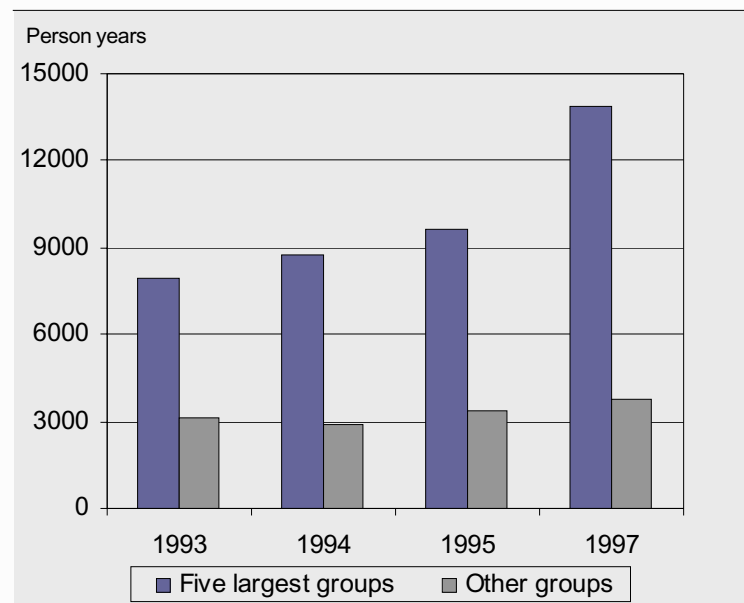


# International business

## Research and Development in international enterprises 1997

Figure 2  
R&D person-years in the large manufacturing groups abroad 1993-1997



# Research and Development in international enterprises 1997

## Contents

Table of contents	2
List of tables	3
Summary	4
R&D of large manufacturing groups in Sweden and Abroad	5
R&D of foreign-owned enterprises in Sweden 1997	8
Tables	14
Facts on Survey	25
List of activities	28



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# List of tables

<b>Table 1</b>	R&D person-years and R&D expenditure (MSEK) in the large manufacturing groups.	7
<b>Table 2</b>	R&D person-years (FTE) in the large manufacturing groups in relation to all their employees by country, 1997 and 1995.	7
<b>Table 3</b>	R&D in international enterprises 1993 -1997.	8
<b>Table 4</b>	Foreign-owned and Swedish-owned enterprises. Number of person-years in 1997.	9
<b>Table 5</b>	Foreign-owned enterprises. Currents costs and capital investments for R&D work. Distribution by sector.	11
<b>Table 6</b>	Person-years and expenditure for R&D-work 1997. Distribution by size of enterprise (number of employees) and type of owner.	12
<b>Table 7</b>	Sources of finance for intramural R&D in Sweden by type of enterprise 1997, MSEK.	12
<b>Table 8</b>	Purchased extramural R&D by enterprises in Sweden 1997, MSEK.	13
<b>Table 9</b>	Expenditures and person-years for R&D in foreign-owned enterprises by county 1997.	13
<b>Table 10</b>	R&D expenditures and person-years (FTE) in the largest manufacturing groups 1997, 1995.	15
<b>Table 11</b>	R&D person-years (FTE) in the largest manufacturing groups performed by university graduates 1997.	15
<b>Table 12</b>	R&D person-years (FTE) in the largest manufacturing groups performed by university graduates 1995.	16
<b>Table 13</b>	R&D person-years (FTE) in the largest manufacturing groups <sup>1)</sup> in relation to all their person-years and to the person-years in all Swedish-owned international enterprise groups 1997.	16
<b>Table 14</b>	R&D person-years (FTE) in the largest manufacturing groups in relation to all their person-years 1995.	17
<b>Table 15</b>	Number of person-years in the largest manufacturing groups and other enterprises in Sweden 1997.	18
<b>Table 16</b>	R&D expenditures in the largest manufacturing groups and other enterprises in Sweden 1997, MSEK.	19
<b>Table 17</b>	R&D expenditures ( MSEK ) per person-years (FTE) in the largest manufacturing groups and other enterprises in Sweden 1997.	20
<b>Table 18</b>	Number of person-years in foreign-owned and Swedish-owned enterprises in Sweden 1997.	21
<b>Table 19</b>	R&D expenditures in foreign-owned and Swedish-owned enterprises in Sweden 1997, MSEK.	22
<b>Table 20</b>	R&D expenditures per person-years (FTE) in foreign-owned and Swedish owned enterprises 1997, MSEK.	23
<b>Table 21</b>	R&D expenditures (MSEK) and person-years in the business sector 1997. Distribution by type of enterprise.	24

# Summary

## Large Swedish Manufacturing Groups

Swedish companies are very internationally oriented and many have major operations abroad. There are a few international enterprise groups in Sweden that are particularly active in the field of research and development in both Sweden and abroad. The 20 large manufacturing groups being surveyed had more employees working with R&D in their total business, i.e. in Sweden and abroad altogether, compared with the number of employees working with R&D in the total business sector in Sweden.

The large, manufacturing groups, i. e. the 20 major, Swedish-owned manufacturing enterprises, had approximately 575 000 employees in 1997, of which 390 000 (68 per cent) of these were employed abroad.

In 1997 investment of the largest groups in research and development (R&D) amounted to SEK 46, billion, of which SEK 30 billion related to investments in Sweden. Foreign investments represented 36 per cent of the total, and 64 per cent was related to Swedish investments. The foreign proportion is larger when measured in terms of R&D person-years (full time equivalent or FTE), rather than R&D expenses. When measured in person-years, the foreign ratio is approximately 39 per cent.

In 1997, the 20-Group reported approximately 45 000 R&D person-years, of which 17 600 were carried out abroad. Regarding the person-years carried out abroad, 57 per cent took place in EU countries (including Denmark and Finland) and 29 per cent took place in NAFTA countries (USA, Canada and Mexico). The proportion carried out in the Nordic region increased to 10 per cent (including Denmark and Finland). The countries where most R&D investments took place are: USA, UK and Germany. Substantial R&D investments also took place in Netherlands, Italy and Canada.

Nearly one-half of the R&D person-years in Sweden in 1997 had been carried out by personnel with higher education (i. e. at least three years training after secondary school, ISCED 6+7). The corresponding figure for R&D abroad was 73 per cent. About 50 per cent of all person-years carried out by such personnel had been abroad. Among personnel with a university degree, 9 per cent had a postgraduate education (ISCED 7). This figure was somewhat higher for Sweden (11 per cent).

Among educated personnel in Sweden without postgraduate education, 77 per cent had an academic background in engineering. The corresponding proportion for technical personnel abroad was nearly 90 per cent.

R&D person-years as a share of the total person-years in the 20 largest manufacturing groups amounted to 15 per cent in Sweden and 5 per cent abroad.

## Foreign owned enterprises in Sweden

There were 3 687 foreign enterprises in Sweden with 301 000 employees at the end of 1997. The foreign-owned enterprises in Sweden accounted for about 14 per cent of the total employees in the business sector 1997 and for 15 per cent 1998.

R&D expenditures in Sweden by foreign-owned enterprises amounted to SEK 9,4 billion in 1997. Knowledge-based, foreign-owned enterprises in the manufacturing industry is the sector with the largest R&D expenditures and number of person-years, nearly SEK 6,7 billion and 5 710 person-years respectively.

