ISBN 978-92-64-03779-3
Globalisation and Regional Economies:
Can OECD Regions Complete in Global Industries?

PART I

Chapter 1

The Reshaping of Regional Economies

Rapid changes in economic structures are causing concern among both policy makers and citizens in OECD countries. To understand how these trends are affecting regions, this chapter explores the dynamics of the manufacturing sector at the regional level and the shift, visible in some places, towards higher value manufacturing and non-manufacturing activities. This chapter sets the scene for subsequent discussion of whether and how regions can seize the opportunities offered by globalisation by building on their accumulated assets.

Introduction and key points

Given that many OECD regions are closely associated with industrial production and often with specific industries, rapid evolutions in economic structures cause concern among both policy makers and citizens in OECD countries. Issues such as delocalisation, jobless growth, job insecurity and the replacement of high-wage, skilled production jobs with lower-wage service jobs are high on the political agenda in many OECD countries. To understand how these trends are affecting regions, this chapter first explores the dynamics of the manufacturing sector at the regional level and the shift, visible in some places, towards higher value manufacturing and non-manufacturing activities.

This chapter also reviews the different dimensions of specialisation. A major part of the concern over the future of manufacturing in the OECD is explained by a perception that what OECD regions can offer in terms of skills, business environment, etc., is ultimately less valuable to global firms than what they can get from lower wage economies where competencies are increasing rapidly. Yet geographic concentration of interconnected companies seems to suggest that locational advantages are still a source of productivity gain for firms. Even if traditional reasons for clustering might have diminished in importance with globalisation, new motivations for proximity to customers and competitors have arguably grown in importance in an increasingly knowledge-based economy.

Key points

- OECD regional economies have evolved away from manufacturing production toward other activities. This has involved substantial job losses in manufacturing, usually but not always, offset by growth in service employment, resulting in net job growth. While around 75% of OECD regions had net employment growth (only 70 regions out of 294 saw total employment decline), less than one-third (29%) recorded an increase in manufacturing employment.
- These job losses in manufacturing are mainly a result of productivity gain and restructuring rather than to processes associated more directly with globalisation such as offshoring/delocalisation. As a result, in many regions manufacturing output has grown while manufacturing employment has declined.
- Nevertheless, manufacturing still has a large economic footprint in many regions, including a strong multiplier between industrial jobs and other jobs (up to 1:10 in the auto industry in one region studied). And much of the regional R&D infrastructure is organised around manufacturing and often around specific sectors. In this respect, the performance of the region is still linked to evolutions in industrial sectors.
- Employment change is strongly influenced by the performance of key sectors/industries such as the boom and bust in ICT or market shifts in the auto industry. Patterns of employment change are related to national performance, but there is also significant variation within countries.

- There is some evidence of increasing concentration of high-technology activity and inter-firm linkages. Patent data suggests that there is considerable concentration of high-tech activity, at least across Europe. And there is also significant specialisation among regions in different high-tech sectors/branches.
- There is increasing overlap between technologies used in industrial sectors such as biopharmaceuticals, ICT and auto. And there is also a transition toward knowledge-intensive services linked to these sectors.
- Despite a general shift to knowledge-intensive services, some regions have significant market niches in high value added manufacturing, even in sectors that are vulnerable to offshoring or where job losses have been significant. These knowledge intensive activities are often still related to manufacturing, and in many cases regional specialisation continues, but without the production components.
- Non-OECD regions are becoming important players in these industries. The standard approach is FDI-based but there are also initiatives that aim to build local capacity, including cluster formation.

The decline in manufacturing

Increased output but fewer jobs in most regions

The principal evolution in most OECD regional economies has been the gradual replacement of manufacturing by service industries as their cornerstone. Over the period 1998-2003/4, the share of manufacturing employment as a proportion of total employment across OECD regions fell by around 10%. While around 75% of OECD regions had net employment growth (only 70 regions out of 294 saw total employment decline), less than one-third (29%) recorded an increase in manufacturing employment. In many regions, the scale of the reduction of manufacturing employment was very striking (see Table 1.1). The largest decreases in manufacturing employment (in absolute numbers) were in Japan, the United States and Germany.

To understand better the scale of the evolution in regional economic structures, it is helpful to imagine a typical region.[1] This average regional economy created a positive balance of 61 000 jobs over the period 1998/9-2003/4 and lost an average of

Table 1.1. **Ten regions with the largest absolute declines in manufacturing employment**

Change in employment from 1998-2003/4

	Region	Manufacturing	Total
Japan	Tohoku	–123 808	–266 000
USA	Pennsylvania	–126 499	117 158
USA	Michigan	–126 688	–177 800
USA	Ohio	–128 159	–11 336
Japan	Toukai	–131 587	–96 000
USA	Texas	–136 613	596 682
Germany	Nordrhein-Westfalen	–146 500	–140 000
USA	California	–263 874	892 961
Japan	Kinki	–315 352	–367 000
Japan	Kanto	–567 964	–112 000

Note: Regions listed are at the Territorial Level 2.

20 000 manufacturing jobs. Regions in G7 countries created 60 000 new jobs, but lost an average of over 30 000 manufacturing jobs each.

The reorientation of individual regional economies was often even more dramatic. In many regions, employment growth exceeded manufacturing job losses by a large margin: up to ten or more new jobs created for every one manufacturing job lost. For example, Lombardy (Italy) saw a net decrease of 17 400 industrial jobs over the period, but created over 300 000 net jobs in other sectors. Nord-Pas-de-Calais (France) had a net loss of 13 900 manufacturing jobs but employment increased by around 295 000 jobs over the period. The Mexican state of Puebla lost 22 585 manufacturing jobs but created 359 000 new jobs overall. The US state of Florida saw 42 615 manufacturing jobs disappear, yet total employment grew by 595 000. And the region of West Netherlands lost 19 000 manufacturing jobs but total employment grew by around 250 000. A similar pattern, though often less striking, emerges across many OECD regions.

Even the significant minority of regions that saw manufacturing employment grow tended also to have relatively high total employment growth. Prominent examples include Ontario and Quebec in Canada, Catalonia and Andalusia in Spain and Korea's Capital and Chungcheong regions (see Table 1.2). In most cases, non-manufacturing job growth exceeded manufacturing job growth by a large margin. As a result, the rate of manufacturing employment in the economy declined even in regions where manufacturing employment expanded. The lack of growth of manufacturing employment in regions in some countries that had healthy increases in manufacturing output overall, notably the United Kingdom, the United States and Sweden, illustrate that growth in output can be decoupled from employment growth in manufacturing.

The decline in manufacturing employment in OECD regions has been principally a result of productivity growth and low market demand rather than a direct result of globalisation. In fact, the volume of manufacturing production and the volume of value added in the OECD area have continued to rise over the past decades. However, as a recent OECD report noted, since much of the manufacturing sector has been characterised by relatively high productivity growth, prices of manufacturing products have tended to increase little over time and for certain products have fallen significantly. For example,

Table 1.2. **Ten regions with the highest absolute growth in manufacturing employment**

1998 to 2003/4

	Region	Manufacturing employment growth	Total employment growth	Ratio of manufacturing growth to total employment growth
Canada	Ontario	112 700	683 500	1:6
Korea	Capital region	101 402	1 595 900	1:15
Korea	Chungcheong region	55 172	182 000	1:3
Spain	Catalonia	39 700	477 300	1:12
Spain	Andalusia	38 900	597 500	1:15
Korea	Gyeongnam region	36 883	248 600	1:7
Korea	Gyeonbuk region	34 459	164 900	1:5
Canada	Quebec	28 000	365 800	1:13
Spain	Basque Country	22 600	107 800	1:5
Mexico	Tamaulipas	21 580	130 852	1:6

Note: Regions listed are at the Territorial Level 2.

from 1992 to 2002 productivity measured as output per hour increased by 55% for the US manufacturing sector but by only 29% for the economy as a whole (including manufacturing but excluding agriculture). Prices increased by 140% in the overall US economy but by only 60% in manufacturing over the same period. Because of this price effect, while manufacturing production has continued to increase, manufacturing products have become relatively cheaper and less profitable (OECD, 2007f). In contrast, many parts of the services sector have experienced slower productivity growth and prices tend to go up more strongly over time. OECD's manufacturing regions have thus been under pressure to find productivity gains by shaving margins and costs in order to remain competitive.

As the share of manufacturing in regional output and employment has decreased, the importance of the service sector has, in turn, increased. The increases in service employment are as striking as the declines in manufacturing employment. Over the period 2001-2005, US states created an average of 125 000 net jobs in service activities (only the industrial mid-west states of Michigan, Ohio and Illinois had service sector growth that did not outstrip manufacturing job losses). Each Australian state and Canadian province saw service employment grow by an average of 122 000 jobs over the same period. The average OECD region saw an increase of around 25 000 jobs in the "real estate, renting and business activities" sector. The increase in this one service sector category alone offsets average job losses in the entire manufacturing sector.

A number of reasons have been put forward to explain the rapid expansion of service activities. First, the low profitability of manufacturing sectors and the growth of demand for services have tended to push expansion of markets for services, particularly in the most advanced OECD economies. Second, socio-economic and lifestyle factors, including the increased labour productivity of manufacturing, have promoted rapid growth in service industries such as health and personal care, leisure and tourism (OECD, 2007f). Finally, liberalisation and deregulation of markets have opened up new possibilities for business and financial services to expand, both with respect to new services and products in home markets and the ability to expand internationally in certain service activities. This is a general phenomenon visible across all OECD regions.

While there has been employment growth across most service activities (the exceptions include public administration in some regions), data for European regions suggests that most regions are becoming more oriented towards knowledge-intensive service activities. Many capital and core metropolitan regions in Europe already have very high rates of knowledge-intensive service employment. Stockholm, London, Brussels-capital, Helsinki, Berlin and the Île-de-France (Paris) all have rates of employment in knowledge-intensive services that approach or exceed 50%. Furthermore, Eurostat data indicates that most EU regions have seen the share of this category of employment increase dramatically over the past five years. Several regions in Greece, Portugal, Spain and Italy, for example, have seen the share of knowledge intensive service employment increase by more than 25% since 2000.

