THE LOCATION OF INVESTMENT OF MULTINATIONALS LINKED TO INNOVATION

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Session 2.1.: International investment and innovation

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Introduction

The location of multinationals linked to innovation is the first aspect of a broader OECD project to analyze the factors that influence the location of multinational firms’ activities.

Recent work by the OECD Working Group on the Globalisation of Industry on the effects of offshoring on the employment market have shown that in order to understand the phenomenon of offshoring it is important to analyze the factors that determine the location of foreign investments by multinational firms.

Territories are now in lively competition to attract internationally mobile investments. Through that competition, countries and regions within each country are seeking to reinforce their industrial fabric, to enhance the productivity and competitiveness of firms operating in their territory, to promote innovation and job creation, and thereby to stimulate growth.

As part of this project, before looking at the factors that play a determining role in the location of different categories of investments by multinationals, we shall first examine the case of investments in innovation. This choice was influenced primarily by the recent mandate that the OECD Ministerial Council gave the Secretariat, which was to refine and analyze the strategy that member countries might be invited to adopt for promoting innovation. This project is in direct response to that ministerial mandate.

The first task in developing the project is to identify what constitutes the innovation activity of multinational firms.

Innovation is a very broad concept, with many characteristics. There are innovations that have to do with the development of new products or new processes. Innovations can be tangible or intangible, technological or non-technological, applied to goods or services, and they can also relate to management and organisation.

The activities of multinationals are characterised, first, by the industrial sector to which they belong, but also by the functions they fulfil.

At first glance, it might be said that innovation concerns all sectors, in one way or another. Given the multitude of possible innovations, it is difficult to establish comparisons between sectors as to their degree of innovation without specifying the field and the type of innovation we are referring to.

In the context of this project, where the intent is to focus on technological innovations, it can be objectively asserted that some sectors innovate more than others. This fact can manifest itself both upstream, through a major R&D effort, and downstream, through the filing of patents and expanding technological revenues. Indirectly, this innovation effort is also accompanied by measurable commercial success.

Previous OECD studies\textsuperscript{2} have shown that the industrial sectors most likely to innovate are those in high-tech areas, which are characterised by faster technological change and stiff international competition.

Under these conditions, it may be said that multinationals’ innovation activities are essentially conducted in the high-tech sectors.

If we look beyond the specific sector and take account also of the functions that correspond to these activities (for example production, accounting, R&D, marketing, logistics, decision centres, etc.) we find that at least two of these functions are involved more directly in the innovation strategy. They are:

- The creation of R&D laboratories, and
- The role that multinational firms’ decision centres play in innovation.

Research and development could be seen as a stand-alone industrial sector, in the case of firms where R&D is the main activity, or as a function, in the case of an industrial group belonging to a particular sector.

As to decision centres, they can play a key role in the innovation strategy of multinational firms. Strategies for R&D and innovation even within the most decentralised groups are implemented by the decision centres.

As will become apparent further on in this report, decision centres can be found in the head offices of multinational firms, but they can also be constituted as independent units within these groups.

This project seeks essentially to respond to the following questions:

- How are the innovation activities of multinational firms distributed geographically within the OECD area and abroad?
- What are the factors that determine the location of these activities?
- How do multinational firms perform in the host country?
- To what extent are the activities in question compatible with the expectations and policies adopted by the host country authorities?

To respond to the first question, as to the geographic distribution of multinational firms’ innovation activities, we must determine the location within the OECD area of:

- High-tech and medium-high-tech activities,
- R&D laboratories,
- Decision centres.

With this information in hand, we can identify the main geographic trends and also track structural changes.

Depending on the information available, the location of these three categories of activities can involve the national territory of the host country, and regions within each country as well.

A second stage, identifying the factors that determine the choice of location for multinationals’ activities, will require an econometric analysis in order to test the role of various factors such as market size, growth of demand, wage costs, sector of activity, local taxation, other factor costs, the number of local and foreign firms present (the cluster effect), the quality of infrastructure, and the existence of local government policies to attract investment.

Past studies or a more qualitative nature have shown that the factors determining the location of a new factory are not the same as those for a research lab or the corporate headquarters of a multinational firm. Depending on the existence of certain factors and specific conditions, some countries will be more successful in attracting production units or research centres, or perhaps corporate headquarters. Case studies could also take account of the strategic needs of multinational investors. Thus, the need to create economies of scale, to export to neighbouring countries, to improve supply conditions for the parent company in the home country, etc., could play a determining role in a firm’s strategic choices. The regional aspect in this choice of location will be determined by the availability of data.

The response to the third question entails developing indicators to measure the performance of multinationals’ activities in the host country. This involves ascertaining, for example, the contribution they may be making to growth, productivity, job creation, the R&D effort, innovation, technology transfer, exports, and more generally the industrial competitiveness of the country in question. This will require, on one hand, an analysis of the spillover effects of foreign subsidiaries on the country’s productivity and industrial activity. On the other hand, the analysis could be supplemented by measuring performance in these activities by the investing countries as well, i.e. the return on investments and the degree to which profits are reinvested or repatriated to the home country.

The last question has more to do with the host country’s policies regarding investment by multinational firms. This part of the project will need to be pursued in close cooperation with the Investment Committee (DAF). At one time or another, every country may introduce incentives to attract foreign investment. The role of these measures as factors in the location of multinational firms’ investments will be examined in connection with the second question. On the other hand, what is needed here is to analyze the extent to which the performance of multinational firms’ investments meets the priorities set by the host country authorities. Those priorities can be short-term or medium-term. Thus, when a country has achieved full employment, we may assume that the government’s priority objective for foreign investments will focus less on creating jobs and more on achieving other goals such as technological innovation, improved competitiveness, or a greater R&D effort.