Nearly 8 500 R&D person-years (FTE) were performed in these enterprises, of which 13 per cent involved research (basic or applied). The remaining 87 per cent was devoted to activities concerning development. The share of person-years in R&D (FTE) performed by university graduates in the foreign-owned enterprises in 1997 was 51 per cent. Men dominate in R&D work. Women accounted for only 27 per cent of all person-years in the foreign-owned enterprises. But the share of person-years performed by women in the foreign enterprises has been higher than the share of person-years performed by women in the Swedish-owned enterprises (23 per cent).

The survey of R&D in the twenty largest Swedish manufacturing groups has from 1995 being carried out every two years. Large is defined in terms of the number of employees abroad. The aim of the survey is to ascertain the extent and scale of research and development activities as carried out by the largest Swedish groups in Sweden and abroad. This publication, also includes R&D activities in majority foreign-owned enterprises in Sweden. Similar data from Sweden and other OECD-countries was published by OECD 1998, Internationalisation of Industrial R&D, Patterns and Trends.

# R&D of Large, Manufacturing Groups in Sweden and Abroad

## General

In 1997, large manufacturing groups comprising of around 20 Swedish-owned manufacturing enterprises had approximately 575 000 employees of which 390 000 (68 per cent) were employed abroad. The sum of research and development (R&D) measured as person-years carried out in 1997 in both Sweden and abroad in the 20 largest manufacturing groups adds up to more than the total amount of R&D in the whole business sector in Sweden. The R&D of the largest manufacturing groups accounted for 80 per cent of all R&D in the manufacturing industry as a whole. These large manufacturing groups are primarily active within the manufacture of fabricated products, machinery and equipment. In 1997, 12 of the 20 largest enterprise groups were in machinery etc. (Nace Rev.1 28-35) As a percentage of total employment in the 20 largest enterprise groups, these 12 employed around 78 per cent of all employees abroad and 75 per cent of employees in Sweden. Among the other enterprise groups there are four pulp and paper and, three chemical groups. The 20 largest manufacturing groups dominate Swedish business activities carried out abroad.

## R&D of Swedish-owned enterprises abroad 1997

Spending by the large manufacturing groups on R&D in 1997 was SEK 47 billion of which SEK 30 billion was in Sweden. The share of total spending on R&D outside Sweden has increased from 22 per cent in 1995 to 36 per cent in 1997. This radical change may be due to a simple change in invoicing routines. If the company charge the parent company in Sweden for R&D carried out abroad, the sum is accounted for as domestic R&D expenditure.

Therefore, for more adequate comparisons of R&D in different countries it is better studying R&D person years.

The large manufacturing groups are not a homogeneous group when it comes to R&D. The extent of R&D carried out abroad differs considerably between the various enterprise groups and industries. There can also be large differences between the business activities of the same enterprise. The share of R&D abroad was smallest in the pulp and paper enterprise groups, i.e. 22 per cent. Even the R&D intensive enterprises in the chemical and pharmaceutical enterprise groups had a lower share of R&D abroad than the 32 per cent average for the whole group. The machinery enterprise groups with a share of 37 per cent of R&D abroad were slightly above the average. The largest amount of R&D carried out abroad was in those machinery enterprise groups that had very little R&D in Sweden – these carried out 75 per cent of R&D outside Sweden's borders.

## Development of person-years in the large manufacturing groups

In 1997, the 20 largest manufacturing groups carried out 45 000 person-years of R&D in total, of which 27 500 in Sweden and around 17 600 abroad. The latter figure is the highest recorded and an increase of 36 per cent compared with the previous survey (1995).

There are large differences in R&D between the various enterprise groups. R&D is strongly concentrated

Figure 1.  
R&D person-years in the large manufacturing groups in Sweden 1993-1997

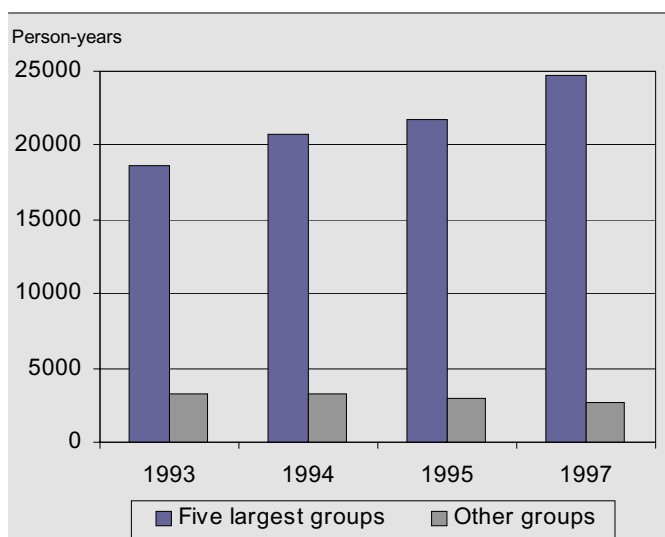
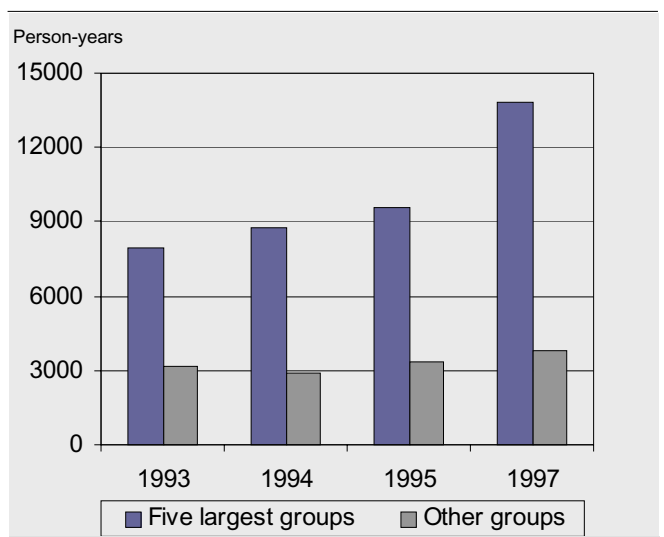


Figure 2.  
R&D person-years in the large manufacturing groups abroad 1993-1997



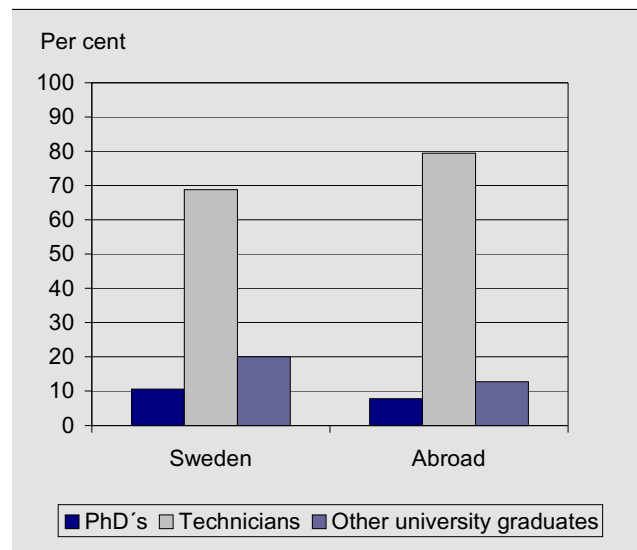
to a few large enterprise groups: of the 20 large manufacturing groups, 5 accounted for 90 per cent of R&D person-years in Sweden in 1997. These 5 also accounted for 79 per cent of all R&D carried out abroad. The increase in the number of R&D person-years carried out abroad also meant that the share of R&D carried out abroad increased. Having been stable at around 34 per cent the share of R&D measured as person-years carried out abroad increased to almost 40 per cent in 1997, which is the highest figure since the surveys started in 1993.