... with strong variations across regions and across sectors

Looking across OECD regions, it is clear that the decline in manufacturing is 1) far from universal and 2) is influenced by the nature of the industry. In other words, behind the bleak aggregates, there is a great deal of variation across regions.

Despite general trends, manufacturing remains a key employer in a large number of OECD regions. As Figure 1.1 indicates, there is significant variation across countries and across regions in the share of manufacturing in total employment. The highest national levels of manufacturing (at 20% of total employment or above) are found in the Czech Republic, Germany, Italy, Hungary, Japan and the Slovak Republic, Within countries, there are very large variations: for example, Austria (Vorarlberg, 25.8%; Vienna, 10.5%), Portugal (Norte, 27%; Algarve, 5.1%), United Kingdom (West Midlands, 20.0%; London, 8.6%) (see Table 1.A1). Not surprisingly, the regions with the highest starting rates of manufacturing have tended to lose the largest numbers of jobs in manufacturing.

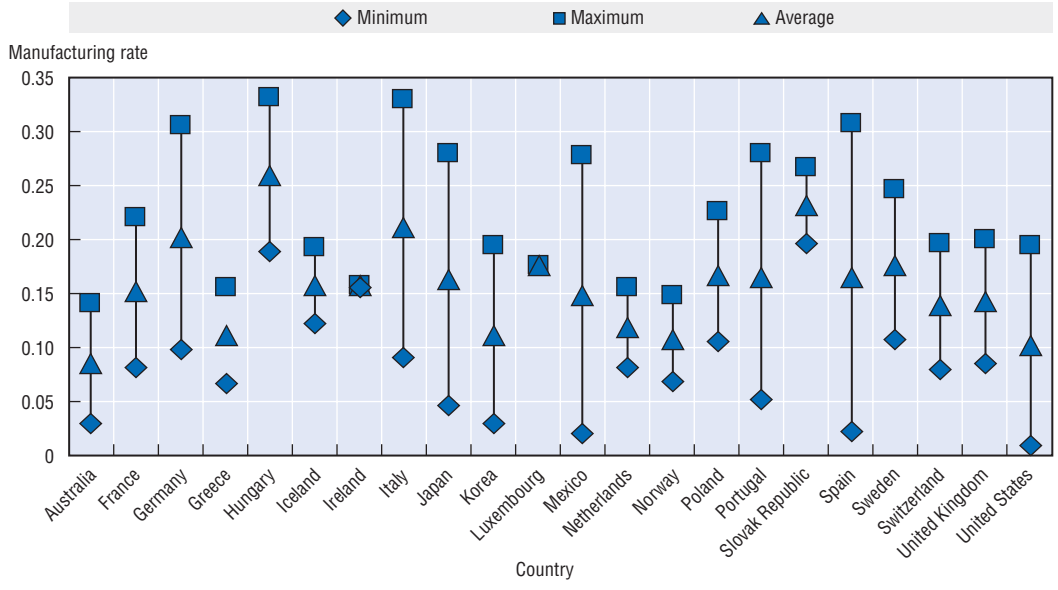
The performance of manufacturing in different regions is strongly influenced by the sectoral or industrial composition of the regional economy.

In certain sectors, particularly textiles, there has been a significant reduction in employment in the OECD area, with relocation of many jobs to non-OECD countries. Over the period 1970-2001, employment in the textile and apparel sectors in OECD countries fell by 6.2 million (around two-thirds of total OECD manufacturing job losses) (Pilat, *et al.*, 2006). There are two main reasons for this. First, labour costs make up a more significant share of total production costs in the textile industry, which makes it more sensitive to wage costs. Second, technological advances have not reduced the labour intensive nature of production enough to make OECD regions competitive production sites. However, innovative firms like Geox (shoes) and Zara (apparel) have shown that production can be profitable without offshoring. In addition, some countries have been more resistant to decline than others. For example, US textile manufacturing declined by 33% between 2001-2003 but in Italy that decline was only around 6% (Berger, *et al.*, 2005).

In some other important industrial sectors such as ICT, pharmaceuticals and automotive, however, aggregate OECD employment levels have been relatively stable or

Figure 1.1. **Share of manufacturing in total employment for regions by country**

2003/4



Note: Regions are at the Territorial Level 2.

Source: OECD (2007e), *OECD Regions at a Glance*, OECD Publications, Paris.

have shown only moderate declines (OECD, 2007f). In each case, the sources of growth or stability, as well as current economic uncertainty, tend to be different. Moreover, behind the aggregate figures, there is often significant job churning and increases and decreases in employment and output across regions within the OECD.

Each of the OECD regions studied (Detroit/south-east Michigan, Turin and the Västra Götaland region) has lost manufacturing employment, both overall and in the auto sector. The main car makers in each of the regions (GM/Ford/Daimler-Chrysler, Fiat and Volvo Cars/Saab, respectively) have gone through major crises and have shed employment. The actual or threatened impact of restructuring of the industry has caused economic upheaval in each region. It is true that the evolution of the sector has been towards lower labour intensity and higher productivity, resulting in a downward trend in terms of employment in the three regions. Nevertheless, there are dimensions of the crises experienced by the these regions that appear more related to market decisions by key firms, over-capacity in the industry, poor financial management and other things that do not necessarily imply a definitive decline. For example, car manufacturing is increasing in other parts of the United States as a counter-example to Detroit/south-east Michigan.

ICT employment maps to the ups and downs of recent industry trends, with sub-sectors growing at different rates. The main identifiable factor with respect to manufacturing employment in the ICT sector is the upheaval caused by the ICT bubble in 1999-2001, provoked initially by the crash of ICT-related stocks on the New York stock exchange, and the subsequent recovery from that. The case studies of Ottawa and Stockholm illustrate the role the performance of a particular industry and the risks that this can entail when the industry contracts. Employment in the ICT industry in Ottawa fell by around 20 000 after the industry slump in 2001. Similar high and sudden job losses happened in the ICT sector in the Stockholm and Eindhoven regions as well. But in each case, output and employment in the industry have rebounded (though more completely in Ottawa than in the other two regions). In each case, the sector-specific shock, more than other identifiable longer-term processes, seems to have triggered a restructuring of the sector in the region.

The biopharmaceuticals industry is one of the few manufacturing sectors to have created employment over the last decade. Other sectors, including ICT and auto, have seen stable employment levels (OECD-wide) over the period, but only pharmaceuticals actually grew (Pilat, *et al*., 2006). Regions with a strong biopharmaceuticals industry have benefited from this expansion. For example, the pharmaceuticals sector in north-western Switzerland (and neighbouring regions in Germany and France) has a sustained record of job growth along with an average GVA growth rate of approximately 10% per year between 1995 and 2004. The pharmaceuticals and biotechnology industries in the two other OECD regions studied – Stockholm and Montreal – also both saw rapid and sustained growth over the past decade.

The coincidence between continuing decline in manufacturing employment, the increase in offshoring and severe slumps in some high-technology industries has given the impression that the future of these sectors in OECD countries is under threat. But the evidence from regions like Montreal, Eindhoven, Ottawa, the Basel region and Stockholm is that OECD regions can still achieve export growth and create employment in manufacturing (and/or in service activities related to manufacturing). Given such industry-specific variations in the performance of manufacturing in OECD countries, the challenge

for regional policy makers is to understand the drivers of structural changes. The policy response needs to differentiate between temporary, sector-specific downturns and firm-level restructuring *versus* more permanent changes in the fundamentals that determine the competitiveness of the region in those industries.

... and growth in related high-value services

The transition that regions have experienced is not only related to changing levels of employment but also to the type of employment.

First, a significant number of manufacturing industry jobs are actually in service occupations. In other words, in some industries, the production facilities have relocated but a range of related service jobs – usually high-value functions – remain. Yet these jobs are still classified as manufacturing sector jobs. OECD estimates suggest that on average around 40% of workers employed in manufacturing sectors are actually employed in service occupations (Pilat, *et al.*, 2006). Examples of these occupations include computer and network services, finance, business, sales, marketing, and legal professions, among others. As one would expect, the rates are particularly high for countries with strong high-tech manufacturing sectors such as the United Kingdom, the Netherlands, Sweden and Finland.

Second, the service value added component of many manufactured goods has increased, whether the service is provided in-house or outsourced. This means that manufactured goods often have an increasingly high service value added embodied in the final product. This is clear from the auto industry, where computer software and ICT supports are an increasingly important part of the car design. This is also true in the ICT sector where much of the growth in mobile technology is based around applications software, such as multimedia where media giants like Disney are working with ICT companies to adapt their production to mobile ICT supports.

This transition away from manufacturing production activities is clear in most of the case study regions. In most cases, the regions combine either specialised or high-skill manufacturing with related knowledge-intensive services. They were once high volume production sites but are now more diverse mixtures of manufacturing and service activities, often with blurred lines between the two and close interlinkages. The extent of the shift varies according to the three sectors studied, with ICT being the least production oriented and the automotive industry remaining more production oriented.

Regions engaged in ICT related industries have seen a shift from production of telecom equipment to telecom service activities. For example, the Ericsson-driven ICT cluster in Stockholm was engaged until recently in telephone handset production, employing around 20 000 production employees. Over the past decade, virtually all production activities have moved overseas. Nevertheless, employment in the sector has remained more or less constant because of the expansion of telecom network and systems support services, which are now a major part of Ericsson's market. There has been a similar evolution in Ottawa's ICT industry. At first, the industry depended heavily on Nortel and grew as that company expanded its telephone and semiconductor production businesses. However, as Nortel restructured, the sector has evolved and broadened. The ICT crisis of 2000 brought significant job losses, but the sector rebounded on the back of a large number of small ICT firms specialising in software applications and advanced ICT service activities.

There are, however, examples of regions that are still strong in niche manufacturing in ICT related activities. In Eindhoven, the ICT industry (Philips, ASML, NXP, FEI) is still internationally competitive in advanced, high-value manufacturing. The industry grew out of Philips, which has been a technology developer for more than 100 years (starting with lighting, then television, radio, data processing, storage and transmission of images, sound and data). Today, NXP (the spin-out of Philips' semiconductor division since September 2006) is the second largest manufacturer of semiconductors in Europe and the cluster has developed strengths in materials and embedded systems. In other words, the industry in Eindhoven is innovating in high-tech equipment and materials rather than moving into network, software applications or systems support, as was the case with Ottawa and Stockholm.

