level, and gives insights on the overall characteristics of foreign presence in each of the OECD countries for which data exist. It also allows time comparisons over a quite extensive period (typically for the mid 90s to the mid-2000s). Among the major shortcoming of this source of information are the lack of available data regarding foreign presence in non-OECD countries, as well as the fact that information on R&D investments is limited to in-house expenditures and does not distinguish R&D subcontracting abroad.

#### *3.2.3. A structural heterogeneity of sources*

109. The various categories of sources mentioned above are basically heterogeneous, in terms of statistical concepts, as well as nomenclatures and data collection methods. For instance, it is presently in most of the cases impossible to give a comprehensive and coherent description of: *i*) the breakdown of FDI flows into M&As and greenfield investments; *ii*) the way the flows of new projects and investments explain the evolution of the level of foreign activity in a given country. These affirmations are true at the global level as well as for each industry taken separately.[29]

### 3.3. Attractiveness as a policy

110. This last concept refers to the implementation of various measures by local authorities (incentives, promotion strategies, improvement of the local business environment) aimed at improving the attractiveness of the territory for outward investments. This definition raises two major difficulties: on the one hand, it is often difficult to establish a clear-cut distinction between policies especially aimed at attracting innovation-related activities and more general measures aimed at improving the local business environment or the general attractiveness of the territory for any kind of foreign investment; on the other hand, it may be difficult to assess clearly, beyond the very many reports and policy announcements made by local authorities, which measures have been effectively implemented and what have been their actual impact on attractiveness performances. Our presentation addresses three points of major interest: *i*) policy advocacy and the elaboration of diagnosis on attractiveness; *ii*) effective implementation of policies and measures; *iii*) assessments on the impact of these policies.

#### *3.3.1. Diagnosis on territorial attractiveness: the case of France*

111. A consequence of the rising concerns over the question of attractiveness has been the publication of a large number of reports, issued either by public authorities, professional groups or independent bodies, with a twofold purpose: on the one hand, establishing a diagnosis on the strengths and weaknesses of a given territory; on the other hand, advocating policies aimed at improving the present situation. Many of these reports are especially focused on innovation-related activities, as illustrated by the example of France.

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*a given activity*, measured as the ratio of foreign presence (or investment flows) in this country vs total foreign presence (or investment flows) in all potential host countries.

28 We shall not comment in this paper on the major findings based on these data bases. For this analysis, please refer to previous work of the OECD secretariat (OECD 2007b; OECD 2008a).

29 It should be noted, however, that some countries have carried out studies to explain the specific contribution of M&As, creation of new subsidiaries, and internal growth of existing subsidiaries to the evolution of the foreign presence, globally and by industry (See Angel & Regnier, 2006, on the French case).

112. *Regarding R&D,* at least two major reports have been dedicated to the question of the attractiveness of France for R&D in the last four years: the Futuris report (Sachwald, 2004) and the report by the "Centre d'analyse stratégique", a body of the French government (2005). Both rely upon a similar structure: after a description of the on-going trend towards internationalisation of R&D, they analyse the new stake involved in terms of attraction of these activities. They make a diagnosis on the French attractiveness in this regard, and identify some major weaknesses, such as i) the insufficient links between public and corporate research, *ii*) the limited size of the major French scientific centres relatively to the largest ones at the world level; *iii*) a sometimes constraining fiscal and legal environment; and *iv*) higher costs than in emerging countries. They finally advocates a series of measures aimed at: *i*) increasing the efficiency of tertiary education and public research; *ii*) developing their link with business; *iii*) increasing legal and fiscal incentives to R&D.

113. *Regarding decision centres*, two major parliamentary reports have been focused on the question of the attractiveness of France for corporate headquarters in the last four years: the Huygue report (2003) and the Marini report (2007). Both reports stress on the fact that France, despite the existence of major strengths (a world-level capital city, good infrastructure, availability of skilled labour, good quality offices at affordable prices, etc.), underperforms in terms of the attraction of headquarters as compared to some other European countries[30]. This is due, among other things, to a series of handicaps linked to personal and corporate fiscal issues, labour regulation, and a mediocre image of France as a business location among corporate executives. They thus propose a series of measures in order to remedy the French weaknesses. For instance, the Marini report advocates for the implementation of not less than 29 measures, covering a wide range of issues such as better protection of groups against hostile bids, the simplification of business regulation and the suppression of red tape, the improvement of the fiscal statute of impatriate executives, stronger incentives to long-term saving, etc.

114. *Regarding high-tech industries*, many sector-specific reports have been published recently in France. To mention only one example, a report by the Rexecode Institute to the Strategic Council on Health Industries (2005)[31] suggests, among other measures, to foster the so-far limited French innovation capabilities in biotechnologies.

### *3.3.2. Policy announcements and actual measures*

115. The attraction of skills, financial resources and projects from abroad may contribute to strengthen the various components of the so-called "local innovation systems" (UNCTAD, 2005). This is why many developed countries have recently focused, in recent years, their attractiveness policies on innovation-related activities, in order to remedy to the loss of advantages in traditional manufacturing activities. This is for instance the case, among others, of such countries as the Netherlands, Sweden, Ireland or France (Hatem, 2007b).