The machinery enterprise groups carried out a very significant share of R&D activities abroad, almost 83 per cent. The chemical enterprise groups accounted for approximately 15 per cent of R&D abroad. In comparison with other countries, the concentration of R&D in Sweden to the machinery etc. is somewhat lower. Of the 27 500 R&D person-years in Sweden in 1997, 22 400 or 81 per cent were carried out by machinery enterprise groups, 14 per cent by the chemical and pharmaceutical enterprise groups and the remaining 5 per cent in other enterprise groups. The share of person-years in R&D in Sweden has reduced by a little under 5-percentage points since 1995. If one studies the shares of R&D at the industry level more closely one sees that the changes for the chemical and machinery enterprise groups is not so great. Traditionally, the pulp and paper enterprise groups are not so R&D intensive.

#### Academic professionals dominate Swedish enterprises

In 1997, academic professionals (with at least 3 years training after secondary school, ISCED 6+7) carried out a little over half of all R&D person-years in Sweden. In R&D abroad the share was higher, slightly over 73 per cent. Of the academic professionals in Sweden, over 11 per cent had carried out post-graduate studies, while the same share for academics involved in R&D abroad was 8 per cent. Academics in Sweden with technical training accounted for 69 per cent of the total involved in R&D,

Figure 7  
The R&D educational structure in the large manufacturing groups 1997



while the share abroad was higher at 79 per cent. Included in the concept of technical training are those who have received education and training in engineering, including architecture. However, it should be noted that it is difficult to make comparisons between Swedish and non-Swedish qualifications, so these data should be treated with a certain amount of caution.

#### R&D still greatest in the USA

Employees in Swedish-owned enterprises in the USA accounted for 3 900 person-years of R&D in 1997, an increase of 900 person-years compared with 1995. The country in which the number of person-years increased the most was the UK, up 950 person-years between 1995 and 1997. In Germany the number of R&D person-years increased by 440. Other countries with a substantial number of R&D person-years were the Netherlands, Italy and Canada.

Figure 3, 4

R&D person-years abroad in the large manufacturing groups 1997 and 1995. Distribution by industry.

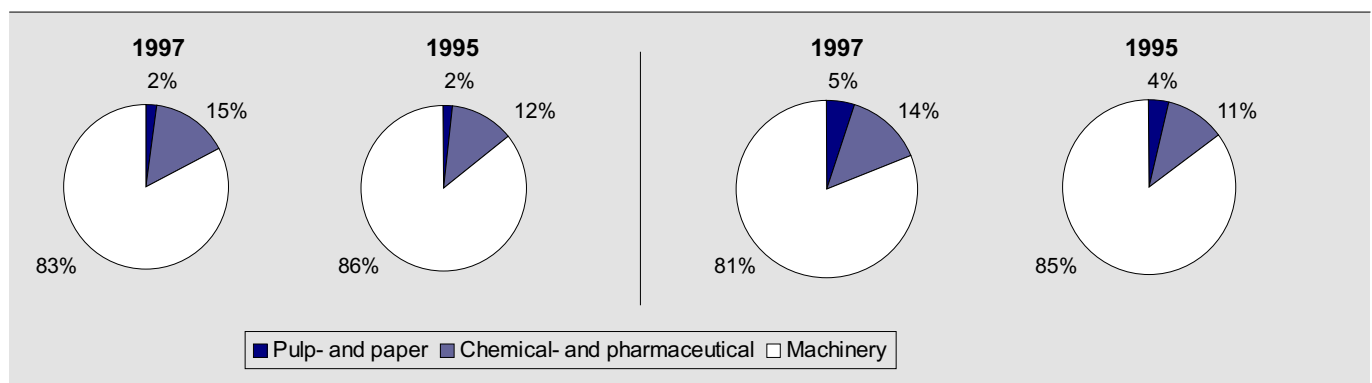


Figure 5,6

R&D person-years in Sweden in the large manufacturing groups 1997 and 1995. Distribution by industry.

Table 1  
**R&D person-years and R&D expenditure (MSEK) in the large manufacturing groups 1997**

Location	R&D expenditures	R&D person-years	Total person-years
Total	46 332	45 135	574 868
Sweden	29 767	27 517	185 164
Abroad	16 565	17 618	389 704
EU 15	8 760	10 013	193 308
NAFTA	6 088	5 170	86 638
Nordic countries*	1 481	1 740	23 321

\* Note Denmark and Finland are included in EU15

### Share of European Union unchanged between 1993 and 1997

The 20 largest manufacturing groups in Sweden have most of their R&D in Sweden. Outside Sweden the largest amount of R&D is carried out in the USA. In 1997, of R&D person-years abroad 57 per cent or 10 000 person-years are carried out in the European Union (excluding Sweden). Only 5 per cent of R&D person-years abroad are carried out in other European countries. The NAFTA countries (USA, Canada, Mexico) account for 29 per cent of all R&D person-years abroad. The shares in Latin America and Asia were 4 per cent and 2 per cent, respectively. The same data for 1993 was 54 per cent for the European Union, 28 per cent for NAFTA and 4 per cent and 2 per cent for Latin America and Asia. In order to make the comparisons relevant the same grouping of countries for the European Union and NAFTA have been used for both 1993 and 1997. In person-years, the share of R&D carried out abroad was 10 per cent in Scandinavia in 1997, which was unchanged from 1993.

### Highest R&D intensity in Sweden

The intensity of R&D is measured here as R&D person-years in relation to the total number of person-years (full time equivalent).

The share of R&D in Sweden carried out by the largest manufacturing groups are over three times the amount carried out abroad. In Sweden, the share of the largest manufacturing groups was 15 per cent compared with 5 per cent abroad.

This shows that R&D activities within the largest manufacturing groups are concentrated on home turf.

R&D carried out abroad in person-years by the largest enterprise groups in relation to all person-years in all Swedish-owned enterprises abroad shows a slightly lower relationship, 3 per cent (see table 13).

Table 2  
**R&D person-years (FTE) in the large manufacturing groups in relation to all their employees by country 1997 and 1995<sup>1)</sup>**

Country	Quota (%)	
	1997 (A)/(B)	1995 (A)/(B)
<b>Sweden</b>	<b>15</b>	<b>12</b>
<b>Abroad</b>	<b>5</b>	<b>3</b>
Netherlands	10	6
United Kingdom	8	5
Denmark, Finland and Norway <sup>2)</sup>	8	7
USA	5	4
Germany	4	3
Italy	4	3
France	2	2
Brazil	2	2
Belgium and Austria <sup>2)</sup>	2	2
Other countries	3	3
<b>Total</b>	<b>8</b>	<b>7</b>

A. R&D person-years in the large manufacturing groups

B. Total person-years in the large manufacturing groups

#### Notes

1. There have been some changes in the population between 1995 and 1997

2. Due to confidentiality these countries have been put together.

If the results of this survey are compared to the survey (see appendix with more than 50 employees on Statistical - Methodology) on the R&D activities of all Swedish enterprises, the following is revealed: The 20 largest manufacturing groups have more person-years of R&D in Sweden and abroad than all the person-years of R&D for the whole of the business sector in Sweden in 1997.

The R&D of the largest manufacturing groups accounted for 80 per cent of all R&D in the manufacturing industry.

In 1997, the largest manufacturing groups carried out 45 000 person-years of R&D compared with almost 43 900 person-years for the whole of the business sector in Sweden. Total spending on R&D was SEK 46 billion in 1997 (SEK 30 billion in Sweden), which comprised almost 92 per cent of the total expenditure by the business sector on R&D in Sweden.