The case study regions specialised in biopharmaceuticals (Montreal, north-western Switzerland, Shanghai and Stockholm) have all witnessed a shift towards higher-value manufacturing and services. Overall, the most basic drug production processes have relocated, but more complex production related processes are still competitive in OECD locations. In north-western Switzerland, the number of employees in the chemical and pharmaceutical industry declined while the more specialised, less production oriented life science branch created employment between 1995 and 2004 (approximately 7%) over the same period, which indicates a shift towards tertiary sector activities. Both Pfizer and Astra Zeneca have announced layoffs among the personnel involved in manufacturing in the Stockholm region while reinforcing investment in upstream non-manufacturing processes.

The automotive industry is a little different because the regions still emphasise car production and the value of maintaining at least some production close to HQ and R&D centres. Although the regions produce fewer cars than in the past, they are still production sites (though within globalised production systems involving numerous other locations). Fiat, for example, has production plants in Italy, Poland, Brazil and Argentina as well as joint ventures and licensing production agreements in a number of other countries including Morocco, Egypt, South Africa, China and India. Nonetheless, production is still concentrated in the Turin region, in close proximity to headquarters and design and R&D centres. The same model is used by most other car makers such as Renault and BMW in Europe and Toyota in Japan.

Manufacturing in OECD regions can still be competitive, but this competitiveness is not as clearly defined around production as it was before. OECD regions are involved in complex and internationalised production systems in which they tend to occupy the high-value functions whether manufacturing or service activities. The ability of regions to produce in industries that are very cost sensitive suggests: 1) that firms in the regions derive certain productivity gains from location within the region, but also 2) that the production system in the region uses network inputs from other places, where those inputs can be produced cheaply. In other words, it would be a misleading to assume that all stages of the production process are internalised within the region.

Specialisation and clustering

A key feature of regional economies is the level of concentration and specialisation that they exhibit. This is not a new phenomenon, of course, as the idea that regions specialise in particular industries where they have a competitive advantage is a basic

principle of economic theory. But it seems paradoxical that in an era when it is possible to produce any good in any location, firms tend to locate in the same places to produce the same or similar goods. There has been renewed policy attention on the issue of the concentration of economic activity because of the assertion that: 1) certain activities, particularly high value added activities, are increasingly concentrated, and 2) this concentration can increase the productivity of firms and make them more innovative. The current debate surrounding the EU's Lisbon Agenda to support a knowledge economy illustrates the link between the achievement of key economic objectives and the issue of specialisation.

Given that regional economies are often closely linked to a limited number of key industries, the performance of those sectors has an important influence on regional performance overall. The declines in employment in textile and clothing industries mentioned above has had serious consequences for many OECD regions because these sectors are among the most geographically concentrated industries (over 40% of employment in each sector in Europe and the US is geographically concentrated). At the same time, the automotive, pharmaceuticals and branches of the ICT industry are also similarly clustered, and the growth of these industries has, in turn, boosted regional economic growth in these places. Anticipating changes in demand by sector is thus a key dimension of the process of economic policy making at regional level.

Countries are increasingly specialised

The concentration of production has an international dimension. A recent OECD report on the evolution of manufacturing noted that some OECD countries have developed or consolidated competitive advantages in specific types of products, categories of technology or particular market segments. With regard to high and medium-high technology sectors, one key message is that manufacturing by sector seems to be increasingly concentrated; with certain countries increasing their specialisation in sectors in which they have a competitive advantage. This trend is true for both countries with existing strengths in those sectors and newer entrants. Only a few OECD countries, notably Switzerland, Ireland, the United States and the United Kingdom have a strong comparative advantage in high-technology manufacturing. Several others, notably Japan and Germany, are particularly strong in medium-high technology industries, such as machinery, electrical equipment and cars (Pilat, *et al.*, 2006).

The report also identifies some significant recent shifts illustrating that countries become relatively more specialised in different types of production. For example Finland and Hungary have become hubs of high-technology manufacturing and the Czech Republic, the Slovak Republic, Korea, Portugal and Turkey have become more competitive in medium-high technology industries. The globalisation of production in ICT goods provides an illustration of these evolutions. Between 1996 and 2004, total OECD ICT goods trade increased by 6.5% a year, while that of Mexico and the eastern European members increased by 17.4% a year (OECD, 2006c).

This sorting on the basis of technology intensity is also apparent in way different countries specialise in different market segments within the same industry. For example, in 2003 Japan had a 16% share of the US market for imported televisions, but only 3% by volume (numbers of TVs imported). The average unit value of imported TVs from Japan was around USD 1 000, whereas the corresponding unit values for Mexico and China were

Table 1.3. **Market shares in value and quantity for TV exports to the United States**

Exporter	Share of market value	Share of market in terms of units exported	Average value of units (USD)	Growth in share, in value terms (1998-2003)
Mexico	48	33	308	2
Japan	16	3	1 034	64
Malaysia	13	20	137	24
China	9	13	96	75
Thailand	7	13	118	11
Korea	3	4	160	29

Source: Japan External Trade Organization (JETRO), ITC calculations/COMTRADE.

USD 300 and less than USD 100 respectively.[2] Moreover, over the period 1998-2003, Japan's export volume increased by 33% and export value by over 60%, indicating that Japanese firms were consolidating their share of the quality end of the US market (see Table 1.3). Another example is provided by the car industry where vehicles produced in the Detroit region source inputs of different types from different countries. For example, engines are largely sourced from Canada, electrical parts and interiors/upholstery from Mexico and chassis from China (Klier, 2007).

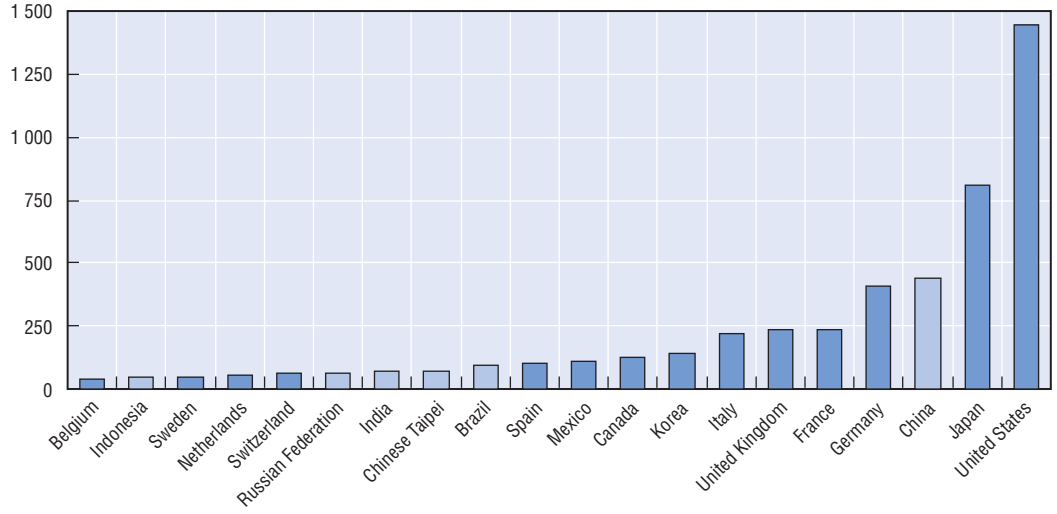
The importance of non-OECD regions in manufacturing has increased. The share of world value added produced in China and in East Asia (excluding China and Japan) has risen from around 2.8% and 1.5% to 6.8% and 7.1% respectively between 1980 and 2000. As a result, the share of manufacturing production accounted for by OECD countries has declined overall, as well as their share of export markets (OECD, 2006c; OECD, 2007f). This can be seen clearly in data on the ICT industry:

- In the late 1990s, 70% of OECD ICT equipment imports came from other OECD countries and 30% from non-OECD countries. By 2004, the OECD share had fallen to 58% and that of non-OECD countries had risen to 42%.
- Between 1996 and 2004, imports of ICT goods into the OECD from non-OECD countries grew by 12%, while imports from OECD countries grew by only 4% respectively.
- China's ICT goods exports grew by 40% a year between 2000 and 2004.
- China (excluding the Hong Kong, China and Macao Special Administrative Regions) is now the world's largest exporter of ICT goods at more than USD 180 billion in 2004, eclipsing the United States (USD 149 billion) and Japan (USD 124 billion) (OECD, 2006c; Ernst, 2006).

However, the main trend is not simply the rise of specific countries as manufacturers of final products competing with those of other countries. After all, despite recent declines in market share, OECD countries still dominate the manufacturing sector with nine out of the top ten global manufacturing countries belonging to the OECD (see Figure 1.2). Rather the key trend is the increasing integration of new countries into global production networks. This trend is exemplified by the increasing share of parts and components in exports, particularly from emerging Asian economies. The overall trends suggest that most Asian economies are becoming more dependent on relationships with OECD-based producers as they become more integrated into production system in which they provide key components for products that are finished elsewhere (see Chapter 2).

Figure 1.2. **Top 20 manufacturing countries, 2002**

USD millions



Note: Data on value added are converted at exchange rates. The estimates should be interpreted with caution.

Source: OECD STAN database, UNIDO and National Statistical Offices in OECD (2007f), "Synthesis report on Global Value Chains" (DSTI/STP/TIP[2007]5).

Regions specialise in different types of goods

Many of the sectors that are most open to global competition are, in reality, heavily concentrated in specific regions. Economic geographers mapping the location of economic activities by region have found clear concentrations across all types of industries. Some of the sectors that have been hardest hit by job losses are also among those that are most concentrated. At the other end of the spectrum, many high growth industries, such as pharmaceuticals, are also strongly regionally based.