116. This new orientation can also be observed among the most advanced emerging and transition countries, such as Korea, the Czech Republic or Mexico (Martinez, 2004). After having based their industrial policy on the attraction or local development of low then mid-tech manufacturing activities, those countries must now turn to more high-added value segments in order to make up for the decline of their competitiveness in labour-intensive activities, where their suffer in turn from the competition of countries with very low wage levels.

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30 The Marini report, however, makes a more optimistic diagnosis on the French performance, on the basis of a E&Y study on the location of the MNEs' regional headquarters in Europe, than the Huygue Report.

31 *Les enjeux de l'industrie du médicament pour l'économie française*, 2005, Available on http://www.leem-media.com/leem-image/leem/document/411.pdf

### *3.3.3. Impact of the attractiveness policies*

117. It should be noted, however, that the scientific literature dedicated to the actual impact of these policies on territorial performances remain relatively scarce[32] and does not always make a very positive diagnosis. For instance, a study by Appold (2004) on the case of the United States finds no significant impact of the creation of scientific parks by public authorities on the location of R&D or other innovation-related activities, for two major reasons: *i*) even if some of these parks have meet tremendous success, a large share of them has totally or partially failed; *ii*) the development of a scientific park can be analysed, in many cases, more as a consequence of a pre-existing local dynamism in innovation-related activities, than as a triggering factor for the location of this kind of activities from scratch.

[32] We exclude, the many apologetic studies published by the institutions in charge of the implementation of these policies.

# CHAPTER IV. CONCEPTS AND METHODS: A CRITICAL VIEW

118. The former literature review has shown the existence of an already substantial "corpus of knowledge" on location determinants in innovation-related activities. However, it is also possible to point out a certain number of uncertainties, shortcomings and ambiguities, as well as pending questions, which may give precious insights in the future orientations of the OECD projects. This chapter addresses four different issues: concepts, level of analysis, methods and data. The question on findings ("What do we know?") will be addressed on the next and last chapter, together with the presentation of the working programme.

## 4.1. Conceptual issues

119. A first conclusion of this literature review on "Location determinants in international innovation-related activities of MNEs" regards the existence of some shortcomings and ambiguities in the definition of the subject itself. These difficulties focus on three major issues: *i*) the definition of "innovation-related activities"; *ii*) the necessity to take into account non-investment modalities such as outsourcing; *iii*) the (ir)relevance of excluding home-based companies (especially MNEs) from the scope of the analysis.

### *4.1.1. Definition of innovation-related activities*

120. To begin with, we should stress the fact that, in the making of this literature review, the authors had to collect papers from very varied fields of research, such as industrial and economics, international economics, management and business, local development dynamics and policies, etc. This fact is not a surprise, as the question of location determinant is by nature at the cross-road of many disciplines. But it also reveals that the concept of "innovation-related activities", as defined by the OECD working party, encompasses a very large and somewhat heterogeneous set of activities, which raises some questions about its overall coherence.

121. One of the major originalities of this definition is that it mixes a sectoral approach (high-tech industries) and a functional one (R&D and decision-making activities). This twofold approach however leads to some ambiguities.

122. First of all, the literature on HQ seems to have relatively few connections with the other sets of work included in our review. In particular, references made to technological innovation dynamics in the literature on HQ location remain quite scarce. Some studies (Strandel, 2007) even explicitly point to the fact that the internationalisation dynamics of HQ and R&D centres are quite independent, at least in terms of site location decisions. These findings are not very surprising when we consider that many of the decisions taken at headquarters regard subjects others than innovation-related ones. For these reasons, we suggest dropping the question of the HQ location determinants from the scope of the project. To better understand the internationalisation dynamics of innovation-related activities, an analysis of the decision-making process within the MNE – especially focused on the respective role of its central and regional headquarters - would seem more appropriate.

123. On the contrary, there are strong connections between the literature on R&D and high-tech location determinants. This is natural when we think that: *i*) HT industries are defined as those where the RD intensity is the highest (OECD, 1997),[33] *ii*) the largest share of R&D efforts are carried out in high-tech

[33] This incidentally led to some minor difficulties in the writing of the review, as many of the papers analysed naturally focus both on R&D and high-tech, leading to difficulties in classifying them under one of these two items and hence to some risks of repetition in the text.

industries. A mixed approach (HT industries + R&D functions) thus seems very pertinent to understand the internationalisation dynamics in innovation-related activities. However, two major difficulties, already addressed in former paper of the OECD secretariat (OECD, 2007b) remain. On the one hand, innovation is limited neither to HT industries nor to technological innovation. A study by Hatem (2007a) identified 25 very innovative segments, where international investment flows could rise sharply in the coming years, out of which less than one half belong to the mere "high-tech" industries (*e.g.* new energies, technical textiles, new materials for the transportation industries). In addition, the dynamics behind many of these innovations are not of a mere technical nature, but also organisational (*e.g.* outsourcing of business functions) or commercial or related to the apparition of new consumers' needs (*e.g.* health food, services to the elderly). On the other hand, some segments and functions in high-tech industries are not more innovative than in others (*e.g.* accountancy, treasury management). These remarks should be kept in mind when the future working priorities for the project will be discussed (see Chapter V).