The 5 enterprise groups that invested the most on R&D in Sweden accounted for 66 per cent of total R&D expenditure in Sweden and 70 per cent of all R&D person-years within the manufacturing industry in Sweden.

## R&D of foreign-owned enterprises in Sweden 1997

In 1997, the number of employees in foreign-owned enterprises in Sweden was a little over 301 000. At the end of 1997 there were 3 687 enterprises in which the majority of equity holdings were in foreign hands. The share of employees in foreign-owned enterprises has continued to expand and during 1997 the figure was 14 per cent. In 1997, 285 foreign-owned enterprises completed the R&D survey. These enterprises employed 125 000 persons or around 40 per cent of the total employed in foreign-owned enterprises.

Foreign-owned enterprises accounted for 19 per cent or SEK 9.4 billion of total expenditure on R&D in Sweden in 1997. If the comparison is limited to the manufacturing industry the percentage share climbs to almost 20 per cent.

Comparing the expenditure of Swedish-owned enterprises on R&D outside Sweden with foreign-owned enterprises inside Sweden shows that the former is larger. In 1997, Swedish enterprises invested SEK16.5 billion outside Sweden's borders, almost double the amount invested by foreign-owned enterprises in Sweden. In 1997, 9 300 people were employed in R&D in foreign-owned enterprises within Sweden. These employees carried out 8 455 person-years of R&D. In their prognoses

for 1999, foreign-owned enterprises forecasted an increase in R&D in Sweden of 2 per cent. For its part, the business sector in total forecasted an increase of 10 per cent. Between 1995 and 1997, the share of R&D measured as person-years carried out by foreign-owned enterprises in Sweden fell from 20 per cent of the total amount of R&D in Sweden to 19 per cent (see figure 10 and 11).

Table 3  
R&D in international enterprises 1993-1997

Type of enterprise	R&D person-years		
	1997	1995*	1993*
Swedish-owned enterprises abroad	17 618	12 953	11 075
Foreign-owned enterprises in Sweden	8 455	8 369	4 835

\* Part of the increase between 1993 and 1995 can be explained with the fact that a Swedish-owned enterprise group became foreign-owned.

Table 3 must be treated with a certain amount of caution for the following two reasons:

- It can be hazardous to draw the line between Swedish- and foreign-owned enterprises. Via changes in share ownership large enterprises can change nationality.
- R&D data from enterprises that are foreign-owned do not include those with less than 50 employees.

Figure 8, 9

R&D expenditure in foreign-owned enterprises compared with R&D expenditure in the business sector

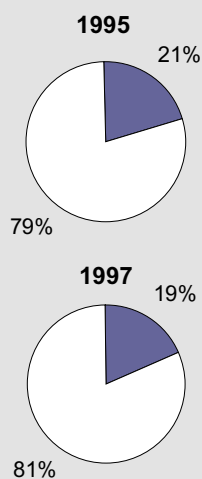
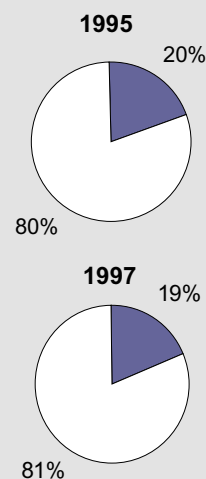


Figure 10, 11

R&D person-years performed in foreign-owned enterprises compared with the total number of person-years performed in the business sector



■ Foreign-owned enterprises □ Swedish-owned enterprises



### R&D person-years in comparison to the total number of employees in R&D

In foreign-owned enterprises, those that work with R&D spend 91 per cent of their time in this particular field. In Swedish-owned enterprises the relationship is about the same, i.e. 88 per cent of their time is spent on R&D. In both cases this is a substantial amount of time that does not allow for other activities.

In the business sector as a whole, the number of R&D person-years has increased far more than the number of persons involved in R&D, which means that those working with R&D spend a larger amount of their working time in this field. This is a process that had accentuated during the 1980's and 1990's. In 1997, every person spent 89 per cent of working time on R&D while the figure for 1983 was 78 per cent.

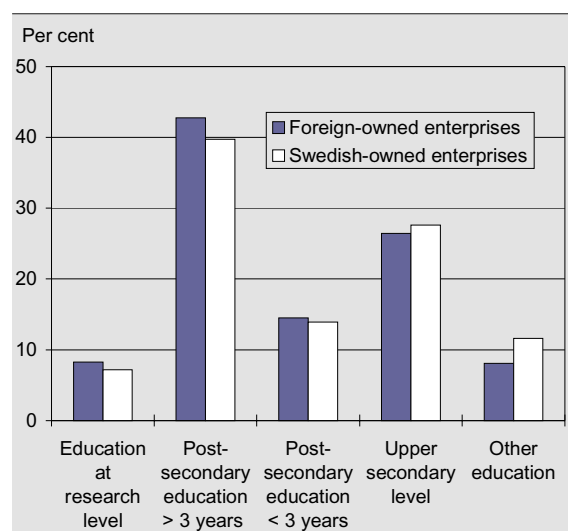
### More women engaged in R&D in foreign-owned enterprises

The share of R&D person-years carried out by women in foreign-owned enterprises was 27 per cent in 1997, which is somewhat higher than for the business sector as a whole, 24 per cent. In Swedish-owned enterprises, women executed 23 per cent of R&D measured as person-years.

### Higher share of academic professionals in foreign-owned enterprises

In the whole of the business sector academic professionals, including those who had completed post-graduate studies carried out almost 48 per cent of R&D. There are differences between the numbers of academics involved in R&D in foreign- and Swedish-owned enterprises. The share of R&D person-years carried out by academics with post-graduate studies in foreign-owned enterprises was 8 per cent in 1997 and those with other academic qualifications (3 years or longer university studies) carried out around 43 per cent of R&D person-years. In Sweden the corresponding figures are 7 per cent and 40 per cent, respectively.

Figure 12  
Educational structure for R&D personnel in foreign-owned and Swedish-owned enterprises 1997



### Less research in foreign-owned enterprises

Research plays a small role in the activities of the whole of the business sector. For the foreign-owned enterprises the share of research is less than for the business sector in total - of all R&D person-years only 13 per cent concentrates on basic and applied research. The remaining 87 per cent are directed towards developmental activities. In the Swedish-owned enterprises the corresponding data is 18 per cent and 82 per cent, respectively. R&D is thus directed more towards developmental activities in the foreign-owned enterprises than in the Swedish-owned enterprises.

Table 4  
Foreign-owned and Swedish-owned enterprises. Number of person-years in 1997

Business sector	R&D person-years			Female employees		
	Foreign-owned enterprises	Total	Quota (%)	Foreign-owned enterprises	Total	Quota (%)
<i>Manufacturing industry</i>						
Knowledge-intensive	5 710	30 373	19	1 339	6 575	20
Capital-intensive	1 040	3 216	32	375	1 176	32
Labour-intensive	446	1 745	26	162	455	36
<i>Services</i>						
Knowledge-intensive	960	6 573	15	308	1 771	17
Capital-intensive	-	932	-	-	282	-
Labour-intensive	299	761	39	134	208	64
<i>Other activity</i>	-	281	-	-	93	-
<b>Total</b>	<b>8 455</b>	<b>43 881</b>	<b>19</b>	<b>2 318</b>	<b>10 560</b>	<b>22</b>

### Technical science the largest research discipline

The distribution of R&D person-years in foreign-owned enterprises shows that technical science is the largest research discipline. 600 person-years or 54 per cent are dedicated towards technical science. Natural science and medicine account for 30 per cent and 13 per cent, respectively. Other disciplines account for the remaining 3 per cent. The corresponding figures for Swedish-owned enterprises were 65 per cent, 16 per cent, 15 per cent and 4.