The idea that specific places specialise in particular activities and that firms engaged in the same or related activities tend to cluster together have been key observations in economics for a long time. The concept of Ricardian comparative advantage from the early 19th century developed the notion of national and regional specialisation. The theory assumes that differences in endowments such as geographic location, presence of raw materials and cheaper labour generate economies that enable one place to produce in a given industry more competitively than another and thereby to specialise in that activity. A century later, Alfred Marshall's work elaborated the reasons for greater firm productivity when several firms in the same industry are located in proximity to one another, notably labour market pooling, knowledge spillovers and supplier specialisation. Subsequent theories have argued that specialisation in a particular industry brings with it a process of accumulation of assets and advantages (cumulative causation), implying a self-reinforcing nature in this process (Krugman and Venables, 1990).[3]

Looking across countries, the differences in the level and nature of specialisation at the regional level are very clear. Each of the countries have regions – core or capital regions – that have very low rates of specialisation in manufacturing overall but above average (and in some the highest) rates of specialisation in high-technology manufacturing. Alongside this, there are some other regions that concentrate strengths in both high-technology and low- and medium-technology manufacturing (such as Catalonia and the Basque Country in Spain, Lombardy and Piedmont in Italy, Alsace and Rhone-Alpes in France). Then, there are

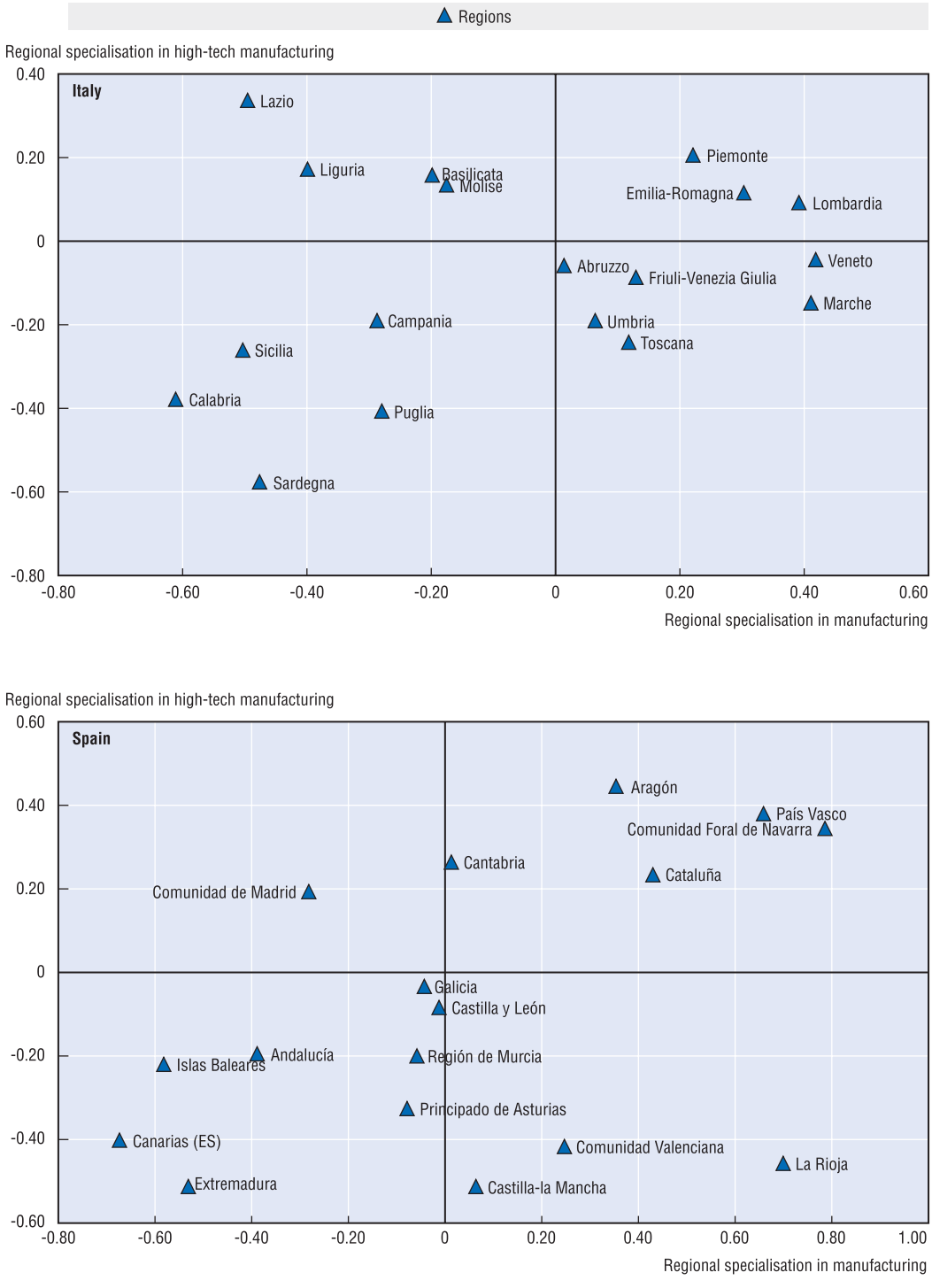
a larger number of regions that are strong manufacturing but have below average rates of specialisation in high-technology industries (see Figure 1.3).

Figure 1.3. **Regional specialisation by technology intensity: France, Czech Republic, Italy and Spain, 2003/4**

The national averages for each index are set to zero (0=1); a positive value indicates above average specialisation, a negative value below average specialisation.

Figure 1.3. **Regional specialisation by technology intensity: France, Czech Republic, Italy and Spain, 2003/4** *(cont.)*

The national averages for each index are set to zero (0=1); a positive value indicates above average specialisation, a negative value below average specialisation.



One striking pattern in terms of regional specialisation is that high-technology manufacturing is often concentrated in regions that have very low shares of

manufacturing activity. In other words, regions can have strong high-tech manufacturing but little manufacturing of other types. The examples of Vienna, Île-de-France, Prague, Lisbon, Bratislava, Berlin, London and Stockholm are striking (Table 1.4). The inverse is also common; regions can have significant manufacturing employment – well above the national average – yet employment shares in high-technology manufacturing that are equally far below the national average.

Evidence from patent statistics tends to confirm the central importance of specialisation in OECD economies. Overall, patents are concentrated in a small number of regions within countries. On average, 57% of total patents recorded in OECD member countries in 2003 came from only 10% of their regions, up from 54% in 2001. A comparison of the indexes of geographic concentration for patents and for population with tertiary education shows that in most countries patenting is significantly more concentrated than the highly skilled population (OECD, 2007e). This suggests that other factors than simply workforce skills are involve, notably the presence of technical infrastructure and the presence of patent intensive industries. In both cases, these tend to be very strongly concentrated within OECD countries.

With respect to the expected link between innovation outcomes and the productivity of firms, the correlation between patent applications and labour productivity within regions during 1998-2003 is positive in 19 out of 22 OECD countries (only in Belgium and Greece is the correlation negative and statistically significant). The positive correlation was

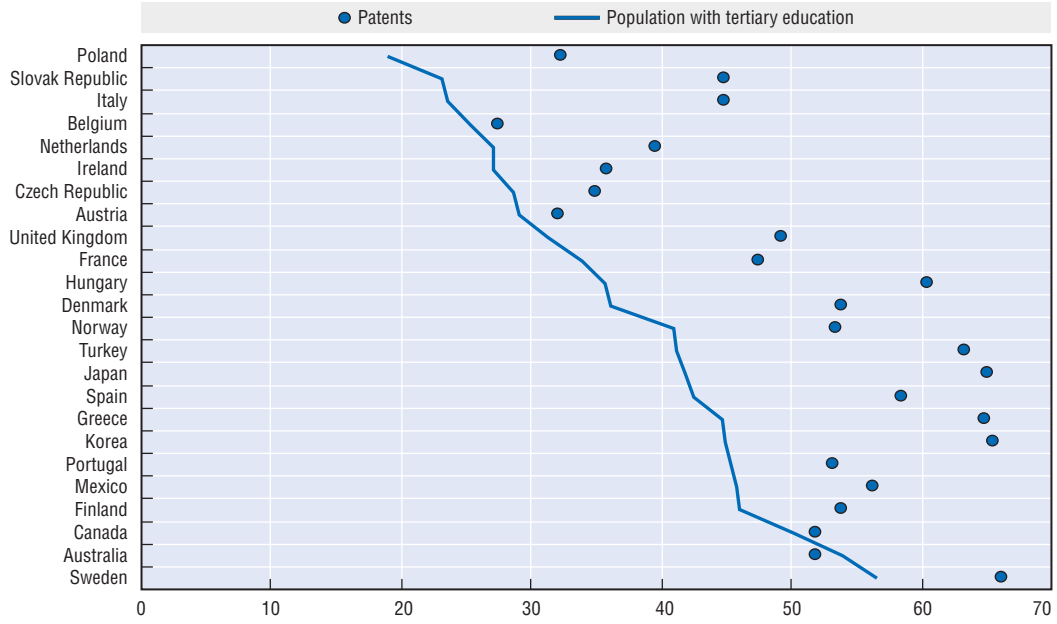
Table 1.4. **Contrast between specialisation in manufacturing and in high-tech manufacturing for selected EU regions**

Country	Region name	Index of specialisation in manufacturing (2003 or most recent year)	Index of specialisation in high-tech manufacturing (2004)
Austria	Vienna	0.62	1.10
Belgium	Région de Bruxelles-Capitale/Brussels Hoofdstedelijk Gewest	0.75	1.03
Czech Republic	Prague	0.43	1.19
Finland	Itä-Suomi	0.88	0.70
France	Languedoc-Roussillon	0.59	0.70
	Île-de-France (Paris region)	0.74	1.38
Germany	Berlin	0.46	1.05
Greece	Nisia Aigaiou, Kriti	0.50	0.58
Hungary	Közép-Magyarország	0.80	1.04
Ireland	Southern and Eastern	0.99	1.02
Italy	Calabria	0.39	0.62
Luxembourg	Luxembourg (Grand-Duché)		1.00
Netherlands	West-Nederland	0.75	0.91
Norway	Oslo og Akershus	0.60	0.92
Poland	Lubelskie	0.58	0.93
Portugal	Lisbon	0.64	1.95
Slovak Republic	Bratislava	0.82	1.22
Spain	Canarias	0.33	0.59
	Madrid	0.72	1.18
Sweden	Stockholm	0.65	1.12
Switzerland	Ticino	0.54	0.91
United Kingdom	London	0.60	0.98
	South East	0.77	1.20

Note: The national average is 1.0 for each index; a value above 1.0 indicates above average specialisation and vice versa. Regions shown are those with the **lowest** specialisation in overall manufacturing.

Source: Based on Eurostat data.