This report constitutes the first chapter of the project, and will seek to provide some elements for answering the first question, on the location of the innovation activities of multinational firms.

The method selected to meet the other questions will depend on the availability and quality of the data needed to answer the first question, which refers to the geographic location of activities within the OECD area.

The analysis of multinationals’ innovation activities outside the OECD area will be more difficult, as few countries have such data.
CHAPTER 1. THE LOCATION OF MULTINATIONAL FIRMS’ HIGH-TECH PRODUCTION ACTIVITIES

The geographic distribution of the high-tech activities of multinational firms within the OECD area and within each member country could in principle be examined from two data sources: (a) the stock of direct investment; and (b) data on the activity of multinational firms. There are a number of variables that can reflect this activity, but the ones most frequently used have to do with production, sales (turnover) and employment.

The high-tech activities of multinationals relate to the investments that such firms make in high-tech sectors. The method used to identify those high-tech sectors is presented in Box 1.

What is at issue here is not the sector to which the multinational firm belongs, but rather the sector in which it makes its investment. This point is important, for a multinational firm engaged primarily in the high-tech sector may also invest in a medium- or low-tech sector.

The available data on direct investment stocks are not at this time sufficiently disaggregated to identify high-tech sectors. For this reason, the only data that could be used for this report are those on the activity of multinational firms. Moreover, it is only in the manufacturing industry that high-tech sectors have been rigorously identified.

The identification of technology-intensive service sectors has not been pursued to the same degree of detail as those in the manufacturing industry. Preliminary results from such studies indicate the following as technology-intensive service sectors:

- Computer and related activities\(^4\) (ISIC 72),
- R&D (referring to foreign affiliates where R&D is the main activity) (ISIC 73),
- Other business services\(^5\) (ISIC 74), and
- Finance and insurance (ISIC 65 to 67).

1.1. Geographic distribution of all multinationals activities within the OECD area

Before identifying where multinational firms’ high-tech activities are located within the OECD area, it is useful to see how manufacturing and services are distributed there.


\(^4\) Hardware consultancy, software publishing, data processing, database activities, maintenance and repair of office and computing machinery, other computer-related activities.

\(^5\) Legal and accounting activities, management consultancy, architectural and engineering activities, advertising, labour recruitment, investigation and security, building-cleaning activities, photographic activities, secretarial services, translation and routing.
Box 1. Identifying high-technology manufacturing sectors

An industrial sector is defined as a high-technology sector if it is intensively producing and using technology. The quantification of this characteristic was approximated through R&D intensity. For this purpose, an overall R&D intensity (sum of direct and indirect intensity) was used. The direct R&D intensity (R&D expenditure/value added) was constructed for each manufacturing sector in each OECD member country, and an OECD list was obtained by weighting each sector for its share in the value added of all OECD member countries, taking GDP purchasing power parities as exchange rates. For indirect intensity, which corresponds to the use of technology, account had to be taken of technology (R&D expenditure) embodied in intermediate and capital goods purchased on the domestic market or imported. Technology moves from one industry (and one country) to another when the industry performing R&D sells its products embodying that R&D to other industries which use them as manufacturing inputs. To calculate indirect intensity, the technical coefficients of manufacturing industries extracted from input-output matrices were used. On the technical assumption that, for a given type of input and for all groups of products, the proportions of R&D expenditure embodied in production remain constant, the input-output coefficients were multiplied by the direct R&D intensities. On this basis, the proposed list of manufacturing industries classified according to their global R&D intensity (ISIC classification Revision 3) is:

<table>
<thead>
<tr>
<th>High-technology industries</th>
<th>ISIC Revision 3</th>
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<tbody>
<tr>
<td>1. Aircraft and spacecraft</td>
<td>353</td>
</tr>
<tr>
<td>2. Pharmaceuticals</td>
<td>2423</td>
</tr>
<tr>
<td>3. Office, accounting and computing machinery</td>
<td>30</td>
</tr>
<tr>
<td>4. Radio, TV and communication equipment</td>
<td>32</td>
</tr>
<tr>
<td>5. Medical, precision and optical instruments</td>
<td>33</td>
</tr>
</tbody>
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<tr>
<th>Medium-high-technology industries</th>
<th>ISIC Revision 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Electrical machinery and apparatus</td>
<td>31</td>
</tr>
<tr>
<td>7. Motor vehicles</td>
<td>34</td>
</tr>
<tr>
<td>8. Chemicals excluding pharmaceuticals</td>
<td>24-2423</td>
</tr>
<tr>
<td>9. Other transport equipment</td>
<td>352-359</td>
</tr>
<tr>
<td>10. Non-electrical machinery</td>
<td>29</td>
</tr>
</tbody>
</table>

Among the main limitations of this list, the first concerns criteria employed. Only R&D intensity, be it direct or indirect, has been taken into account. Research is an extremely important characteristic of high technology but it is not the only. Other factors also play a significant role (e.g. scientific personnel, technology embodied in patents, licences and know-how, technical co-operation, etc.). Another limitation is that R&D intensity can also be skewed because in each sector all research is attributed to the principal activity of the firms making up the sector. Thus, a significant proportion of a particular sector’s R&D could concern another sector, which may not necessarily be related to high technology. In addition, the lack of sufficiently aggregated data means that many products manufactured by high-technology sectors could be classified as medium- or even low-tech. Conversely, some products made by medium- or low-technology sectors could be classified as high-tech.
Figure 1. Country share in the turnover under foreign control in the manufacturing sector, OECD area*, 2003

United States 29%
EU15 52%
Japan 3%
Other 16%

* Countries included: United States, Japan, Germany, France, Italy, United Kingdom, Canada, Ireland, Netherlands, Sweden, Czech Republic and Poland.