### Most R&D in knowledge-intensive enterprises

Knowledge-intensive enterprises carried out a substantial share of all R&D activities in the manufacturing industry. With certain simplifications one could say that such enterprises carried out a major share of R&D in Sweden. Of total investment in R&D in the whole manufacturing industry, knowledge-intensive enterprises accounted for 89 per cent, while capital-intensive and labour-intensive enterprises accounted for 8 per cent and 3 per cent, respectively. In the service sector, knowledge-intensive enterprises accounted for 78 per cent of all investment in R&D, while the two other sectors accounted for 12 per cent and 10 per cent, respectively.

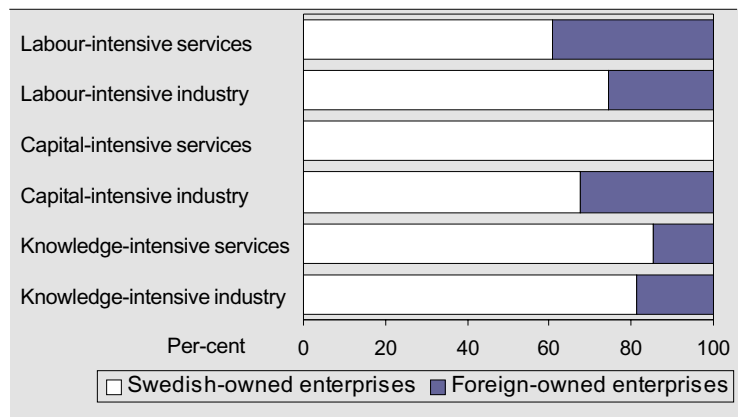
If Swedish- and foreign-owned enterprises are studied separately, one sees that Swedish-owned knowledge-intensive industrial enterprises accounted for 90 per cent of R&D investment carried out by Swedish-owned industrial enterprises, while the corresponding figure for foreign-owned enterprises was somewhat lower at 84 per cent.

There were also differences between Swedish- and foreign-owned enterprises in the service sector. Foreign-owned knowledge-intensive service enterprises carried out 67 per cent of R&D activities while labour-intensive enterprises stood for 33 per cent. Capital-intensive enterprises carried out no R&D activities.

For the group of Swedish-owned service sector enterprises the distribution was somewhat different. Knowledge-intensive enterprises in the Swedish-owned service sector accounted for 80 per cent of R&D in 1997. Of the remainder, 14 per cent of all service sector R&D was carried out by labour-intensive enterprises and 6 per cent by capital-intensive enterprises.

Figure 13

**R&D person-years in foreign-owned enterprises compared with R&D person-years in Swedish-owned enterprises. Distribution by business sector**



### Person-years in the knowledge-intensive enterprises

In 1997, the number of R&D person-years in the business sector was 43 881. Of this, personnel based in the knowledge-intensive enterprises accounted for 84 per cent.

Almost 30 000 R&D person-years were executed in the knowledge-intensive industrial enterprises. A comparison of R&D person-years between Swedish- and foreign-owned enterprises shows that in 1997 Swedish-owned industrial enterprises accounted 81 per cent of R&D person-years in the knowledge-intensive industrial enterprises. For enterprises in the knowledge-intensive service sector 6 600 R&D person-years were executed, of which Swedish-owned enterprises accounted for 5 600 person-years, a little over 85 per cent.

### R&D operating costs and investment

The distribution of operating costs for R&D between personnel, other items and investment spending does not vary much between the Swedish- and foreign-owned enterprises. The share of labour costs in foreign-owned enterprises was 43 per cent, while it was a little lower in Swedish-owned enterprises (41 per cent). Swedish-owned enterprises had a slightly higher share of other operating costs and investment, i.e. 50 per cent and 8 per cent, respectively. The corresponding data for foreign-owned enterprises was 49 per cent and 7 per cent, respectively.

Table 5  
**Foreign-owned enterprises. Currents costs and capital investments for R&D work. Distribution by sector**

Sector	Current costs				Capital investments		R&D expenditures	
	Labour costs		Other current costs		Foreign-owned enterprises	Swedish-owned enterprises	Foreign-owned enterprises	Swedish-owned enterprises
	Foreign-owned enterprises	Swedish-owned enterprises	Foreign-owned enterprises	Swedish-owned enterprises				
<i>Manufacturing industry</i>								
Knowledge-intensive	2 867	11 857	3288	15 175	544	2 401	6 699	29 433
Capital-intensive	441	964	419	910	52	353	912	2 226
Labour-intensive	187	611	135	408	19	53	341	1 072
<i>Services</i>								
Knowledge-intensive	434	2 659	437	3 213	66	317	937	6 190
Capital-intensive	-	459	-	493	-	123	-	1 075
Labour-intensive	168	220	290	165	8	69	466	454
Other activity	-	123	-	192	-	31	-	346
<b>Total</b>	<b>4096</b>	<b>16892</b>	<b>4570</b>	<b>20 557</b>	<b>689</b>	<b>3347</b>	<b>9 355</b>	<b>40796</b>

#### R&D spending per R&D person-year

R&D costs per R&D person-year were somewhat higher in Swedish-owned enterprises than foreign-owned enterprises, i.e. SEK 1 152 000 against SEK 1 106 000. The average cost per R&D person-year varied with both the size of the enterprise concerned as well as the industry a firm belonged to.

#### Investment in R&D software dominated by knowledge-intensive enterprises

Starting with the 1997, the survey tries to ascertain the cost of R&D software for all enterprises. Included in this is R&D in relation to software that is the finished product of an enterprise or software that is used in the products or processes of an enterprise. In 1997 the total cost for software-related R&D was SEK 10 billion. Almost SEK 9 billion or 90 per cent of these costs emanated from Swedish-owned enterprises. The main share of these particular R&D costs in Swedish-owned enterprises emerged from the knowledge-intensive sector. These enterprises in turn accounted for 94 per cent of all software-related R&D in all knowledge-intensive enterprises in 1997.

The software-related R&D activities of foreign-owned enterprises are also strongly concentrated to the knowledge-intensive sector. During 1997 foreign-owned enterprises invested almost SEK 1 billion on software-related R&D. Of this the knowledge-intensive enterprises accounted for a little over 93 per cent.

#### Foreign-owned R&D investment divided by product group

The R&D activities of many enterprises can be applied to several products. A major share of R&D investment in foreign-owned enterprises in 1997 was directed towards pharmaceuticals, machinery, precision instruments and other electrical product groups. These accounted for almost two-thirds of the R&D resources of foreign-owned enterprises. In Swedish-owned enterprises the emphasis was a little different: the product groups that used up most R&D investment resources were in telecommunication, transport, pharmaceutical and machinery areas. These four product groups accounted for over 80 per cent of the R&D activities of Swedish-owned enterprises.

#### R&D activities less concentrated in foreign-owned enterprises

To a large extent R&D activities are concentrated in enterprises with more than 500 employees. In 1997, such enterprises accounted for 84 per cent or SEK 34 billion of R&D investment by Swedish-owned enterprises. Foreign-owned enterprises with more than 500 employees invested almost SEK 7 billion on R&D, which was 74 per cent of total R&D spending by foreign-owned enterprises in Sweden.