Figure 1.4. **Concentration index of patenting activity and population with tertiary education**

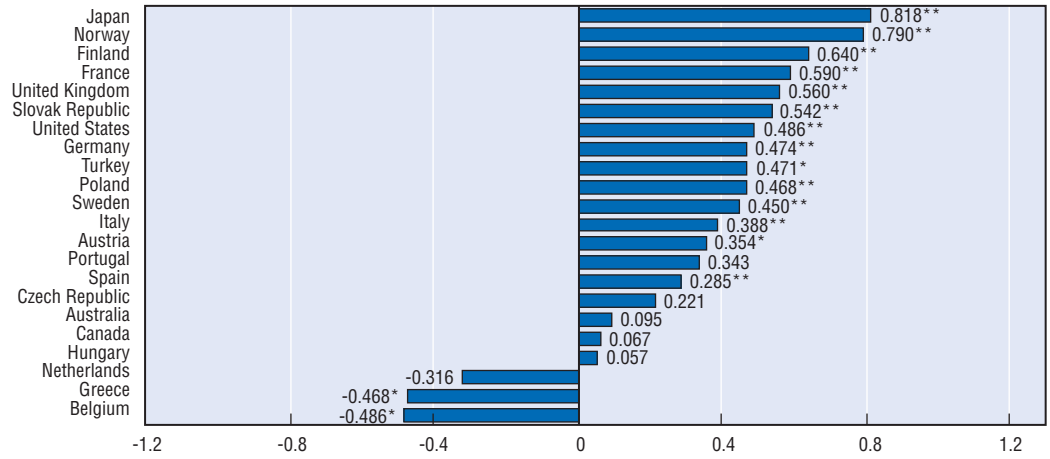


Source: OECD (2007e), *OECD Regions at a Glance*, OECD Publications, Paris.

particularly pronounced in Japan (0.82), Norway (0.79) and Finland (0.64), followed by France (0.59), the United Kingdom (0.56), the Slovak Republic (0.54), the United States (0.49), Germany, Turkey and Poland (0.47), and Sweden (0.45). In all these countries the relationship was statistically significant (OECD, 2007e).

The concentration of innovation-related assets is also striking. The ten leading regions in Europe in terms of GDP per capita account for more than one-third of all patents. At the same time, while these ten regions were responsible for more than 250 patent applications

Figure 1.5. **Spearman rank correlation of regional labour productivity and regional patent applications, 1998-2003 (TL2)**



* Indicates significant at 95%.
** Indicates significant at 99%.

Source: OECD (2007e), *OECD Regions at a Glance*, OECD Publications, Paris.

per million each across all high-technology sectors, one-third of EU regions recorded less than one patent per million in the same year. Moreover, there is a very strong link between certain characteristics of regional economies and innovation. For example, the level of patenting activity is strongly correlated with GDP per capita (correlation coefficient of 0.86, significant at the 0.05 level), with students in higher education (correlation coefficient, 0.81) and with employment in high-technology industries (correlation coefficient, 0.85).

Regions also specialise within technology fields. The Noord Brabant region around Eindhoven (one of the case study regions) generates more than 10% of European semiconductor patents (see Table 1.5). Stockholm performs strongly with respect to patents in both life sciences/genetics and ICT equipment (see Table 1.6). While most of the regions are large urban regions, the influence of major research centres and the clustered high-tech activities around them is visible. For example, the strong patent performance of the UK region of East Anglia is largely attributable to the technology cluster around Cambridge University.

Similar concentrations of high-technology activities can be seen in the United States as well. As shown in Figure 1.6, there is a general relationship between high-technology firms and states with higher GDP per capita, as would probably be expected. Other data pertaining more directly to innovation suggest a stronger concentration of high-technology capacity. Patent data, for example, shows the large differences between innovation hubs such as San José, Boston, Rochester, Raleigh-Durham and even Detroit and the large

Table 1.5. **Patent applications in semiconductors**

Patent applications per million inhabitants

	2000 (1990)
Oberpfalz, Germany	48 (0)
Oberbayern, Germany	47 (12)
Dresden, Germany	46
Noord-Brabant, Netherlands	**45 (14)**
Bayern, Germany	25
Kärnten, Austria	20
Sachsen, Germany	18
Mittelfranken, Germany	16
Prov. Vlaams Brabant, Belgium	12

Source: Based on Eurostat data.

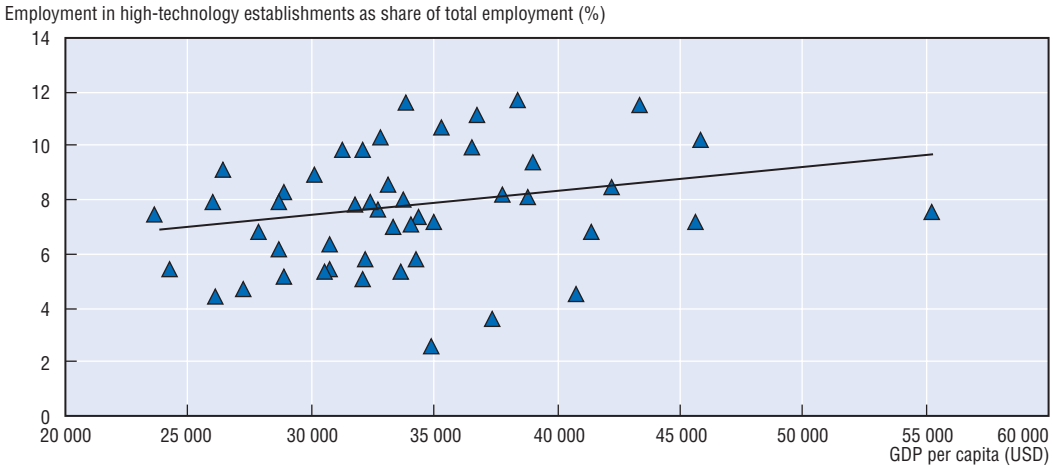
Table 1.6. **Patent applications in ICT**

Patent applications per million inhabitants

	2000 (1990)
Noord-Brabant, Netherlands	**552 (124)**
Stockholm, Sweden	**327 (42)**
Etelä-Suomi, Finland	233
Pohjois-Suomi, Finland	212
Oberbayern, Germany	370 (129)
Manner-Suomi, Finland	185 (23)
Länsi-Suomi, Finland	166
East Anglia, United Kingdom	196 (70)
Sydsverige, Sweden	180 (11)

Source: Based on Eurostat data.

Figure 1.6. **Employment in high-technology firms and GDP in US states (2002, 2003)**



Source: National Science Foundation database.

majority of other US metro regions (Hunt, 2007). One interesting indicator is the level of venture capital disbursed (per USD 1 000 of gross state product). The average for all states is around USD 1 of venture capital for every USD 1 000 of state product. When Massachusetts (USD 8.70) and California (USD 5.73) are excluded from that figure, the average drops considerably to only around USD 0.65 of venture capital. The large ratio between the amounts of venture capital available in states like California and Massachusetts as compared to the majority of other states reflects the technology intensity of the two states economies. National Science Foundation data shows a strong correlation between the level of venture capital in the economy and the technology intensity of the regional economy (measured as the proportion of total employment in high-technology firms). The relationship between state-level GDP and employment in high-technology firms is also positive.

Employment in high-value services is also strongly concentrated. The share of high-technology services in total employment for most EU regions rarely surpasses 4% (the average for all regions is around 3%). These activities appear to be concentrated mainly in parts of Belgium (Brussels and Western Flanders), the Netherlands (4-6%), Sweden (more than 8% in Stockholm), and the United Kingdom (notably parts of the South-East and Eastern regions with rates of between 5-10%). Combining these activities, total high technology employment (high- and medium-technology manufacturing plus knowledge intensive services) can represent a significant share of employment in some regions – over 20% in a few German *Länder*, over 15% in Piedmont and Lombardy in Italy, over 10% in Catalonia and the Basque Country in Spain and similar shares in the South and Midlands regions of the United Kingdom.

The level of technological specialisation influences the place of the region in production systems and the type of products that it produces. Car production plants for top of the range models tend to be located close to research and design centres in traditional production centres (Germany, Italy, France and the United States, plus the United Kingdom for sports and luxury models) while small cars are produced in more diverse locations (sites in Portugal, Slovak Republic, Turkey, Mexico and in Asian non-OECD countries).

Table 1.7. **Theoretical benefits of clusters**

Concept	Benefit
Marshallian externalities	
Labour market pooling	Labour cost savings due to access to specialised skills, especially in an environment where quick turnaround is important
Greater variety of specialised intermediate goods and services	Access to a local supplier base that has more product variety and a high degree of specialisation
(Tacit) knowledge spillovers	Access to tacit knowledge in geographic proximity by means of both formal processes as well as through such informal channels as knowledge leakages made possible by casual inter-firm interactions
Porter's market conditions	
Demanding customers	Motivational effects due to demands of highly competitive local customers that improve quality, cost, etc.
Rivalry	Motivational effects related to social/peer pressure
Complementarities	Better sales opportunities of firms due to search cost savings for the buyers of complementary products offered in proximity and privileged opportunities for co-operation (sales, marketing, etc.) between nearby suppliers of complementary products
Cost advantages	
Transportation	Transportation cost savings due to geographic proximity, especially in the case of just in time delivery contracts
Trust	Transaction cost savings due to an environment that encourages trust

Source: Adapted from Lublinski, A. (2003), "Does Geographic Proximity Matter? Evidence from Clustered and Non-clustered Aeronautic Firms in Germany", *Regional Studies*, Vol. 37, pp. 453-467.

Table 1.8. **Characteristics of science-based and traditional clusters**

	Science-based	Traditional
Age	Young industries, new concentrations	Mature industries, established concentrations
Type of relationships/transaction	Market-based, temporary coalitions for R&D joint ventures	Long-term relationships, market based local supply chains
Innovation activity	Technological innovation	Incremental innovation, technology absorption

Source: Adapted from EC, Enterprise Directorate-General (2002), *Regional Clusters in Europe: Observatory of European SMEs*, N. 3/2002, European Commission, Brussels.

Moreover, parts and components for cars also tend to be sourced from regions according to their level of technological specialisation – the highest value components for US car productions come from Canada, then Mexico, and the lowest value parts come from Asia.