Figure 2. Turnover under foreign control in the manufacturing sector

Billion PPP dollars

1997 2003

* Methodological break between the two years shown.
From the sales viewpoint, figure 1 shows that in 2003 more than 80% of the manufacturing activity of foreign affiliates was concentrated in the EU-15 and in the United States.

Figure 2 shows developments between 1997 and 2003. However, the comparison of changes between these two periods poses some problems, as the data collection method has changed in several countries.

In Germany, for example, sales by foreign manufacturing subsidiaries essentially tripled between 1997 and 2003, because new categories of firms were brought into the surveys. Affiliates under indirect foreign control were excluded in 1997, but included in 2003.

Comparisons with services (figure 3) also reveal some problems of measurement, in that the available data do not always relate to the same countries as those for the manufacturing industry.

Nevertheless, a look at the absolute values of sales by foreign affiliates reveals that some countries attract more activity from multinationals in the services sector than in manufacturing. Thus, foreign multinationals in the UK are twice as active in services as in manufacturing, and 1 1/2 times in the United States. On the other hand, in Germany, France and Japan, the two categories are roughly balanced, with manufacturing having a slight lead.

Most countries in Central Europe attract twice as much activity from multinationals in manufacturing as in services.

Figure 3. Country share in the turnover under foreign control in the service sector, OECD area*, 2003

* Countries included: United States, Japan, Germany, France, Italy, United Kingdom, Belgium, Luxembourg, Netherlands, Spain, Sweden, Czech Republic, Hungary and Poland.


1.2. The geographic distribution of multinationals’ high-tech activities in the OECD area

The geographic distribution of multinationals’ sales in the high-tech sectors shows that these activities are most heavily concentrated in the United States and in Japan, and to a lesser degree in Europe and in Canada.
In effect, the high-tech production of foreign affiliates in the EU-15 is proportionate to the total manufacturing output of foreign affiliates, while it is more than proportionate in the United States and in Japan (figures 1 and 4).

The Central European countries and Canada attract less in the way of high-tech activities from foreign multinationals: overall, the weight of these activities in the OECD area is below that of all manufacturing activities of these firms.

Within the EU-15, moreover, there are some major discrepancies (figure 5).

In 2003 the high-tech share of foreign-controlled affiliates' sales in the manufacturing sector was very high in Ireland (more than 35%), and lower in Spain, the Netherlands and Poland.

The country distribution of foreign affiliates' sales in each high-tech sector shows that the aeronautics industry carries the greatest weight in overall high-tech sales in the OECD area (figure 6).

This may reflect the fact that production in this sector is fairly concentrated geographically and the number of foreign-controlled affiliates in each country is relatively small, except in France.

Foreign-controlled affiliates in the computer sector within the OECD area generate sales slightly higher than those in the aeronautics industry. It must be noted that in 2003, however, there were three European countries, led by Ireland (figure 7), where foreign affiliates produced sales greater than those of foreign affiliates established in the United States.

Foreign affiliates' sales in electronics, pharmaceuticals and scientific instruments are much greater in the United States than in other OECD countries (figures 8, 9 and 10).

The geographic concentration of foreign affiliates seemed strongest in the electronics industry, and weakest in pharmaceuticals and scientific instruments.

The important changes in sales volumes noted in some countries between 1997 and 2003 reflect changes in the way the surveys are organised (different sources for the two periods).
Figure 4. Country share in the turnover under foreign control in the high-technology sector, OECD area*, 2003

* Countries included: United States, Japan, Germany, France, Italy, United Kingdom, Canada, Ireland, Netherlands, Sweden, Czech Republic and Poland.


Figure 5. Share of the high-technology sector in the turnover under foreign control in manufacturing, 2003

Figure 6. **Turnover under foreign control in the aerospace sector (ISIC 353)**

Billion PPP dollars

*Methodological break between the two years shown.*


Figure 7. **Turnover under foreign control in the office, accounting and computing machinery sector (ISIC 30)**

Billion PPP dollars

*Methodological break between the two years shown.*

Figure 8. Turnover under foreign control in the radio, TV and communication equipment sector (ISIC 32)

* Methodological break between the two years shown.

Figure 9. Turnover under foreign control in the pharmaceuticals sector (ISIC 2423)
* Methodological break between the two years shown.


1.3. Geographic distribution of medium-high-tech activities of multinational firms

Foreign-controlled affiliates' sales in medium-high-tech sectors generally exceed those in the high-tech sector.

This reflects the important weight of these sectors (automobiles, chemicals other than pharmaceuticals, electrical and non-electrical machinery) in manufacturing output (whether domestic or foreign-controlled). Thus sales of foreign affiliates in medium high tech sectors in the United States are 1 1/2 times as great as those in high-tech. On the other hand, the equivalent ratios are 2.7:1 in the United Kingdom, 2.6:1 in Germany, and 1.3:1 in France.

The attractiveness of the American market in both the high-tech and the medium-high-tech sectors is confirmed again by the fact that US sales of foreign affiliates in these sectors exceed those in Germany, France and the United Kingdom combined.

In the automotive sector, foreign affiliates' sales in Canada exceed those in Germany, the United Kingdom or France (figure 11). In the chemicals sector (excluding pharmaceuticals), the gaps between foreign affiliates' sales in host countries are narrower, and the values significantly lower than in the automotive sector.
Non-electrical machinery sales of foreign affiliates (figure 14) in nearly all countries are twice as high as their sales of electrical machinery. In both industries, the countries attracting the greatest activity from foreign affiliates are the United States, Germany and France (figure 13 and 14).