Table 6  
**Person-years and expenditure for R&D-work 1997. Distribution by size of enterprise (number of employees) and type of owner**

**A. R&D person-years**

Size of enterprise	R&D person-years					
	Foreign-owned enterprises	(%)	Swedish-owned enterprises	(%)	Business enterprise sector	(%)
50-99	351	4	2 125	6	2476	6
100-249	1 039	12	1 946	5	2985	7
250-499	1 248	15	2 983	8	4231	10
500-	5 817	69	28 372	80	34189	78

**B. R&D expenditure**

Size of enterprise	R&D expenditure					
	Foreign-owned enterprises	(%)	Swedish-owned enterprises	(%)	Business enterprise sector	(%)
50-99	354	4	1 866	5	2219	4
100-249	946	10	1 961	5	2906	6
250-499	1133	12	2 728	7	3861	8
500-	6 922	74	34 242	84	41164	82

**Financing of R&D activities**

A large share, 80 per cent, of R&D activities is financed with internal funds. Military authorities and Swedish enterprises provide the largest share of external financing.

The various company groupings exhibit varying financing methods. In foreign-owned enterprises, the use of internal funds financed 88 per cent of investment capital while the figure for Swedish-owned enterprises was 80 per cent. Financial resources from abroad stood for 9 per cent of the financing of foreign-owned enterprises while for Swedish-owned enterprises the figure was 1 per cent. Financial resources raised in Sweden from subsidiaries of the parent company accounted for 8 per cent of R&D resources for Swedish-owned enterprises and only 3 per cent for foreign-owned enterprises.

Table 7  
**Sources of finance for intramural R&D in Sweden by type of enterprise 1997, MSEK**

Sources of finance	Swedish-owned enterprises	Foreign-owned enterprises	Business sector
Internal funds in Sweden	31 856	8186	40 043
Enterprises own group in Sweden	3 417	294	3 711
Other enterprises in Sweden	658	14	672
Enterprises own group abroad	267	814	1 081
Other enterprises abroad	179	20	199
Funds from EU	170	8	178
<i>Other Swedish financing</i>	4 039	15	4 053
<i>Other foreign financing</i>	211	3	214
<b>Total for the business sector</b>	<b>40 796</b>	<b>9 355</b>	<b>50 151</b>

### External R&D activities

The survey also asks enterprises about R&D assignments or R&D support given to organisations outside their own enterprise. These two types of external R&D activities have been combined in the statistics. The total cost for assignments and support was SEK 13 billion in 1997. Of this amount foreign-owned enterprises accounted for SEK 1.1 billion or 9 per cent. A study of each group of company shows that SEK 0.7 billion or 63 per cent went to enterprises outside Sweden. In Swedish-owned enterprises a little over SEK 7 billion (62 per cent) went to enterprises abroad.

### Regional distribution of R&D activities in foreign-owned enterprises

In the County of Västmanland the share of R&D spending by foreign-owned enterprises was 88 per cent in 1997, while the share of total R&D person-years carried out at workplaces that were foreign-owned was 85 per cent. Other counties where foreign-owned enterprises controlled a relatively large share of R&D activities were Stockholm, Dalarna and Skåne. For Swedish-owned enterprises R&D activities were concentrated in the metropolitan regions. The largest investments were in Stockholm, Västra Götaland and Skåne. In total these counties accounted for 80 per cent of R&D investment by Swedish-owned enterprises in Sweden.

Table 8

#### Purchased extramural R&D by enterprises in Sweden 1997, MSEK

Supplier of R&D	Buyer of R&D		
	Swedish-owned enterprises	Foreign-owned enterprises	Total business sector
Enterprises own group in Sweden	2 804	88	2 892
Other enterprises in Sweden	818	228	1 047
Enterprises own group abroad	5 857	533	6 390
Other enterprises abroad	897	86	983
Joint venture enterprises abroad	112	21	133
Research institutes abroad	176	53	229
Universities <sup>1)</sup>	290	62	352
Research institutes	252	25	278
Other organisations in Sweden	215	22	238
Other organisations abroad	83	29	112
<b>Total business sector</b>	<b>11 506</b>	<b>1 148</b>	<b>12 653</b>

1. These receive subsidy

Table 9

#### Expenditures and person-years for R&D in foreign-owned enterprises by county 1997

County	R&D person-years	R&D expenditures (MSEK)
Stockholm	1 964	2 236
Skåne	1 835	2 260
Västmanland	1 233	1 377
Västra Götaland	845	710
Östergötland	501	478
Dalarna	303	397
Other counties	1 381	1 639
Not distributed <sup>1)</sup>	393	258
<b>Total foreign-owned enterprises</b>	<b>8 455</b>	<b>9 355</b>

1. R&D expenditures and person-years, which have not been possible to distribute by county.

# Tables

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Table 10  
R&D expenditures and person-years (FTE) in the largest manufacturing groups <sup>1)</sup> 1997 and 1995

Country	R&D expenditures MSEK		R&D person-years (FTE)	
	1997	1995	1997	1995
<b>Sweden</b>	<b>29 767</b>	<b>28 549</b>	<b>27 517</b>	<b>24 786</b>
<b>Abroad <sup>2)</sup></b>	<b>16 565</b>	<b>7 936</b>	<b>17 618</b>	<b>12 953</b>
USA	5 034	2 419	3 865	2 997
United Kingdom	2 276	901	2 469	1 523
Germany	1 866	952	1 894	1 453
Denmark, Finland, Norway <sup>3)</sup>	1 481	520	1 740	1 462
Italy	993	510	1 166	971
Netherlands	828	553	1 215	762
Belgium and Austria <sup>3)</sup>	512	554	401	503
France	477	388	543	473
Brazil	332	152	338	240
Other countries	2 766	986	3 987	2 569
<b>Total</b>	<b>46 332</b>	<b>36 485</b>	<b>45 135</b>	<b>37 739</b>

Notes

1. The information is gathered from the survey regarding R&D in the 20 largest manufacturing groups.

2. A geographical distribution of the R&D-activity should be more reliable if measured in R&D person-years (FTE) than in R&D expenditures since a few enterprise groups have problems to distribute R&D expenditures by the country of location.

3. Due to confidentiality these countries have been put together.

Table 11  
R&D person-years (FTE) in the largest manufacturing groups <sup>1)</sup> performed by university graduates 1997

Country	Level of education <sup>2)</sup>						
	Licentiate & doctors	Share that are licentia- tes and doctors	Techni- cians	Share that are techni- cians	Other university graduates	Share of other university graduates	University graduates Total <sup>3)</sup>
<b>Sweden</b>	<b>1 505</b>	<b>11</b>	<b>9 754</b>	<b>69</b>	<b>2 912</b>	<b>21</b>	<b>14 171</b>
<b>Abroad <sup>4)</sup></b>	<b>1 008</b>	<b>8</b>	<b>10 255</b>	<b>79</b>	<b>1 652</b>	<b>13</b>	<b>12 915</b>
USA	222	8	2 259	80	342	12	2 823
United Kingdom	325	19	970	58	372	22	1 667
Germany	92	6	1 135	80	192	14	1 419
Denmark, Finland and Norway <sup>5)</sup>	54	4	1 167	90	72	6	1 293
Italy	42	5	711	80	137	15	890
Netherlands	25	3	864	91	65	7	954
Belgium and Austria <sup>5)</sup>	9	4	195	91	11	5	215
France	34	8	277	68	94	23	405
Brazil	11	5	189	94	2	1	202
Other countries	195	6	2 488	82	365	12	3 048
<b>Total</b>	<b>2 513</b>	<b>9</b>	<b>20 009</b>	<b>74</b>	<b>4 564</b>	<b>17</b>	<b>27 086</b>