Regional clusters and knowledge spillovers

Region-level specialisation, which is clear in a large number of industries, raises the related issue of clustering. The term regional cluster refers to geographically bounded concentrations of *interdependent* firms (Rosenfeld, 1997; OECD, 2001), and tends to cover concepts like industrial districts, specialised industrial agglomerations and local production systems (OECD, 2007a). The cluster concept is seen as one explanation for the persistence of specialisation at the regional level despite the increased range of options for firms to relocate production away from higher cost locations. In other words, firms concentrate together, thereby increasing the level of specialisation of a region, because they benefit from clustering effects generated by this geographical proximity to one another. The benefits of clustering are usually presented as including the following elements.

One useful distinction is between the more science-based clusters and the more traditional industry clusters. This is clearly visible in different sectors. The different

histories of the clusters and the recent evolutions of production methods in different sectors lead to the generation of quite different types of external economies for firms located in the region. For example, transactions in traditional clusters are based primarily on long-term relationships between customer and supplier and they emphasise incremental innovation (process or product innovation) while for newer science-based clusters these relationships may have a much shorter time horizon and be more focused on new technology development

In order to understand the different ways that regional economies are clustered, typologies have been developed that generally distinguish between two main categories: 1) "Marshallian" clusters comprised primarily of locally owned SMEs (in both lower and high technology activities), and 2) "hub and spoke" clusters or "industrial-complexes" dominated by one or several large firms surrounded by dense supplier networks. These typologies also include instances of concentration without real cluster behaviour among firms in regions where, for example, the hub is a branch plant that has little interaction with local firms or where firms are grouped around a public facility such as a military base (OECD, 2007a).

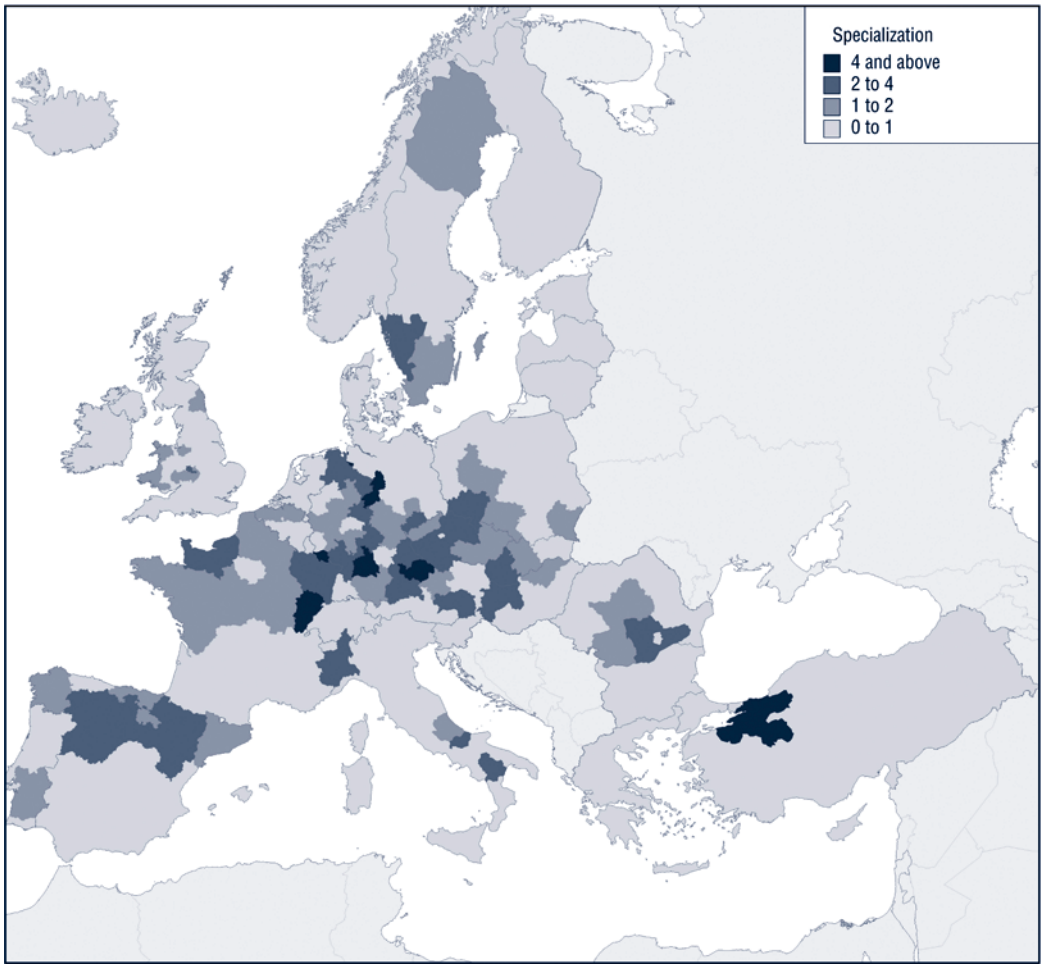
The different sectors studied here exhibit characteristics of both the two main cluster categories (ICT and biotechnology more Marshallian and automotive and pharmaceuticals more the hub and spoke variety).

The automobile industry is one industry that is clustered in a limited number of regions, mainly in established industrial sites with strong "traditional" cluster characteristics. For example, the success of the European automotive industry (car, bus and truck assembly, engines and other components) is built on a network of about 25 regional clusters that account for more than half of all European employment in the industry (see Figure 1.7). There are few automotive clusters of lesser intensity, indicating that regions either have a strong position in automotive or are hardly present at all.

The three automotive regions studied are characterised by classic hub-and-spoke vertically integrated industry structures, with one or a few large firms linking a broad, local supplier chain. For example, in the Västra Götaland region, the auto cluster has several leading vehicle manufacturers that are nodes in the global network. The major vehicle manufactures (AB Volvo, Volvo Car Corporation and Saab Automobile) and their suppliers (such as SKF, Autoliv, Haldex and Opcon) constitute the motor of the industry. Automotive R&D, conducted by these companies through universities and research institutes, plays a significant role in the development of Sweden's automotive sector. Beyond these major firms, the industry is structured around approximately 200 SMEs that act as suppliers of components and services. The pattern in Turin is similar, with most of Fiat's major suppliers being located in the province of Turin (around 75% of modules and systems suppliers) and employing around 70 000 people in addition to those employed by Fiat. The system of clustering in Detroit/south-east Michigan is similar but on a massive scale.

The nature of these traditional clusters is changing. Given the economic centrality of the sector and the widespread automotive culture, the automotive sector is still regarded as a key sector in each of the three regions. As such, the notion of the auto cluster is still strong, not only with respect to employment or economic importance but in terms of developing, testing and applying new technologies. The new focus varies across the regions, but the emphasis is increasingly on the global positioning of the regions as centres of excellence in design and

Figure 1.7. **Specialisation in the automotive industry in the EU area**



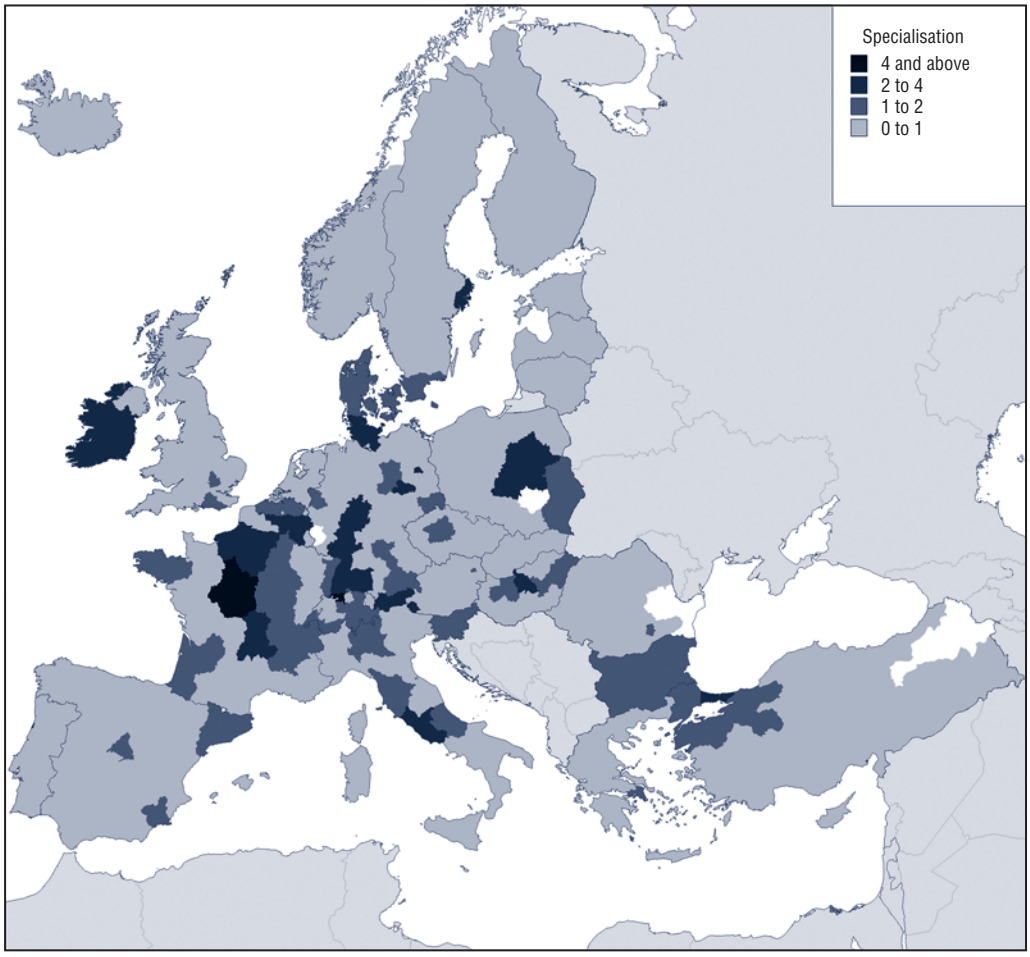
Source: European Cluster Observatory, ISC/CSC cluster codes 1.0, dataset 20070512.

innovation in global automotive markets (or more broadly technology markets), not exclusively or primarily linked to Fiat, Ford or any of the other traditional regional champions.