### *4.1.2. Internationalisation modalities*

124. To set up their R&D activities abroad, MNEs may choose to outsource and/or buy patents, develop partnerships or do in-house research. In this last case, they may have the choice between internal growth through a greenfield investment or external growth through M&A.

125. Although some papers explicitly address this last question[34], our general feeling is that most of the literature we have read implicitly focuses on the question of location determinants for in-house R&D through greenfield investments. The interactions between entry mode, choice between in-house and out-sourcing, and geographical location patterns and determinants have not, to our knowledge, been addressed as such in many studies.

126. The question of outsourcing[35] is of particular interest. It is now well recognised that firms are outsourcing a wide range of their tasks, including to abroad. This trend is also noticeable in R&D activities, albeit on a small scale than for other corporate functions such as production[36]. For instance, a report issued by the French government (CAS, 2005) indicates the growing importance of outsourcing in firms' R&D strategies (see also OECD, 2008b). Ignoring this internationalisation mode would lead to underestimating the total international R&D efforts carried out by MNEs.

### *4.1.3. Attractiveness and the firm's nationality*

127. The implicit choice to limit the analysis on territorial attractiveness to the only case of so-called "foreign" companies nationality is questionable, for at least four main reasons: *i*) many MNEs, especially in high-tech activities, have reached such a high level of internationalisation, be it in terms of turnover, nationality of owners and decision-makers, building up of cross-border innovation and production networks, that it becomes increasingly difficult to identify clearly their nationality; *ii*) the so-called "home-based" companies may benchmark their home country to others, exactly as do the so-called "foreign" ones, for the location of new investments or the relocation of existing activities; *iii*) the so-called "foreign"

34 Kuemmerle (1999) examines the mode of overseas R&D and finds that greenfield investments are the dominant mode of entry: 79% of all sites are greenfield, followed by acquisitions 15% and joint venture, 6%.

35 See (OECD, 2008a) for a complete definition of various entry mode.

36 Ito, Tomuira and Wakasagi (2007), have carried out an extensive analysis of offshore outsourcing by Japanese manufacturing companies, based on a very large survey (more than 5500 respondents). They found that *i*) 21% of firms are outsourcing in foreign countries (with however only 3.6% of this outsourcing offshore being related to R&D, as compared to 70% in production tasks); *ii*) most of the time, R&D is outsourced in the boundary of multinational firms, *e.g.* to the own foreign subsidiaries of the firm.

companies have sometimes a very ancient and strong presence in a given home country, and fully participate, through their subsidiaries, into the local territorial development; *iv*) at the infra-national level, the most operational distinction is not between "national" and "foreign" companies, but between "regional-based" and "external" companies, whatever the nationality of the latter. This means that the focus on "foreign" companies as a distinct category might prove more and more inadequate, while the problematic of attractiveness might be diluted into the question of the creation of a favourable business environment for all companies, whatever their home country.[37]

### 4.2. Level of analysis

128. Our review reveals the coexistence of very heterogeneous levels of analysis in the literature, as regards both spatial and activity coverage. Each of them presents specific advantages and shortcomings.

#### *4.2.1. Activity scope: general or specific?*

129. Some studies cover a very broad scope of activities (industries and/or functions), of which innovation-related activities are only a part. Defever (2006) compares for instance the location determinants of a set of corporate functions including production, logistics, headquarters, R&D centres and call centres. This approach allows a perspective view on the specific findings regarding HQ and R&D centres as compared to other business functions. But its global nature also implies that the same set of explanatory variables is tested for all activities, whereas more adapted variables could be more accurate for a specific industry or function.

130. Other studies, on the other hand, are specifically focused on only one function or industry. In this case, more activity-specific variables can be used. For instance, Koenig and MacGarvie (2007) study the specific impact of the regulation of drugs prices on the location of pharmaceutical projects in Europe. But the shortcoming of this approach, symmetrical with that of the previous one, is that it does not allow to compare on a harmonised basis the location behaviour of innovation-related activities with those at work in other activities.

131. It should also be remembered that in the case of activity-specific studies, various levels of generalities can be found (see Chapter II, section 2). For instance, Hacker (2003) makes a broad opposition between so-called "low-tech" and "high-tech" location determinants in the United States. Barrios et al. (2008) study the global geographical pattern of ITC in Europe, but also analyse in depth specific issues for each of it sub-sectors. Finally, many consulting firms have issued reports on specific niches characterised by a large flow on innovation and where a significant rise in FDI could take place in the coming years, such as renewable energies (Lemagnen, 2007).

#### *4.2.2. Geographical focus: from global to local*

132. The literature is also characterised by a large variety of spatial level of analysis:

- *Some studies are based on information on a large range of home and host countries*. This is for instance the case of the UNCTAD's World Investment Report 2005, which analyses R&D internationalisation trends at the global level. Many benchmarking studies on attractiveness or competitiveness also cover a wide range of countries, regions or cities all around the world (see

[37] At the very limit, *e.g.* in a totally integrated world economy the question of attractiveness can be captured through very traditional indicators, such as the world share of a given territory in production, investment, international trade, with no more distinction made depending on the so-called "nationality" of the firm nor mention of so-called "international" investment.