Notes

1. The information is gathered from the survey regarding R&D in the 20 largest manufacturing groups.

2. Rough estimation, according to the respondents.

3. Persons with at least a university education of three years.

4. Difficulties in translation between Sweden's education system and the ones abroad.

5. Due to confidentiality these countries have been put together.

Table 12  
R&D person-years (FTE) in the largest manufacturing groups <sup>1)</sup> performed by university graduates 1995

Country	Level of education <sup>2)</sup>						University graduates Total <sup>3)</sup>
	Licentiatees & doctors	Share that are licentiatees and doctors	Technicians	Share that are technicians	Other university graduates	Share of Other university graduates	
<b>Sweden</b>	<b>1 087</b>	<b>9</b>	<b>8 080</b>	<b>69</b>	<b>2 584</b>	<b>22</b>	<b>11 751</b>
<b>Abroad <sup>4)</sup></b>	<b>677</b>	<b>7</b>	<b>7 484</b>	<b>82</b>	<b>951</b>	<b>10</b>	<b>9 112</b>
USA	185	8	1 808	82	199	9	2 192
United Kingdom	58	6	851	84	110	11	1 019
Germany	173	18	611	62	197	20	981
Denmark, Finland and Norway <sup>5)</sup>	7	2	279	93	13	4	299
Italy	18	3	499	87	54	9	571
Netherlands	52	5	990	91	42	4	1 084
Belgium and Austria <sup>5)</sup>	28	4	592	83	91	13	711
France	27	9	220	77	39	14	286
Brazil	0	0	75	100	0	0	75
Other countries	130	7	1 559	82	206	11	1 895
<b>Total</b>	<b>1 764</b>	<b>8</b>	<b>15 564</b>	<b>75</b>	<b>3 535</b>	<b>17</b>	<b>20 863</b>

Notes

1. The information is gathered from the survey regarding R&D in the 20 largest manufacturing groups.
2. Rough estimation, according to the respondents.
3. Persons with at least a university education of three years.
4. Difficulties in translation between Sweden's education system and the ones abroad.
5. Due to confidentiality these countries have been put together.

Table 13  
R&D person-years (FTE) in the largest manufacturing groups <sup>1)</sup> in relation to all their person-years and to the person-years in all Swedish-owned international enterprise groups 1997

Country	R&D person-years <sup>2)</sup> in the large manufacturing groups	Total person-years in the large manufacturing groups	Employed in Swedish international enterprise groups	Quota, 1 (%)	Quota, 2 (%)
	(A)	(B)	(C)	(A) / (B)	(A) / (C)
<b>Sweden</b>	<b>27 517</b>	<b>185 174</b>	<b>667 046</b>	<b>15</b>	<b>4</b>
<b>Abroad</b>	<b>17 618</b>	<b>389 275</b>	<b>627 132</b>	<b>5</b>	<b>3</b>
USA	3 865	72 122	94 837	5	4
United Kingdom	2 469	30 465	55 286	8	4
Germany	1 894	44 160	71 724	4	3
Denmark, Finland, Norway <sup>3)</sup>	1 740	23 180	86 358	8	2
Italy	1 166	30 758	33 058	4	4
Netherlands	1 215	11 863	18 104	10	7
Belgium and Austria <sup>3)</sup>	401	20 538	28 102	2	1
France	543	23 429	38 422	2	1
Brazil	338	17 162	18 426	2	2
Other countries	3 987	115 598	182 815	3	2
<b>Total</b>	<b>45 135</b>	<b>574 449</b>	<b>1 294 178</b>	<b>8</b>	<b>3</b>

Notes

1. The information is gathered from the survey regarding R&D in the 20 largest manufacturing groups.
2. One person-year is the labour of one full time employee during one year.
3. Due to confidentiality these countries have been put together.



Table 14

**R&D person-years (FTE) in the largest manufacturing groups <sup>1)</sup> in relation to all their person-years 1995**

<b>Country</b>	R&D person-years <sup>2)</sup> in the large manu- facturing groups <b>(A)</b>	Total person-years in the large manu- facturing groups <b>(B)</b>	Quota (%) <b>(A) / (B)</b>
<b>Sweden</b>	<b>24 786</b>	<b>202 699</b>	<b>12</b>
<b>Abroad</b>	<b>12 953</b>	<b>374 580</b>	<b>3</b>
USA	2 997	66 882	4
United Kingdom	1 523	32 630	5
Germany	1 453	50 377	3
Denmark, Finland, Norway <sup>3)</sup>	1 462	22 484	7
Italy	971	30 298	3
Netherlands	762	13 215	6
Belgium and Austria <sup>3)</sup>	503	22 743	2
France	473	23 309	2
Brazil	240	13 235	2
Other countries	2 569	99 407	3
<b>Total</b>	<b>37 739</b>	<b>577 279</b>	<b>7</b>

*Notes*

1. The information is gathered from the survey regarding R&D in the 20 largest manufacturing groups.
2. One person-year is the labour of one full time employee during one year.
3. Due to confidentiality these countries have been put together.

Table 15

**Number of person-years in the largest manufacturing groups and other enterprises in Sweden 1997 <sup>1)</sup>**

Business sector	Type of enterprise	R&D person-years	Share of the sector	Share of all sectors
<b>Knowledge-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	20 346	67	46
	Other enterprises	10 026	33	23
	Total	30 373	100	69
<i>Services</i>	The large manufacturing groups	2 851	43	6
	Other enterprises	3 722	57	8
	Total	6 573	100	15
<b>Capital-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	1 502	47	3
	Other enterprises	1 714	53	4
	Total	3 216	100	7
<i>Services</i>	The large manufacturing groups	-	-	-
	Other enterprises	932	100	2
	Total	932	100	2
<b>Labour-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	800	46	2
	Other enterprises	945	54	2
	Total	1 745	100	4
<i>Services</i>	The large manufacturing groups	77	10	0
	Other enterprises	683	90	2
	Total	761	100	2
<b>Total manufacturing industry</b>				
	The large manufacturing groups	22 648	64	52
	Other enterprises	12 686	36	29
	Total	35 334	100	81
<b>Total services</b>				
	The large manufacturing groups	2 929	35	7
	Other enterprises	5 338	65	12
	Total	8 266	100	19
<b>Other activity</b>				
	The large manufacturing groups	16	6	0
	Other enterprises	265	94	1
	Total	281	100	1
<b>The business sector</b>				
	The large manufacturing groups	25 593	58	58
	Other enterprises	18 289	42	42
	Total	43 881	100	100

*Notes*

1. The information in this table is not from the survey to the 20 largest manufacturing groups. The information is from the survey, "R&D in the Business Enterprise Sector 1997", covering non-financial enterprises with at least 50 employees.

Table 16  
**R&D expenditures in the largest manufacturing groups and other enterprises in Sweden 1997, MSEK <sup>1)</sup>**

Business sector	Type of enterprise	R&D expend.	Share of the sector	Share of all sectors
<b>Knowledge-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	25 108	69	50
	Other enterprises	11 024	31	22
	Total	36 132	100	72
<i>Services</i>	The large manufacturing groups	3 778	53	8
	Other enterprises	3 349	47	7
	Total	7 126	100	14
<b>Capital-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	1 605	51	3
	Other enterprises	1 534	49	3
	Total	3 138	100	6
<i>Services</i>	The large manufacturing groups	-	-	-
	Other enterprises	1 075	100	2
	Total	1 075	100	2
<b>Labour-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	690	49	1
	Other enterprises	723	51	1
	Total	1 413	100	3
<i>Services</i>	The large manufacturing groups	105	11	0
	Other enterprises	815	89	2
	Total	920	100	2
<b>Total manufacturing industry</b>	The large manufacturing groups	27 403	67	55
	Other enterprises	13 281	33	26
	Total	40 684	100	81
<b>Total services</b>	The large manufacturing groups	3 883	43	8
	Other enterprises	5 239	57	10
	Total	9 121	100	18
<b>Other activity</b>	The large manufacturing groups	12	3	0
	Other enterprises	334	97	1
	Total	346	100	1
<b>The business sector</b>	The large manufacturing groups	31 297	62	62
	Other enterprises	18 854	38	38
	Total	50 151	100	100

*Notes*

1. The information in this table is not from the survey to the 20 largest manufacturing groups. The information is from the survey, "R&D in the Business Enterprise Sector 1997", covering non-financial enterprises with at least 50 employees.