Figure 11. Figure 11. *Turnover under foreign control in the motor vehicles sector (ISIC 34)*

Billion PPP dollars

* Methodological break between the two years shown.

Figure 12. Figure 12. **Turnover under foreign control in the chemical sector (except pharmaceuticals) (ISIC 24 exc. 2423)**

**Billion PPP dollars**

*Methodological break between the two years shown.*


Figure 13. Figure 13. **Turnover under foreign control in the electrical machinery sector (ISIC 31)**

**Billion PPP dollars**

*Methodological break between the two years shown.*
1.4. Geographic distribution of technology-intensive services provided by multinationals

When it comes to the technology-intensive services mentioned above, with the exception of R&D, “other services” may also include activities that are not necessarily technology-intensive, as is the case in the automotive industry.

For computer services, R&D and other business services, the location of multinationals can be identified through the sales of their affiliates in host countries. On the other hand, for finance and insurance services it is employment that is taken as the measure, since few countries have sales data.

In terms of relative importance, sales of other business services are twice as high in most countries as sales of computer services, while the figure for R&D is barely one-tenth that for computer services.

The United Kingdom is the most attractive country for computer services and R&D (figures 15 and 16). Foreign affiliates' sales in these two sectors exceed those of foreign affiliates established in the United States or Germany.

It is worth noting as well that sales of computer services by foreign affiliates are higher in Italy and Spain than in France.

As to multinationals’ R&D activities, it should be noted that these relate primarily to affiliates that are primarily engaged in research. Available sales data likely include secondary activities other than research.
In the case of other business services, and in particular that of finance and insurance, foreign affiliates in the United States are much more important than in other countries.

The US lead in the finance and insurance sector is all the more impressive if we consider that banks were not included in the 2003 data (they are covered only every five years in the benchmark surveys). If they had been included, the finance and insurance sector would have been twice as big.

Figure 15. Turnover under foreign control in the computer services and related activities sector (ISIC 72)

Note: Breaks in series for Germany and Italy due to change in methodology between the two years shown.
Figure 16. Turnover under foreign control in the research and development services (ISIC 73)

Note: Break in series for Germany due to change in methodology between the two years shown.

Figure 17. Turnover under foreign control in the other business services (ISIC 74)

Note: Breaks in series for Germany and Italy due to change in methodology between the two years shown.
1. Breaks in series for Germany, Belgium, Finland and Poland due to change in methodology between the two years shown.

2. Excluding banks (ISIC 651).


1.5. Geographic distribution of American, Japanese and German affiliates abroad in the manufacturing sector

The purpose of this report is to identify where high-tech multinationals locate their activities, taking as reference the host countries of the OECD area. It is important, however, to look at the geographic distribution of multinationals’ high-tech activities not only within but also beyond the OECD area.

The answer to this question runs up against two major problems. First, few countries collect data on the foreign activities of their own multinationals. Second, the available data are broken down either by industrial sector or by country of destination, and so we cannot identify those foreign countries where high-tech activities are located.

In the absence of information on high-tech activities, we must confine ourselves to noting the worldwide location pattern of the manufacturing activities of affiliates from the three largest countries, the United States, Japan and Germany.

The manufacturing activities of American affiliates are for the most part concentrated in Europe (figure 19), but between 1995 and 2003 their weight declined from 59% to 53%. This drop is due to the offshoring of some of these activities to Asia (14.1% in 2003), and especially to China, the weighting of which doubled between the two periods, although it remains modest (3.3% of the total). On the other hand, Latin America's share has declined slightly, while Canada's has risen to 15.4% of total manufacturing activity.
The activities of Japanese manufacturing affiliates abroad (figure 20) are more evenly distributed between the United States (39.7%), Europe (20.2%) and Asia (31.1%). Manufacturing activities in Asia, however, produce sales higher than in Europe.

Three-quarters of German manufacturing affiliates (figure 21) are to be found in Europe and the United States. Between 1995 and 2003, Europe’s weight in the sales of German affiliates declined sharply (from 57.4% to 40.2%) in favour of the United States (from 23.2% to 30%), and to a lesser extent non-OECD Asia (from 3.7% to 5.2%). Despite the increase in its share between the two periods, China still had only a modest weight in 2003 (1.6% of the total).

Figure 19. Turnover of American affiliates abroad broken down by country of location in the manufacturing sector


Figure 20. Turnover of Japanese affiliates abroad broken down by country of location in the manufacturing sector

Figure 21. Turnover of German affiliates abroad broken down by country of location in the manufacturing sector

CHAPTER 2. THE LOCATION OF MULTINATIONAL FIRMS’ R&D LABORATORIES

2.1. Geographic and sectoral distribution of multinational firms’ R&D

This chapter looks only at the location of R&D laboratories of multinationals in the manufacturing industry, as data for foreign affiliates in services are not available.

A comparison of figures 1 and 22 shows that 38% of foreign affiliates’ R&D in the manufacturing sector is conducted in the United States, compared to only 29% of their sales. In Europe, the shares of sales and of R&D spending by foreign firms are of the same order, between 51% and 52%. On the other hand, in the other countries considered (particularly Canada, the Czech Republic and Poland), R&D is only a third of sales. These figures show that the United States is ahead of other OECD regions and countries in attracting R&D.

The United States seems to be a pole of attraction for the R&D of foreign multinationals, not only in general manufacturing but, more particularly, in the high-tech sectors (Figure 23). Europe, by contrast, attracts more than two-thirds of foreign affiliates’ R&D in low-tech sectors in the OECD area, or more than doubles the amount going to the United States (figure 34).

Yet it must be recalled that 51% of the R&D performed by foreign affiliates located in the bulk of OECD countries involves high technology, compared to 3.3% and 45.7% in low and medium technology respectively.