Chapter III). Other studies cover a whole continent or integrated economic regions, in particular those made at the EU-27 level (Barrios et al., 2007) or those regarding OECD countries. However, it should be stressed that, in most of the case, those regional studies are focused on developed countries (both as home and host regions). Little is known about the growing role of emerging countries in R&D internationalisation.

- *Some studies are focused on a given home country.* Examples are: Germany (Ambos, 2005), Japan (Ito and Waksaugi 2007; Iwas and Odagiri, 2004), United States (Zhao, 2004), Norway (Narula (2002). In this case, findings regarding the internationalisation determinants of R&D are likely to be country-specific and then difficult to generalise. Indeed, as pointed out by several researchers, strategies regarding R&D internationalisation differ substantially between countries (see for instance Granstrand, 1999, Edler *et al.*, 2002).

- *Studies focused on a given host country.* Examples are: the United States (Florida, 1997; Iwasa and Odagiri, 2004); United Kingdom (Pearce, 1999). The drawback of this approach is that, contrary to the previous studies that cover generally a wide range of host country, comparisons of the relative attractiveness features of various host countries are not possible.

- *Bilateral approaches,* such as the study carried out by Isawa and Odagiri (2004) on the location of Japanese MNEs' R&D activities in the United States (2004) or the study by Mataloni on location determinants of US firms in Europe (2007).

- *Studies focused on internal competition within a country*. This is typically the case for the United States (see the example of studies on the location of headquarters, Chapter I). One should stress the particular interest of this focus on the local level, as many of the location determinants for innovation-related activities, such as agglomeration effects, cannot be efficiently analysed at the country level.

### 4.3. Advantages and shortcomings of various methodological approaches

133. The studies described above were mainly based on four broad types of methodologies, each one presenting different advantages and drawbacks: *i*) Econometric or other elaborate statistic analysis methods; *ii*) surveys, especially among MNEs; *iii*) case studies and monographies; *iv*) typified presentation of decision-making processes regarding individual location choices. Of course, some studies combine these various approaches.

#### *4.3.1. Econometric studies and other complex statistical analysis*

*134.* *A* wide range of econometric methods has been used in the literature on location determinants:[38]

- Some recent econometric studies on location determinants still use data on FDI flows and stocks as an explained variable (see the study by Stein and Daube (2007) on the role of time zone in bilateral flows). But their number is in relative decline as compared to 20 or 30 years ago (see an old literature review by Mucchielli, 1992). As a matter of fact, this variable has shown many shortcomings as a measure of real international investment flows (for a critical review, see Hatem, 2004).

[38] The description of each of these methods is well beyond the scope of the present study because it would imply a very specialised and technical discussion in econometrics. See for instance (Greene, 2003) for an overview of econometric analysis.

- On the opposite, two complementary factors contributed to the development of discrete choice location models in the recent years: *i*) the implementation of the logit method by Mc Fadden[39] in 1974; *ii*) the development of microeconomic databases on individual projects, establishments and companies with sometimes information at a very detailed geographical level. In consequence, discrete location choice models have been used in a very large number of recent publications, providing very interesting results in location determinants. More than 10 of the studies censed in our literature survey use this approach, mostly under its logit form, or under one of its major variant (tobit), which takes explicitly into account the absence of location as a decision in itself (Goetz and Rupasingha, 2002).

- Various kinds of principal components analysis have been carried out, generally on data regarding individual investment projects, in order either to identify a typology of projects depending on the type of determinants having influenced their location (Le Gall, 2008), or to detect the existence of country profiles well adapted to the attraction of a given type of project (Anima, 2007).

135. The major advantage of these methods is that they give a high level of scientific legitimacy to the results obtained. But they also suffer from three major shortcomings: *i*) the implementation of these econometric approaches is limited by the availability of internationally harmonised data at the country level, which sometimes obliges to use lousy proxies or to give up the analysis of some interesting explanatory variables, and thus limits the precision and quality of the findings; *ii*) some of these methods, such as the logit approach with its varied developments, are technically extremely complex, and their results not always easy to understand in simple words by non-specialists.

### *4.3.2. Surveys among companies*

136. Surveys among TNCs business executives are very commonly used, essentially by consultants but also by some academics, in order to give insights on two main categories of question:

*i.* *The identification of location criteria*. Examples are: Thursby and Thursby (2006) for R&D activities; Le Gall for ITC industry (2008).

*ii.* *The measurement of the attractiveness of potential host territories*. The Consultants' literature on this subject is especially impressive, as already seen in Chapter III (Cushman-Wakefield, 2008; AT Kearney, 2008); Ernst and Young, 2008a et b).

137. The main advantage of surveys is that they allow asking direct and precise questions to decision-makers over a large range of issues, without any limitations related to the unavailability of data as in the case of econometric approaches. For instance, the fact that some firms locate their R&D units near universities or research centres cannot in general be properly tested in econometric studies due to the lack of precise enough data, whereas a direct question on this issue can be easily addressed in a survey.