The pharmaceuticals industry is also strongly concentrated in particular regions, with clusters usually growing out of regional specialisation in the chemicals industry (see Figure 1.8). Other factors such as the momentum provided by national health care systems or public R&D investment strategies have also played a role. Stockholm, for example, has a long tradition of life science research with effective collaboration between researchers at the universities, industry, the government and the health care sector. The Swedish pharmaceutical and medical device industry emerged as a result of this and generated a number of globally competitive innovations such as the pacemaker, gastric ulcer drugs, diagnostic allergy tests and equipment for protein separation. Two major pharmaceuticals companies, Astra and Pharmacia, started in the region and have driven the emergence of a concentration of pharmaceuticals and biotechnology companies.

By contrast, the ICT industry is less concentrated and clusters are less traditional in structure. ICT clusters tend to see more rapid evolutions in relationships among firms and

Figure 1.8. **Specialisation in pharmaceuticals in the EU area**

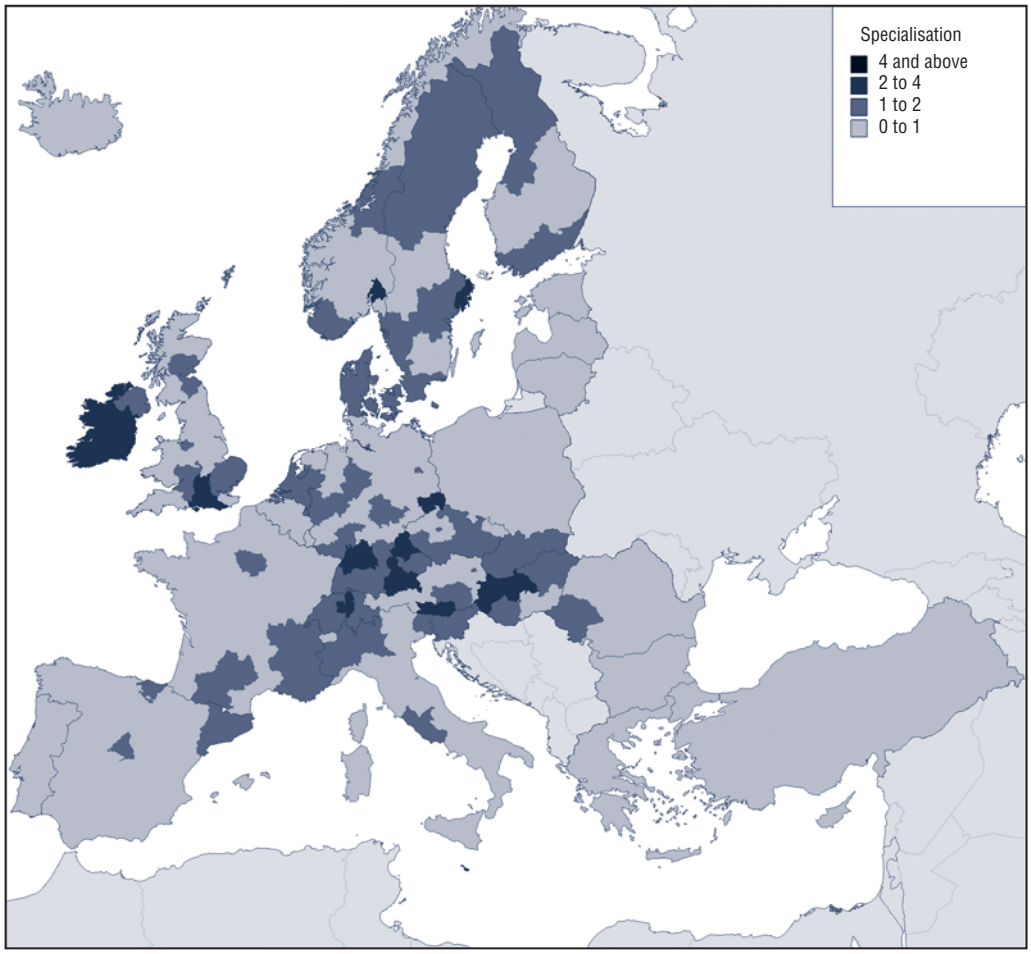


Source: European Cluster Observatory, ISC/CSC cluster codes 1.0, dataset 20070512.

supplier chains are internationalised (see Figure 1.9). ICT is generally a far more diffuse industry classification with a large number of branches and sub-branches encompassing a wide range of both manufacturing and service occupations. The industry is not always as diffuse, however. At the sub-sector level, there is significant regional concentration. Looking at Mexico, the ICT equipment industry is almost exclusively in small pockets in the border regions (see Figure 1.10).

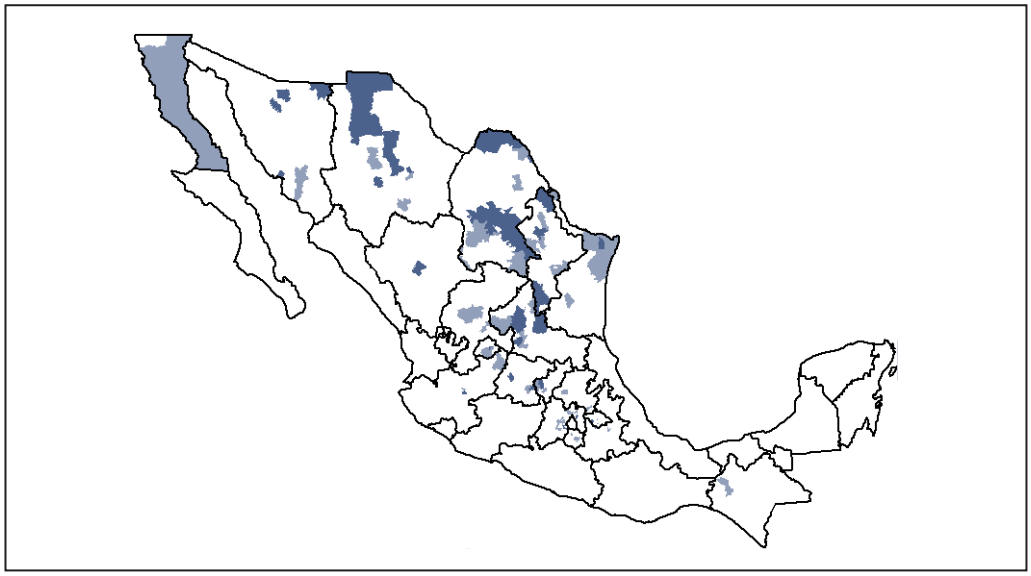
Among regions involved in ICT industries, there is evidence of clustering among firms but the firm structures and relationships seem to evolve more rapidly, with less clear hierarchies among firms. Stockholm's ICT sector, although spread across the region, has a concentration of key large and small firms in the Kista area, where Ericsson moved its headquarters, followed by Adobe, ABB, HP, Intel, Nokia, Oracle and Sun. These firms are all looking to tap into typical cluster advantages such as a qualified labour market, access to specialised services, etc. However, the ICT clusters studied tend to be more dynamic than those in auto or biopharmaceuticals and the focus of the leading firms is more prone to rapid evolution. In general, ICT industries cover a broad range of sub-sectors some of which expand rapidly, while others stagnate as new technologies or standards replace old

Figure 1.9. **Specialisation in ICT industries in the EU area**



Source: European Cluster Observatory, ISC/CSC cluster codes 1.0, dataset 20070512.

Figure 1.10. **Concentration of ICT equipment in Mexico**



Note: Shaded areas indicate a location quotient greater than four.

technologies. This is the case with Ottawa, for example, with several sub-specialisations appearing over the past few years – mobile communications (large, expanding), software applications (transforming, new technology driven) and photonics (small, high growth). Both Eindhoven and Ottawa are good examples of formerly vertically integrated systems that have gradually become more horizontal and entrepreneurial.

One motivation for interest in clusters is the accumulation of evidence from different countries that both productivity and wage levels can be higher in clustered activities than in non-clustered activities (see Box 1.1). Furthermore, that clusters in "traded" (as opposed to local or resource dependent) industries have a strong influence on the overall prosperity of the region and on its average wage level. Porter found that clusters increase the contribution of traded sectors to regional output and wages (Porter, 2003). Similar research by METI in Japan and the Bank of Italy has suggested a correlation between clustering and higher productivity.

Another more recent motivation is the link made between clusters and innovation. Research into the sources of productivity advantage in clusters focuses principally on the positive impact of the circulation of people and knowledge around a local economic system. These knowledge flows in turn support the generation of innovative ideas and the development of new products and technologies. Within dynamic high-technology clusters, levels of personal exchanges between firms appear to be higher than in non-clustered locations. This type of "cross-pollination" of ideas and innovation is put forward as one of the main drivers of the success of the Silicon Valley model (Saxenian, 1994).

Although cluster mapping tends to suggest that there is a less clear link between clustering and innovation performance in European regions overall, empirical research seems to verify the thesis for some regions. For example, the successful Stockholm ICT cluster exhibits higher rates of inter-firm labour mobility that the rest of the labour market and higher rates of intra-firm mobility than other comparable private-sector enterprises (Power and Lundmark, 2004). Work by Cooke (2004) on the biosciences industry in Sweden also reveals a close association between proximity and knowledge transfer. The value of both the biopharmaceuticals and ICT sectors to the regional economy can be seen both in terms of employment and wage level (See Table 1.9).

Nevertheless, there are risks related to the use of a cluster approach generally, as well as with more specific risks relating to the design of these programmes. Insufficient economic

Box 1.1. **Innovation performance in the EU and US: evidence from cluster mapping**

The idea that clusters are a key driver of innovation is currently being tested at the international level via a Europe-wide cluster mapping exercise. The first results from this review suggest significant differences between Europe and the US in terms of the level of concentration and specialisation at the regional level. The average US region tends to be more specialised and to have stronger concentrations in terms of employment by a factor of one-quarter – 28% of employment in the average US region is in a strong cluster, while in Europe only 21% of the region's employment is clustered. The initiative aims to assess to what extent the relative strength of US regions compared to EU regions can be said to influence the level of innovation and the extent to which poorer outcomes in terms of R&D performance in Europe can be attributed to the structure of firms and their relationships at the regional level rather than to the level of investment inputs or other factors.