The sectoral distribution of foreign affiliates’ R&D in the OECD area (figure 25) shows the pharmaceutical industry in a predominant place, with more than 30% of R&D spending, followed by the automotive industry, and electronics and communications. This last industry saw its share decline between 1997 and 2003, as did chemicals (excluding pharmaceuticals).

The weight of foreign affiliates’ R&D in the computer hardware industry is still below that in chemicals, at barely 2%, but this of course does not include software production, which is a separate industry.
Figure 22. Country share in the R&D expenditure under foreign control in the manufacturing sector, OECD area*, 2003

* Countries included: United States, Japan, Germany, France, United Kingdom, Canada, Ireland, Netherlands, Spain, Sweden, Czech Republic and Poland.


Figure 23. Country share in the R&D expenditure under foreign control in the high-technology sector, OECD area*, 2003

* Countries included: United States, Japan, Germany, France, United Kingdom, Canada, Ireland, Netherlands, Spain, Sweden, Czech Republic and Poland.

**Figure 24.** Country share in the R&D expenditure under foreign control in the low-technology sector, OECD area*, 2003

* Countries included: United States, Japan, Germany, France, United Kingdom, Canada, Ireland, Netherlands, Spain, Sweden, Czech Republic and Poland.


**Figure 25.** Main R&D performing sectors in affiliates under foreign control in selected OECD countries*

* Countries included: United States, Japan, France, United Kingdom, Canada, Ireland, Netherlands, Spain, Sweden and Czech Republic.

2.2. R&D by foreign affiliates in OECD countries, by sector and by country of origin

The objective of this section is to identify, first, the sectors in which foreign affiliates conduct R&D in each host country, and the country of origin of those R&D investments.

At a second stage, we will need to look for factors that have influenced the countries of origin in their location of these investments. The final stage of the study should be devoted to analyzing policies that could in some cases constitute either an incentive or an obstacle in attracting these R&D activities.

In light of data availability, the only practical approach is to analyze foreign affiliates’ R&D activities from the host country perspective. In fact, though, if the relevant data were available, it would probably be more interesting to look at the location of R&D laboratories abroad in terms of the decisions taken by each investing country.

The methodological constraints imposed by the lack of data go beyond the shortage of information on the R&D activities of affiliates in a foreign country.

Box 2 summarises a number of other limitations, beyond the lack of certain data. One way of overcoming these constraints would be to work with micro-data (at the level of individual firms). However, some of that information can be hard to find: firms treat R&D as a strategic activity and they are very reluctant to disclose detailed information on it.

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<th>Box 2. Box 2. Principal data constraints on multinational firms’ R&amp;D activities</th>
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<td><strong>The unavailability of several categories of data on multinational firms’ research and development activity may reflect the fact that these data are not requested in national surveys, or that multinationals are reluctant to disclose this information. The main data constraints can be summarised as follows:</strong></td>
</tr>
<tr>
<td>• Some OECD countries are still not in a position to identify R&amp;D activities of foreign-controlled affiliates in their national R&amp;D or business surveys.</td>
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<tr>
<td>• Very few countries collect data on the foreign R&amp;D activities of their own multinationals.</td>
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<tr>
<td>• Very few countries have data on R&amp;D activities of foreign-controlled affiliates in the services sector.</td>
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<tr>
<td>• Some countries do not specify whether the foreign-controlled affiliate’s country of origin refers to the country of ultimate control or that of the immediate investor.</td>
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<td>• Few countries can verify whether changes in the R&amp;D activities of foreign-controlled subsidiaries operating in their territory are due to new R&amp;D activities or to foreign takeover of existing R&amp;D labs.</td>
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<tr>
<td>• Some countries do not cross-tabulate foreign-controlled affiliates’ R&amp;D by sector with the country of origin of these investments, because of statistical secrecy.</td>
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<td>• There is no information available on the nature of foreign-controlled affiliates’ R&amp;D activities (basic research, applied research, adaptation of products to local markets, improvement of existing technologies, development of new technologies, etc.). It should be noted that information of this kind is not requested even from domestically controlled firms.</td>
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<tr>
<td>• There is no information reported on the offshoring of R&amp;D labs under foreign control or even under domestic control.</td>
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<td>• There is no information on the type or source of financing for foreign-controlled affiliates’ R&amp;D, or on the qualifications of their R&amp;D personnel.</td>
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The following sections present the principal sectors of foreign-controlled affiliates’ R&D in the five largest OECD countries: the United States, Japan, Germany, France and the United Kingdom. Data for other countries are presented in Annex 1, while Annex 2 provides a breakdown of foreign affiliates’ R&D in the high-tech and medium-high-tech sectors, by host country.

2.2.1. United States

The United States attracts more than 40% of foreign multinationals’ R&D spending, amounting to more than USD70 billion. Manufacturing accounts for about 70% of foreign-controlled affiliates’ R&D spending, and services 30%. In 2005, more than 80% of foreign affiliates’ R&D was in six broad sectors: pharmaceuticals, motor vehicles, machinery (electrical, electronic including computers), scientific instruments, and communications equipment (figure 26). As to services, nearly all the R&D of foreign affiliates relates to finance, insurance and business services.

Foreign manufacturing affiliates employ slightly more than 90,000 people, versus 33,000 working in R&D in the services sector.

It is important to note that the pharmaceutical industry is the only US industry where more than half (53.3%) of R&D is foreign-controlled: the national average for foreign-controlled R&D in manufacturing as a whole is around 16 to 17%.

About 85% of foreign manufacturing affiliates’ R&D investment in the United States is of European origin (EU-15). Germany is the lead investor in manufacturing R&D, accounting for slightly more than 25% of foreign affiliates’ R&D, followed by the United Kingdom (20%), Switzerland (17%), and France (15%). Japan ranks only in fifth place, accounting for just over 5% of foreign affiliates’ R&D spending (figure 27).