138. It should however be underlined that the reliability of these approaches is globally questionable for many reasons.

[39] The idea is to explain the probability of locating a given type of project or establishment into a given territory, depending upon the characteristics of this territory. It implies to have access to data on individual projects or establishments.

139. First, surveys and questionnaire surveys cover very often a quite restricted sample of firms, albeit larger than in case studies. This is in particular due to the fact that it is hard to collect responses and that this situation seems to be gradually worsening.

140. Second, while these surveys are addressed to top managers, the identity of respondents inside the company is not always well known, particularly when answers are collected by e-mail. It is thus difficult to check whether the real respondent really mastered the information necessary to give proper answers to the survey.

141. Third, the way the questionnaire is set up can largely influence the results. As pointed out by a study by the university of Texas,[40], the form of the question (open-ended, closed, scaled or ranking) as well as its wording can influence the result. This is due in particular[41] to the "anchoring effects" (*e.g.* the human tendency to rely too "heavily" on one piece of information, for instance the one contained in the question or in the survey itself, when providing an answer).

142. Fourth, the intrinsic quality of answers is questionable for many reasons: *i*) acquiescence or yes-saying (people having a tendency to answer "yes" rather than "no", inasmuch as there is uncertainty about the answer); *ii*) "framing effect" (*e.g.* the fact that same issue presented in different ways in the survey results in contradictory answers); *iii*) various other biasing factors: misunderstanding of the question, insincerity of replies, and desire of the respondent to avoid wasting time. A study by Jun and Sungh on location determinants of Asian companies (1996) found a considerable discrepancy between replies to a survey among these firms and the results of an econometric analysis on their effective location choices.

143. Fifth, in the case of very diversified groups, a difficult choice has to be made regarding the firm to which the questionnaire should be addressed (parent company? Specialised subsidiaries? In this last case, how many specialised subsidiaries should be surveyed inside of the same group? etc.).

144. A way to address some of these difficulties is to carry out partly or totally the survey through direct interviews with the respondents. But this is of course a very time-costly approach.

### *4.3.3. Case studies and monographies*

145. Some studies do not rely upon a statistical approach based on the retrieving of an important quantity of numeric data, but on case studies based on an in-depth analysis of a limited number of examples. For instance, a recent study by Mechin (2006) has analysed in detail the decision-making process which has led to the opening of a new research centre on micropressors by NXP in Colombelles, near Caen in France.

146. These case studies give very precious insights into concrete reality. They are often used to illustrate some precise trend and provide explicit examples. However, their major shortcoming is that they can hardly be used as a basis for conclusions of a general nature. In addition, they do not provide in most of the cases, elements of comparison between the specific focus of the study (*e.g.* industry, geographical area) and other groups or categories.

### *4.3.4. Modelisation of the decision-making process*

147. The principle of this approach is relatively simple (see (KPMG, 2008), a study already presented in Chapter III): the main elements of comparisons taken into account by the company in its location

40 http://www.utexas.edu/diia/assessment/iar/teaching/plan/method/survey/survey_tables_questiontypes.pdf

41 See Dominitz and Van Soest (2008), Survey data Analysis of the New Palgrave Dictionary of Economics.

decision (availability and cost of resources, quality of infrastructures and labour, distance to market, etc.) are represented in a simplified business-plan. For each potential location, the model is parametrised according to the local conditions (especially local prices, etc.). Its main results consist in a handful of synthesis financial indicators (such as pay-back, profit, etc.) for each location, which allows to rank these locations according to their compared profitability. An interesting characteristic of this approach is that it allows, practically by definition, to take into account the varied nature of projects, as each type of project is characterised by a different vector of needed inputs. The specificity of innovation-related projects can thus be accurately described.

148. A major shortcoming of this approach is that it takes into account only the direct investment and operating costs of the projects, with no mention of the quality of the business environment. Some consultants have overcome this limits by the implementation of a two-fold approach taking into account both the cost and quality factors (Spee, 2004). Results show that higher operating costs in such countries as Germany are compensated by a better quality of the business environment, while some cheap-labour developing countries still lag behind regarding this indicator.

#### *4.3.5. Combined approaches*

149. Many studies rely in fact on a combination of the former methodological approaches. Results from a survey among companies may be subject to various elaborate statistical works, such as the principal components analysis carried out in the study by Le Gall (2008). Some case-studies rely on very extensive and systematic interviews carried out among the actors in the location decision process (Mechin, 2006).

150. But the most frequent case is the implementation of a mixed approach, based partly on an opinion survey and partly on a set of statistical hard data, in order to build scoreboards or attractiveness rankings. Examples are: IMD's Global Competitiveness Yearbook (2008); WEF's World Competitiveness Report (2008); E&Y's European Attractiveness Survey (2008).

### 4.4. The question of data

151. *Regarding data on international investment and projects*, shortcomings on FDI data make their usefulness for our subject quite problematic. Data on projects or establishments, such as retrieved from private consultants' databases (such as fDi market, IBM/PLI, etc.), seem of more interest, as they can serve as a basis for the modelisation of discrete choices.