Source: European Cluster Observatory, *www.clusterobservatory.eu*.

Table 1.9. **Regional specialisation in the Stockholm-Mälar Region, 2003**

Industry	Employment	Wage/per worker (SEK 1 000)	Employees with higher education (%)
ICT	77 627	406	35.6
Biotech/pharmaceuticals	26 424	363	35.7
Rest of privately owned companies and public sector	989 872	247	21.3

Source: The County Administrative Boards in the Stockholm-Mälar Region.

diversification, lock-in (in the sense of being tied by long-term investment strategies to supporting specific sectors and being unable subsequently to change track) or over-reliance on key firms are among the dangers that are associated with the cluster approach. Other concerns relate to how effective the public sector can be in identifying instruments that can help firms to react to very rapid changes in global markets and production systems.

Regional specialisation and clustering in non-OECD countries

While developing countries integrate into global production networks, there is also evidence that regions are specialising and that new clusters are developing. The emerging patterns of spatial location of the automotive industry provide some illustrations of clustering in non-OECD countries. The key to competitive production in the auto industry is minimising the carrying cost associated with large inventories, by means of tighter production planning, precisely scheduled delivery of components and drastic reduction of component failures, which otherwise could slow down production runs. As such, many of the benefits of clustering are also being sought by producers in non-OECD countries. An important point to note is that clustering in certain non-OECD countries comes about due to inadequate infrastructure, as is shown by the example of Maruti in India (Box 1.2). It may also be due to public policies promoting special zones to attract FDI or co-locate firms, such as with the automotive industry in Shanghai. OECD MNEs are increasingly able to find

Box 1.2. **Clustering driven by Maruti in India**

Lack of road infrastructure and vast distances between production centres and markets have forced supplier firms to cluster around assembler firms. The resulting ecosystem of supplier firms has shown remarkable efficiency in delivery schedules and quality control, thereby improving the overall quality of the end product. As a result, both foreign and domestic manufacturers have pushed for the progressive localisation of component suppliers.

For example, in the mid-1990s the main challenge for India's leading car manufacturer, Maruti, was inventory costs. From 1992-1997, inventory carrying costs were up to 4% of sales revenue (in comparison labour costs amounted to only 2%-3%). The average in-transit inventory costs were particularly high. For the Maruti management the remedy lay in localising the supplier base to the maximum extent possible. By 1997, Maruti had managed to cluster 70% of its components and materials within a radius of 80 km, and inventory costs had converged with labour costs. In 2001, about half of its top 100 domestic suppliers, accounting for roughly 50% of the purchase value, were located near the assembler.

Source: Gulyani, Sumila (2001), "Effects of Poor Transportation on Lean Production and Industrial Clustering: Evidence from the Indian Auto Industry", *World Development*, Vol. 29 No. 7, pp. 1157-1177.

reliable production partners in non-OECD countries that make investment a less risky operation. Renault's investment in Nashik in partnership with Mahindra and Mahindra is a good example of this. Renault is able to develop a low cost, high operating margin production process by joining forces with an established local manufacturer with strong supplier networks and a skilled workforce (Sen, 2007). Here the MNE is reinforcing regional specialisation. Mercedes-Benz and Skoda, as well as domestic manufacturers, are also located in the region.

The biopharmaceuticals industry is also strongly concentrated in particular regions in non-OECD countries. The main criteria seem to be a critical mass of scientists and research infrastructure, the existence of venture capital and, in some cases, the presence of a domestic industrial base in a related industry (*e.g.*, chemicals). Venture capital appears to be particularly important. In India, for example, more than 75% of venture capital has been placed in only five states (Maharashtra, Tamil Nadu, Andhra Pradesh, Gujarat and Karnataka), leading to strong growth of capital intensive industries in those regions (Bowonder and Mani, 2002). From the perspective of this report, the development of the biotech industry in Bangalore and Hyderabad is interesting because it has been supported by the existence of ICT skills and specialised firms. These assets have helped the biotech industry develop a specialisation in bioinformatics in those regions, while in the other biotech clusters in India are based around chemicals or drug manufacturing centres.

While Shanghai, one of the case study regions, is a diverse manufacturing centre and an international financial hub, its economy is based around "pillar industries" that account for the majority of its gross regional product (GRP). These pillar industries include microelectronics, automotive, chemicals, high quality steel and shipbuilding. However, its economic base is broadening to include identifiable clusters in ICT, biotechnology, pharmaceuticals, and financial services. These industries tend to be strongly concentrated, partly as a result of the government's policy of developing special zones and parks.

The life science sector in Shanghai is an important and growing sector, even if still comparatively small. The industry is dominated by foreign companies that have offshored segments of their R&D and production to China. For example, the region has over 140 foreign-controlled R&D laboratories. The predominant part of the sector is located in the Zhin Yang science park in Pudong. The park was established some 15 years ago to focus on high technology, particularly in two areas: ICT and pharmaceuticals. There are over 55 000 total employees in the park. Over the last six to seven years, a number of institutions and research institutes as well as foreign big pharmaceuticals companies have located to the area (for example, Roche, Novartis, GE Healthcare, Boehringer Ingelheim, GlaxoSmithKline, plus related companies such as Du Pont and Estée Lauder). Furthermore, the government is promoting links between public agencies, research institutions, foreign companies and the 200 domestic start-ups in the park.

Recife in Brazil illustrates another dimension of growth in non-OECD countries, a model that is local asset-driven with only a limited FDI catalyst. Recife is the largest city in Brazil's relatively poor north-east region and the third largest city in the country. The history of the ICT sector in Recife dates back to the beginning of the 1980s, with close collaboration on the development of ICT-based financial services between the university, local software companies and the north-east region's major bank, *Banco do Nordeste*. The positive outcome of the collaboration encouraged the team of professors at the university to promote ICT education in the region. In 2000, the state government launched the cluster initiative Porto Digital to further

develop the ICT sector and facilities were built up in the old harbour and dockland area, housing about 250 start-up firms across a broad business range including computer games, financial services, healthcare systems, logistic in mining and railway, road traffic informatics and software development in general. The reputation of the ICT industry in Recife is now strong and around half of the sector's output in Recife is sold outside the region, mainly to the southern part of the country and in collaboration with MNEs such as IBM, Motorola and Nokia.

Notes

1. For all regional statistics cited in this section from the OECD Regional Database, regions are taken at the Territorial Level 2.
2. The source of this data is the Japan External Trade Organization (JETRO) using ISIC classification 8538 Television receivers including monitors and video projectors.
3. These basic models have been further elaborated by academic fields such as business economics and economic geography. For example, theories on firm performance emphasise the innovative process, notably the quality of factor inputs such as education, the positive rivalry between firms that drives innovation, and the structures/institutions that support innovation (Porter, 1990). Economic geographers, particularly those favouring the flexible specialisation model, have emphasised the importance of non-tradable inputs to production, notably the intangible transaction cost savings that come from networking and co-operative linkages that are embedded locally (Krugman and Venables, 1990). Other schools include regional science (impact of industrial organisation on culture), urbanism (cities have diversity to drive innovation) and economic development (supporting local small firms) among others (Cortright, 2006).

ANNEX 1.A1

Table 1.A1. **Comparison of rates of manufacturing employment in regions, by country (2003/4)**

Country	Region with the highest rate of manufacturing employment	Type	Rate	Region with the lowest rate of manufacturing employment	Type	Rate	Average all regions
Australia (2004)	Victoria	PU	14.0	Northern Territory and Australian Capital Territory	PR PU	2.9	9.5
Austria	Vorarlberg	IN	25.8	Vienna	PU	10.5	17.2
Belgium	Vlaams gewest	PU	17.3	Region Bruxelles-capital	PU	11.5	13.6
Canada	Ontario	IN	17.6	Saskatchewan	PR	5.7	11.0
Czech Republic	Stredni morava	IN	36.2	Prague	PU	12.1	27.8
Denmark (2004)	Vest for storebaelt	PR	19.3	Hovedstadsregionen	PU	9.4	14.4
Finland	Lansi-suomi	PR	23.7	Aland	PR	9.4	16.9
France	Franche-Comté	PR	22.1	Corse	PR	8.2	16.1
Germany	Baden-Wuerttemberg	PU	30.5	Berlin	PU	9.9	19.0
Greece	Attiki	PU	15.6	Nisia aigaiou, Kriti	PR	6.6	11.8
Hungary	Nyugat-dunantul/western Transdanubia	IN	33.1	Kosep-magyarorszag	PU	18.9	24.7
Iceland (2004)	Other regions	PR	19.3	Capital region	IN	12.2	15.7
Ireland	Border, Midlands and Western	PR	15.8	Southern and Eastern	IN	15.5	15.7
Italy	Veneto	PU	33.0	Calabria	IN	9.1	21.0
Japan (2004)	Toukai	PU	28.0	Okinawa	PU	4.6	14.8
Korea (2004)	Gyeongnam region	IN	19.4	Jeju	IN	2.9	12.3
Luxembourg	Luxembourg	IN	17.6				17.6
Mexico (2004)	Chihuahua	PR	27.7	Quintana roo	IN	2.1	9.8
Netherlands	Zuid-Nederland	PU	15.6	West-Nederland	PU	8.2	11.9
New Zealand							
Norway (2004)	Sør-østlandet	PR	14.8	Oslo og akershus	PU	6.8	11.6
Poland	Wielkopolskie	PR	22.6	Lubelskie	PR	10.6	17.9
Portugal	Norte	IN	27.9	Algarve	IN	5.1	14.0
Slovak Republic	Zapadne slovensko	IN	26.7	Bratislav kraj	PU	19.7	23.3
Spain	Navarra	IN	30.7	Ciudad autónoma de Melilla	PU	2.2	16.2
Sweden	Smaaland med oearna	PR	24.6	Stockholm	PU	10.7	16.7
Switzerland (2000)	Ostschweiz	IN	19.7	Ticino	IN	7.9	14.1
Turkey			. .			..	..
United Kingdom (2001)	West Midlands	PU	20.0	London	PU	8.6	15.1
United States (2004)	Indiana	PR	19.4	District of Columbia	PU	1.0	10.3

Note: Region type: PU = Predominantly Urban; PR = Predominantly Rural; IN = Intermediate.

Table of Contents

• • •

List of boxes

List of tables

List of figures