The ranking of countries investing in R&D in the United States is consistent with that of US affiliates’ investments abroad. However, in absolute terms, European countries invest far more in R&D in the United States than do US firms in Europe. The discrepancy is particularly great in the case of Switzerland, which invests 13 times as much in R&D in the United States as US firms do in Switzerland.

Nearly 90% of Swiss investments in the United States are in the pharmaceuticals industry. 50% of German affiliates’ investments in the United States go to the automotive industry, and 22% to pharmaceuticals. The United Kingdom devotes 30% of its R&D investments to computers and electronics, while French affiliates in the United States spend about 64% of their R&D funds in chemicals excluding pharmaceuticals. About 31% of Japanese affiliates’ R&D spending is in computers and electronics, 23% in chemicals excluding pharmaceuticals, and 22% in the automotive industry.
Figure 26. Main R&D performing sectors in affiliates under foreign control in the United States


Figure 27. R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in the United States, 2005

2.2.2. Japan

Japan is host to only 6% of R&D spending by foreign multinationals in the manufacturing sector, but this is proportionately twice what such firms spend on production in Japan.

In 2003, more than 65% of foreign affiliates’ R&D spending went to the automotive industry: their spending in that industry increased by a factor of 6.5 between 1995 and 2003, whereas their R&D share declined in all other sectors (figure 28).

Pharmaceuticals attract slightly over 20% of foreign affiliates’ R&D spending, while no other sector accounts for more than 3%. The automotive and pharmaceutical industries are foreign-controlled to the extent of 18% and 13%, respectively, while the average figure for the rest of the economy is around 4.8%.

The EU-15 is the main R&D investor in Japan, with more than 85% of foreign affiliates’ R&D spending. This outcome is due to the spectacular performance of France, as a result of the linking of Renault and Nissan: in fact, more than 97% of French R&D spending in Japan goes to the automotive industry (figure 29).

Other countries have a much more modest investment presence. Dutch affiliates account for slightly over 11% of total foreign R&D, Germany 10%, and the United States 7.5%.

It may also be noted that, according to Japanese statistics, French affiliates in Japan invest more in R&D than do Japanese affiliates in France. The sharp decline in US affiliates’ share of R&D spending could reflect in part the growing presence of French firms, but this interpretation is not confirmed by the official US available data.

Figure 28. Main R&D performing sectors in affiliates under foreign control in Japan

2.2.3. Germany

Germany attracts 15% of foreign multinationals’ R&D spending, placing it in the head of all European countries in this respect. Between 1995 and 2003, R&D spending in Germany by foreign affiliates grew at a rate of 6.7%, the highest in all OECD countries except the United States. At the same time, German multinationals account for nearly 50% of worldwide R&D spending by all European-controlled multinationals.

The three dominant sectors, accounting for nearly 53% of foreign affiliates’ R&D in manufacturing in 2005 were aerospace, motor vehicles and pharmaceuticals (figure 30). The other sectors (electronics and communications, non-electrical machinery, chemicals excluding pharmaceuticals, and scientific instruments) accounted for 30%, but no sector alone amounted to 10% of the total. The principal source of R&D spending is the United States (figure 31): its share in R&D is double that in production. The bulk of its R&D spending is concentrated in aircraft and motor vehicles (43%), electronics (26%), and pharmaceuticals (7%).

The Netherlands is second-largest source of R&D investment, with a primary focus on the electronics industry. Yet, in contrast to the United States, its share in R&D is less than that in production.

Switzerland’s share in R&D investment in Germany is somewhat higher than its production share (13% versus 9%). Swiss firms’ R&D is concentrated in chemicals excluding pharmaceuticals (46%), non-electrical machinery (18%), and scientific instruments (10%).

France invests slightly less than Switzerland in R&D, concentrating in chemicals excluding pharmaceuticals (49%) and in electronics and communications and computers (27%).
It should be noted that German affiliates spend more on R&D in France than French affiliates do in Germany.

Figure 30. Figure 30. **Main R&D performing sectors in affiliates under foreign control in Germany, 2005**

% 


Figure 31. Figure 31. **R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in Germany, 2005**

% 

2.2.4. France

In 2004 France attracted €5.6 billion in R&D investment by foreign affiliates, which employed around 27,000 researchers.

It should be noted, however, that in that same year foreign affiliates in Germany employed more than 60,000 R&D researchers, and spent €9.9 billion on research and development.

The change in R&D spending between 1995 and 2003 reveals a slowing of R&D expenditure growth by foreign affiliates in France, thereby bringing down the French share of foreign affiliates’ R&D spending in the OECD area. During this time, foreign-controlled affiliates in France increased their R&D investments by €2.4 billion, versus €4.6 billion in the United Kingdom and €6.7 billion in Germany.

Figure 32 shows the main sectors of foreign affiliates’ R&D spending. In 2004, apart from a 20% concentration in electronics and communications, foreign affiliates’ R&D investment was spread across a broad range of sectors, with aerospace, pharmaceuticals and motor vehicles in the lead.

Two countries account for more than 58% of foreign affiliates’ R&D spending: Germany, with 29.8%, and the United States, with 28.6% (figure 33).

Around 46% of German affiliates’ R&D spending in France is in the aerospace industry, while US firms’ spending is distributed among several industries: electronics 25%, pharmaceuticals 21%, motor vehicles 16%, and scientific instruments 12%.

Swiss affiliates devote more than half of their R&D spending to chemicals excluding pharmaceuticals, while Dutch affiliates pour 52% of their R&D spending into the electronics industry.