152. *Regarding the presence of foreign companies in OECD countries*, aggregated data such as those recently gathered by the OECD in the AFA and FATS database, show an interesting potential which so far has not been fully exploited for analytical purposes.[42]

153. *To conclude with, data on patents* also represent an interesting and somewhat under-used source of information. Various studies have used the patenting activity in order to measure extent and motives of R&D internationalisation (Cantwell and Janne (1999), Patel and Vega (1999), Le Bas and Sierra (2002), Ivasa and Odagiri (2004), Zhao (2004)).This approach involved two major problems (Griliches, 1990).

154. The first one is related to the industry classification of patent. Must it be assigned to the industry in which the invention was made? To the industry which has the strongest technological connections with it? Or to the industry which will take advantage of this innovation through the use of the resulting product as an input into its own activities?

[42] These data base however give no insights on the presence by MNEs in non-OECD host countries.

155. The second one is related to the intrinsic value of the patent. Various patents may obviously differ widely as regard their technical and economic significance. Then, patenting strategies differ widely depending upon the firm or the country. In some cases, only one general patent may be taken for a whole stream of innovations. In other cases, the choice can be made to patent separately each single component of this innovation[43]. This may involve biases in the measures of revealed technological advantages (either country or company-specific) build in many studies on the basis of the raw number of patents filed.

156. Despite these shortcomings, data on patents provide very complementary information to those regarding R&D expenditures, especially in case of studies aimed at intra-national issues such as the identification and analysis of clusters, agglomeration effects, etc.

[43] This seems to be the case, for instance, in Japan.

# CHAPTER V. PROPOSALS FOR FUTURE WORK

157. The first section of this chapter presents a list of works to be carried out in the next steps of the project. The second section discusses implementation issues, such as mobilisation of resources, potential partnerships, working options, and time schedules.

## 5.1. Major studies to be implemented

158. These studies may be regrouped into four categories: description of the FDI trends and markets; analysis of location determinants; assessment of territorial attractiveness, insights on public policies and their impact.

### *5.1.1. Description of trends in international expansion of innovation-related activities*[44]

159. Additional works could be carried out in four major fields:

- *The universe of investors and their motivation*. A better knowledge of the MNEs active in innovation-related activities seems advisable. A first approach could be to make use of some existing data base such as Thomson one banker, in order to give more insight into the specific characteristics of these companies in terms of home country, size, and internationalisation levels. In a second step, some case studies could be carried out in order to collect more insights into the patterns of cross-border networks set up by these companies.

- *Trends in international investment.* Based on the existing data bases such as OCO's or IBM/PLI's, an overview of present trends in greenfield investments should be made, in order to assess the magnitude of the international investment market. This approach based on the flow of greenfield projects should be complemented by the collection of data on M&A in the same activities. Some more traditional data on FDI could also be retrieved for information purposes. It should be noted, however, that, as in any other activities, these various types of sources (greenfield, M&As, FDI, etc.) are heterogeneous and not directly comparable.

- *Non-investment internationalisation modalities*. As noted before, the literature on R&D location determinants focuses on in-house activities carried out by the firm (such as greenfield investments, existing subsidiaries, etc.), while other modes of entry, such as partnerships or outsourcing, might be growing in importance. Collecting information and implementing further investigations on these modes would be of upmost interest. In particular, this would help to understand better how and to which extend the various local innovation system integrate into open cross-border innovation networks. However, this task falls beyond the scope of the present

[44] Two additional items are closely connected to the topic of the working group: the attraction of talents and skills and the attraction of financial resources for the financing of local innovative projects and research. However, due to the already very large scope covered by this work programme, no specific proposal will be made in this paper on these two key issues,

project, and should be kept in mind only as a medium to long- term objective[45]. In the short term, more qualitative approaches could be considered, such as the inclusion in a survey among decision-makers of a question regarding the relative preference given in their R&D internationalisation process to various modalities, such as greenfields, acquisitions, licencing, outsourcing, etc.

- *Census and analysis of innovative segments in all industries. As mentioned above,* innovative segments of activity can be found in most of the industries, including those which are not usually classified as "high-tech". It could thus look interesting to identify a list of 20 to 30 segments of activities (not only belonging to high-tech) where an on-going intensive innovation process of any nature (including commercial or organisational), could involve a substantial flow of new international investment projects in the years to come.

### *5.1.2. Analysis of location determinants*

160. Works to be carried out on this topic can be regrouped into five major fields:

- *Econometric approaches aimed at explaining aggregated variables.* Aggregated data from the AFA and FATS database on the presence of MNEs (production or R&D) in OECD countries could here be used as an explained variable. This approach could be especially useful to remedy the present shortcomings in knowledge regarding industry-specific determinants. Depending on the formalisation, this variable could be expressed, either in absolute level, or as a share of total of all host countries for which data are available[46]. The explanatory variables could relate to the size and growth of market, costs and quality of resources, legal and fiscal environment, co-location effect, etc. It would however be advisable to complete the data base in order to get a minimum of relevant information on non-OECD economies in competition for the attraction of innovation-related activities, such as China, Singapore or India (non exhaustive list).

- *Econometric approaches using discrete location choice models.* Logit or tobit methods could be once again implemented on a wide range of countries (including some major non-OECD economies such as the BRICs) in order to identify function-specific or industry-specific location determinants. Individual data on project retrieved from such databases as OCO's or IBM/PLI's could be used for this purpose. Some methodological safeguard should however be implemented to avoid disappointments:

  - Regarding R&D centres, a distinction should be made depending on the various types of objectives and/or nature of projects (*e.g.* innovation, adaptation, support to other R&D activities, etc.).

  - Regarding headquarters, a straightforward worldwide approach is not advisable, as the competition for the location of regional HQs takes place by definition at the regional level[47]. A study focused on Europe could be sufficient as a first step. In addition, it will be

45 Some results of a recent Eurostat study on international sourcing could be useful for our project. For more detail, see, « International Sourcing - Moving Business Functions Abroad », a joint study issued in 2008 by Eurostat and the national statistical offices of Denmark, Finland, the Netherlands, Norway and Sweden.

46 Note that data are not available in the AFA and FATS data bases for all OECD host countries. For instance, information is missing regarding such countries as Mexico or Korea.

47 This remark is also true for many of the R&D centres, especially the adaptation ones, which by definition have to locate close to each final market. The competition for the location of each of these projects is thus limited to a handful of neighbouring countries.

necessary to make sure that the nature of projects used as an explained variable fits with the common acceptation of headquarters and does not include other types of establishments (such as representative offices or administrative back-offices).

- Regarding industries, the study should focus on the production function in order to avoid confusion with other location determinants specific to other functions inside of the same industry (such as back office, logistics, or call centres, not to mention R&D centres and headquarters).

- Databases produced by consulting companies such as EIU or OCO on the characteristics of potential host territories could be used in order to provide more industry-specific explanatory variables than those provided by the usual public macroeconomic database. The number of world-class clusters, such as those surveyed by OCO (2005), as well as the number of patents delivered in each of the potential home countries, could be included in the list of potential explanatory variables.

- Another difficult choice regards the activity scope of the study. Should all industries and/or functions be considered simultaneously in order to be able to understand how high-tech industries differ from the others, or should the analysis be focused on innovation-related activities only in order to be able to introduce activity-specific explanatory variables?[48] We suggest implementing simultaneously these two approaches (analysis at the general level complemented by specific analysis on some innovation-related activities), in order to take profit from the respective advantages of each of them.

- Regarding the geographical approach, the country level could be privileged for reasons of convenience and availability of data. However, the possibility of carrying out more specific studies at the infra-national level[49], in particular to capture clustering or agglomeration effects, should be taken into account as this level of analysis seems especially relevant for the understanding of some location behaviours.

- Surveys among decision-makers regarding location determinants. Another possible approach is to collect evidence among companies regarding their location criteria. This survey could be made as a stand-alone one or in cooperation with other organisations carrying out this kind of survey on a regular basis.[50] Given the growing difficulty to collect responses to such surveys, a support could be requested from governments in order to set up lists of companies to be surveyed.

- Analysis of decision-making processes. This question has seemingly been given so far less interest in the economic literature than that of the internationalisation motives and the location determinants. The position of the authors is that this issue should be addressed as such. As a matter of fact, the authorities in charge of the implementation of attractiveness policies in OECD countries are in need of a better knowledge of decision-making processes among companies in order to improve the efficiency of their promotion efforts. A case-study approach could be

48 To give an example, the study by Sachwald and Chassagneux (2007) on location criteria in international greenfield projects focuses only on R&D centres, while Defever (2006) considers all types of functions (R&D, headquarters, logistics, production, call centers, etc.).

49 Regions, metropolitan areas, etc.

50 For instance, the yearly UNCTAD's World Investment Prospects (2007).

implemented on this subject. This work could eventually be carried out in cooperation with specialised location consultants.

- *Analysis of the geographical patterns of international innovation networks.* As mentioned above, the mere case-by-case analysis of decision processes and location determinants is not sufficient to understand how the company organises its innovation value chain (including outsourcing and partnerships) on a geographical basis. Which parts of the value chain are located in the home country and abroad? How is taken the decision to do in-house or outsource various segments of this chain value? In the first case, what is the rational for locating a specific segment of this chain value in a given place (including the choice between the home country and abroad)? In the second case, how are the outsourcers and the partners selected? In particular, how do the concerns regarding the global configuration and management of the system[51] influence the decision on each individual project? And finally, what is the final outcome in terms of international division of labour between the various territories where the company has set up innovation-related activities? Given the very complex nature of this question, a qualitative approach based on case-studies could be appropriate.[52]

### *5.1.3. Measurement of attractiveness*

161. This could take a twofold approach:

- On the one hand, some complements could be made to the already impressive study carried out by the OECD secretariat on the international location patterns of innovation-related activities in order to improve the measurement of the compared performances of potential host countries. This study could be made on the basis of three complementary sets of indicators: *i*) data on greenfield international projects retrieved from private consultants' data base, such as OCO or IBM/PLI; *ii*) collection of some additional estimates on the presence of MNEs in various non-OECD host countries, in order to complement and enlarge the results of the AFA and FATS data bases;[53] *iii*) data on FDI inward flows and stocks as collected, among others, by OECD.