The decline in the proportion of R&D going into the pharmaceuticals industry between 1995 and 2004 (figure 32) might at first glance be attributed to the shrinkage in Germany’s share. However, a more likely reason is the merger of two companies, Hoechst of Germany and Rhône-Poulenc of France, which gave rise to the Aventis group in 1999, and subsequently to the Sanofi-Aventis group in 2004, under French control. Thus, it would seem to be the shift to French control of certain German activities that explains the drop in foreign-controlled R&D spending in the pharmaceuticals industry.
Figure 32. Main R&D performing sectors in affiliates under foreign control in France


Figure 33. R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in France, 2004

2.2.5. United Kingdom

The United Kingdom stands just behind Germany, and ahead of France and Italy, in the volume of R&D spending by foreign affiliates in Europe. Yet while it is the second destination for R&D investment in Europe, it ranks as less attractive (behind France) in terms of production and sales (figure 2).

In 2004, about 22% of foreign affiliates’ R&D was in services, the highest proportion for any OECD country. By way of comparison, foreign affiliates did only 13% of their research in services in the United States, 5.5% in France, 3.5% in Japan and 4% in Germany.

Foreign affiliates’ R&D in manufacturing is concentrated to the extent of 60% in only three sectors. Automotive R&D is relatively low (figure 34), considering that 88% of this industry (all carmakers apart from subcontracting firms) is under foreign control. These carmakers do most of their R&D in their home country.

It should also be noted that R&D by foreign affiliates in finance, insurance and business services is higher than that in other sectors such as motor vehicles.

A further feature of the United Kingdom is that half of foreign affiliates’ R&D is conducted by US firms, compared to only 36% in Germany and 28% in France.

Figure 34. Main R&D performing sectors in affiliates under foreign control in the United Kingdom

Figure 35. R&D expenditures of affiliates under foreign control broken down by country of origin in the United Kingdom, 2005

CHAPTER 3. THE LOCATION OF DECISION CENTERS

3.1. The link between the nationality of majority shareholders and the location of a company's headquarters

The question posed here is to determine who takes the important decisions about technological innovation within a multinational enterprise.

It is obvious that decisions about the launching of new research projects, the creation of a new laboratory abroad, the adoption of new technologies, or even the offshoring of certain activities, particularly high-tech ones, will not be taken directly by the researchers themselves or by the persons immediately involved, even if their opinion will be taken into account in the final decision.

Finding out who takes the strategic decisions within a multinational group is a very complex undertaking.

At first glance, one might assume that this task will fall to corporate headquarters. These questions were thoroughly debated within the Working Party on the Globalisation of Industry during preparation of the OECD Handbook on Economic Globalisation Indicators.

The handbook specifies that the parent company and the head office of an enterprise group may be different entities. It is the head office that should be called the “unit of ultimate control”. A company is considered to be the investor of ultimate control over other companies of a group if it is at the head of a chain of companies and directly or indirectly controls all the companies in the chain without itself being controlled by any other enterprise or individual.

On the other hand, in a host country, the parent of a foreign-controlled affiliate is the first foreign investor outside the borders of the country exercising direct or indirect control over that affiliate. If the parent is also controlled by another investor, then the parent of the affiliate in question could be different from the company of ultimate control that stands at the head of the group.

The notion of control used here implies the ability to appoint a majority on the board of directors to run the enterprise, to guide its activities, and to determine its strategy. This ability can be exercised by a single investor or by a group of shareholders acting in concert and holding a majority (more than 50%) of voting shares. Control of an enterprise may be direct or indirect, immediate or ultimate.

All of these considerations show that for an enterprise, a centre of management does not necessarily coincide with the head office or the institutional unit of ultimate control.

The parent corporation of a foreign-controlled affiliate may be a decision centre for many projects, but the more strategic the nature of these projects, the more likely it is that decisions will be shunted up to the office of ultimate control.

During preparation of the OECD Handbook on Economic Globalisation Indicators, the Working Party on the Globalisation of Industry held many discussions on the location of corporate headquarters. It agreed
that the country of origin of an investment should be deemed the country in which the institutional unit of ultimate control is located.

While this choice simplifies the statistical task of identifying an investor's country of origin, it raises some complex questions of an analytical kind.

One may then ask what is the link between the nationality of the majority investor, its place of residence and the location of its corporate headquarters. When the capital structure of a group is highly internationalised, the dispersal of shareholders often implies an international make up of its management teams.

Under these conditions, it is difficult to attribute to an enterprise the nationality of its managers.

The key question that arises in this context is how to determine the country of origin of a company's head office when the dominant nationality of its managers is different from the country in which it is located.

The statistics collected to date by the Secretariat for identifying country of origin give precedence to the geographic location of the company of ultimate control.

However, some experts have suggested that in certain cases the nationality of managers and of majority shareholders (especially if it is largely the same for both groups) might be a better criterion for attributing the geographic origin of an investment or a company.

For purposes of this project, the most interesting question is to discover why the managers or majority shareholders of a company might decide to establish its headquarters in a country other than that of their nationality or their residence.

Figure 36. Relocation of headquarters in Europe by country

As a percentage of total

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland</td>
<td>55</td>
</tr>
<tr>
<td>Belgium</td>
<td>16</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>16</td>
</tr>
<tr>
<td>Netherlands</td>
<td>7</td>
</tr>
<tr>
<td>France</td>
<td>3</td>
</tr>
<tr>
<td>Denmark</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: KPMG.
In some countries, a distinction can be made between the legal head office (or registered corporate headquarters) and the real head office, which is where the company is effectively run, i.e. the place where its governing bodies meet, where strategic decisions are taken, and where the main contracts are signed.