- On the other hand, the building of an "attractiveness scoreboard" regarding the specific case of innovation-related activities could be considered. The indicators of this scoreboard could be selected according to what is known on the hierarchy of location criteria. Such an approach could be eventually carried out in partnership with institutes specialised in setting up benchmarking databases and competitiveness indexes, such as EIU, OCO, WEF or IMD, and which have already produced a large range of available material. Would this goal seem too ambitious given the amount of resources available for the project, some elements of benchmark between OECD and some major non-OECD countries, based on a set of pertinent indicators on attractiveness, should at least be included in the final report.

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51 *e.g.* optimisation of flows of products and information, trade-off between proximity to market and resources, concerns about IPR and control over strategic activities, impact of risk-adverse strategies, role of clustering, etc.

52 The results of the on-going works by the OECD "Committee for Scientific and Technological Policies" on open international innovation networks could also provide many answers to these questions (Sachwald, 2008).

53 Data in patents and royalties flows could also prove useful in this regard.

### *5.1.4. Analysis of policies aimed at the attraction of innovation-related activities*

162. Little is known about the policies carried out by national and governments regarding the attraction of innovation-related activities. This question however is complex for many reasons:

- Difficulty to make a clear-cut distinction between general policies aimed at improving the local business environment and those specifically focused on the attraction of foreign projects.

- Difficulty to distinguish between the general measures on attractiveness and those specifically aimed at attracting innovation-related activities (such as tax credit on R&D expenditures, promotion of clusters, training and incentives to young researchers, facilitation of partnerships with local universities, implementation of intellectual property protection…).

- Difficulty to assess the reality of effort specifically carried out by governments and promotion agencies to attract innovative activities (as declarations are not always in line with real actions).

- Difficulty to assess the actual impact of these initiatives on the attractiveness of the territory.

- Necessity to extend the approach to some policies not merely aimed at foreign greenfield investment, such as the attraction of talents and skills or of financial resources dedicated to innovation (venture capital, business angels; starting funds; stock exchange markets specifically dedicated to high-tech activities, etc.).

- Necessity to distinguish policies carried out at various geographical levels (national vs local).

163. Two complementary approaches could be implemented to collect information on this subject: *i*) a survey among governments regarding their policies aiming at the attraction of innovation-related activities; *ii*) an analysis of some of the best practices in the matter, including some case studies on policies implemented by local bodies. The major fields of study in this regard could be: cluster development, fiscal policies and incentives; attraction of talents and financial resources, promotion of linkages with local partners.

164. Finally, we should remind that the question of the impacts of R&D internationalisation on origin and host country, albeit not addressed in this survey, remains a key issue of the OECD project, and should be given more attention on the next steps of the work.

## 5.2. Resources and time schedule: Implications for the Secretariat

165. The amount of resources necessary to complete the project is very important (presumably not less than 2 men-year in total). It thus seems necessary to list the resources which could eventually be taped in, and to define an order of priorities in case where the resources actually available would not be considered as sufficient to implement the whole working programme.

### *5.2.1. Mobilisation of available resources*

166. Three questions are pending in this regard: *i*) what amount of resources could be made available inside of the OECD itself? *ii*) Which contribution could be made by the members of the Working Party to the completion of the above programme? *iii*) Which kind of partnership could be considered with other

institution having already carried out studies or surveys on issues related to the purposes of the OECD project?[54]

### *5.2.2. Various options under consideration*

167. Depending on the responses to the three previous questions, three working options could be considered:

- *Option 1:* the additional necessary resources (*i.e.* 2 additional man-years + setting up of an extensive network of partnerships) are fully available. The totality of the work programme may then be completed.

- *Option 2: only a part of the necessary internal or external resources is available (half to one additional man-year)* The priority might the launching of one or two studies (econometrics or survey[55]) about location determinants of innovation-related activities, the building up of a limited set of comparative indicators regarding OECD countries' attractiveness, and the implementation of a survey among national authorities of the member countries regarding their innovation-related attractiveness policies.

- *Option 3: no additional resources are available*. The OECD report will rely mostly on existing studies made by other bodies. The OECD secretariat will only implement a survey among government regarding their innovation-related attractiveness policies.

### *5.2.3. Elements of planning and time schedule*

168. By October 2008, one more year will be left for the completion of the final report by the Working Party on the Globalisation of Industry. The following time schedule might be advisable:

- The bulk of additional studies should have been completed by summer 2009. It means that the choice of responsible bodies and/or authors should have been made by the end of 2008, and that the terms of reference of each study be ready and approved at the beginning of 2009 for completion of the work during the following six months.

- On the basis of the first results, a pre-report could be made available for the new meeting of the group in autumn 2009.

- A final version of the report, incorporating observations by delegates, could then be produced at the end of 2009.

- Once this report has been finalised, a decision should be taken regarding the continuation of this project in order to implement the rest of the work programme by 2010.

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54 Let us mention as examples of potential partners: UNCTAD (for the implementation of a survey among companies on location determinants); WEF or IMD (for the building of an IRA attractiveness scoreboard); OCO or IBM/PLI (for the analysis of trends in FDI markets); national bodies in charge of the implementation of the attractiveness policies (for the benchmark of these policies); etc.

55 With a preference for approaches relying upon the use of the OECD databases (AFA, FATS, etc.).

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