Yet the location of the head office, even if it is only the "legal" one, can nevertheless be a key factor in the identity of an enterprise.

Figure 36 gives a very rough idea of the relocation headquarters within Europe in 2003. The numbers shown do not represent the total number of corporate headquarters established in each country, but only those that have relocated there from another country. These results also help in examining the attractiveness of countries as a location for multinational headquarters.
CONCLUSIONS

This report offers only a provisional picture of the location of foreign investments in technological innovation within the OECD area.

The most important messages emerging from these results confirm that the United States and Japan appear overall to be the most attractive countries for the research and high-tech activity of multinational firms. In Europe, taken as a whole, the attractiveness for these activities seems to be weaker, but there are important differences from country to country.

Germany is the primary pole of attraction for manufacturing R&D in Europe, while the United Kingdom is more successful in attracting knowledge-intensive services (computer services, R&D, financial services). Some European countries are still very attractive for research in specific sectors: France, for example, in electronics, Germany in aerospace, computers and motor vehicles, or the United Kingdom in pharmaceuticals (Annex 2). Others are more likely to attract investment in high-tech production, as Ireland does in computers or Hungary in electronics.

The available data are still inadequate for a detailed analysis of each country's attractiveness in individual sectors of high technology and research laboratories. The need to base such an analysis on data on inward investments in each reporting country, rather than on outward investments, presents some significant problems. When it comes to research labs, Box 2 summarises the main data availability constraints.

With respect to the location of decision centres, which play an important role in innovation strategy, further work on concepts and definitions is needed before data can be collected.

For the second stage of the project, i.e. the identification of factors influencing the location of investment in innovation, the kind of data that must be collected will be determined in part by economic analysis and the methodology selected.
ANNEX 1

Main R&D performing sectors in affiliates under foreign control and main countries of origin

1. Italy
2. Canada
3. Belgium
4. Netherlands
5. Sweden
6. Finland
7. Ireland
8. Austria
9. Portugal
10. Poland
11. Hungary
Figure 37. Main R&D performing sectors in affiliates under foreign control in Italy, 2004


Figure 38. R&D expenditures of affiliates under foreign control broken down by country of origin in Italy, 2003

Figure 39. Main R&D performing sectors in affiliates under foreign control in Canada

![Bar chart showing the distribution of R&D expenditures by sector in affiliates under foreign control in Canada for 1995 and 2004.](chart)


Figure 40. R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in Canada, 2004

![Bar chart showing the distribution of R&D expenditures by country of origin in Canada for 2004.](chart)

Figure 41. Main R&D performing sectors in affiliates under foreign control in Belgium, 2005


Figure 42. R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in Belgium, 2005

Figure 43. Main R&D performing sectors in affiliates under foreign control in the Netherlands


Figure 44. R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in the Netherlands, 2003

Figure 45. Main R&D performing sectors in affiliates under foreign control in Sweden


Figure 46. R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in Sweden, 2005

Figure 47. Main R&D performing sectors in affiliates under foreign control in Finland


Figure 48. R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in Finland, 2005

Figure 49.  Main R&D performing sectors in affiliates under foreign control in Ireland


Figure 50.  R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in Ireland, 2005

Figure 51.  Main R&D performing sectors in affiliates under foreign control in Austria, 2004


Figure 52.  R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in Austria, 2004

Figure 53. Main R&D performing sectors in affiliates under foreign control in Portugal, 2005

%  

Radio, TV and communication equipment  Non-electrical machinery  Motor vehicles  All chemical products (incl. pharmaceuticals)


Figure 54. R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in Portugal, 2005

%  

Germany  Spain  United States  Netherlands  France  United Kingdom

Figure 55. Main R&D performing sectors in affiliates under foreign control in Poland


Figure 56. R&D expenditures of affiliates under foreign control broken down by country of origin in Poland, 2005

Figure 57.  Main R&D performing sectors in affiliates under foreign control in Hungary, 2004


Figure 58.  R&D expenditures of manufacturing affiliates under foreign control broken down by country of origin in Hungary, 2004

ANNEX 2

R&D expenditures under foreign control in high and medium-high technology sectors broken down by country

1. Aerospace (ISIC 353)
2. Electronics (ISIC 32)
3. Pharmaceuticals (ISIC 2423)
4. Computers (ISIC 30)
5. ICT (manufacturing)
6. Scientific instruments (ISIC 33)
7. Non-electrical machinery (ISIC 29)
8. Chemicals (excl. pharmaceuticals) (ISIC 24 excl. 2423)
9. Motor vehicles (ISIC 34)
10. Electrical machinery (ISIC 31)
Figure 59. R&D expenditures under foreign control in the aerospace sector in 2004


Figure 60. R&D expenditures under foreign control in the radio, TV and communication equipment sector in 2004

Figure 61.  R&D expenditures under foreign control in the pharmaceuticals sector in 2004

Million PPP dollars


Figure 62.  R&D expenditures under foreign control in the office, accounting and computing machinery sector in 2004

Million PPP dollars

Figure 63.  R&D expenditures under foreign control in the ICT\(^1\) sector in 2004

Million PPP dollars

1. Manufacturing ICT only (ISIC 30, 32 and 33).

Figure 64.  R&D expenditures under foreign control in the scientific instruments sector in 2004

Million PPP dollars

Figure 65.  R&D expenditures under foreign control in the non-electrical machinery sector in 2004

Million PPP dollars


Figure 66.  R&D expenditures under foreign control in the chemical sector (excl. pharmaceuticals) in 2004

Million PPP dollars

Figure 67. R&D expenditures under foreign control in the motor vehicles sector en 2004

Million PPP dollars


Figure 68. R&D expenditures under foreign control in the electrical machinery sector in 2004

Million PPP dollars