Table 17  
**R&D expenditures ( MSEK ) per person-years (FTE) in the largest manufacturing groups and other enterprises  
in Sweden 1997 <sup>1)</sup>**

Business sector	Type of enterprise	R&D expend.	R&D person- years	R&D expend./ <sup>2)</sup> person-years
<b>Knowledge-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	25 108	20 346	1 234
	Other enterprises	11 024	10 026	1 100
	Total	36 132	30 373	1 190
<i>Services</i>	The large manufacturing groups	3 778	2 851	1 325
	Other enterprises	3 349	3 722	900
	Total	7 126	6 573	1 084
<b>Capital-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	1 605	1 502	1 068
	Other enterprises	1 534	1 714	894
	Total	3 138	3 216	976
<i>Services</i>	The large manufacturing groups	-	-	-
	Other enterprises	1 075	932	1 153
	Total	1 075	932	1 153
<b>Labour-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	690	800	863
	Other enterprises	723	945	765
	Total	1 413	1 745	810
<i>Services</i>	The large manufacturing groups	105	77	1 353
	Other enterprises	815	683	1 193
	Total	920	761	1 209
<b>Total manufacturing industry</b>	The large manufacturing groups	27 403	22 648	1 210
	Other enterprises	13 281	12 686	1 047
	Total	40 684	35 334	1 151
<b>Total services</b>	The large manufacturing groups	3 883	2 929	1 326
	Other enterprises	5 239	5 338	981
	Total	9 121	8 266	1 103
<b>Other activity</b>	The large manufacturing groups	12	16	719
	Other enterprises	334	265	1 261
	Total	346	281	1 230
<b>The business sector</b>	The large manufacturing groups	31 297	25 593	1 223
	Other enterprises	18 854	18 289	1 031
	Total	50 151	43 881	1 143

*Notes*

1. The information in this table is not from the survey to the 20 largest manufacturing groups. The information is from the survey, "R&D in the Business Enterprise Sector 1997", covering non-financial enterprises with at least 50 employees.

2. SEK thousands

Table 18

**Number of person-years in foreign-owned and Swedish-owned enterprises in Sweden 1997<sup>1)</sup>**

Business sector	Type of enterprise	R&D person-years	Share of the sector (%)	Share of all sectors (%)
<b>Knowledge-intensive</b>				
<i>Manufacturing industry</i>	Foreign-owned enterprises	5 710	19	13
	Swedish-owned enterprises	24 662	81	56
	Total	30 373	100	69
<i>Services</i>	Foreign-owned enterprises	960	15	2
	Swedish-owned enterprises	5 613	85	13
	Total	6 573	100	15
<b>Capital-intensive</b>				
<i>Manufacturing industry</i>	Foreign-owned enterprises	1 040	32	2
	Swedish-owned enterprises	2 177	68	5
	Total	3 216	100	7
<i>Services</i>	Foreign-owned enterprises	-	-	-
	Swedish-owned enterprises	932	100	2
	Total	932	100	2
<b>Labour-intensive</b>				
<i>Manufacturing industry</i>	Foreign-owned enterprises	446	26	1
	Swedish-owned enterprises	1 299	74	3
	Total	1 745	100	4
<i>Services</i>	Foreign-owned enterprises	299	39	1
	Swedish-owned enterprises	462	61	1
	Total	761	100	2
<b>Total manufacturing industry</b>	Foreign-owned enterprises	7 196	20	16
	Swedish-owned enterprises	28 138	80	64
	Total	35 334	100	81
<b>Total services</b>	Foreign-owned enterprises	1 259	15	3
	Swedish-owned enterprises	7 007	85	16
	Total	8 266	100	19
<b>Other activity</b>	Foreign-owned enterprises	-	-	-
	Swedish-owned enterprises	281	100	1
	Total	281	100	1
<b>The business sector</b>	Foreign-owned enterprises	8 455	19	19
	Swedish-owned enterprises	35 427	81	81
	Total	43 881	100	100

*Notes*

1. The information is gathered from the survey, "R&D in the Business Enterprise Sector 1997", covering non-financial enterprises with at least 50 employees.

Table 19  
**R&D expenditures in foreign-owned and Swedish-owned enterprises in Sweden 1997, MSEK <sup>1)</sup>**

Business sector	Type of enterprise	R&D expend.	Share of the sector (%)	Share of all sectors (%)
<b>Knowledge-intensive</b>				
<i>Manufacturing industry</i>	Foreign-owned enterprises	6 699	19	13
	Swedish-owned enterprises	29 433	81	59
	Total	36 132	100	72
<i>Services</i>	Foreign-owned enterprises	937	13	2
	Swedish-owned enterprises	6 190	87	12
	Total	7 126	100	14
<b>Capital-intensive</b>				
<i>Manufacturing industry</i>	Foreign-owned enterprises	912	29	2
	Swedish-owned enterprises	2 226	71	4
	Total	3 138	100	6
<i>Services</i>	Foreign-owned enterprises	-		-
	Swedish-owned enterprises	1 075	100	2
	Total	1 075	100	2
<b>Labour-intensive</b>				
<i>Manufacturing industry</i>	Foreign-owned enterprises	341	24	1
	Swedish-owned enterprises	1 072	76	2
	Total	1 413	100	3
<i>Services</i>	Foreign-owned enterprises	466	51	1
	Swedish-owned enterprises	454	49	1
	Total	920	100	2
<b>Total manufacturing industry</b>	Foreign-owned enterprises	7 952	20	16
	Swedish-owned enterprises	32 732	80	65
	Total	40 684	100	81
<b>Total services</b>	Foreign-owned enterprises	1 403	15	3
	Swedish-owned enterprises	7 719	85	15
	Total	9 121	100	18
<b>Other activity</b>	Foreign-owned enterprises	-		0
	Swedish-owned enterprises	346	100	1
	Total	346	100	1
<b>The business sector</b>	Foreign-owned enterprises	9 355	19	19
	Swedish-owned enterprises	40 796	81	81
	Total	50 151	100	100

*Notes*

1. The information is gathered from the survey, "R&D in the Business Enterprise Sector 1997", covering non-financial enterprises with at least 50 employees.

Table 20  
**R&D expenditures per person-years (FTE) in foreign-owned and Swedish-owned enterprises 1997, MSEK <sup>1)</sup>**

Business sector	Type of enterprise	R&D expend.	R&D person- years	R&D expend./ <sup>2)</sup> person-years
<b>Knowledge-intensive</b>				
<i>Manufacturing industry</i>	Foreign-owned enterprises	6 699	5 710	1 173
	Swedish-owned enterprises	29 433	24 662	1 193
	Total	36 132	30 373	1 190
<i>Services</i>	Foreign-owned enterprises	937	960	976
	Swedish-owned enterprises	6 190	5 613	1 103
	Total	7 126	6 573	1 084
<b>Capital-intensive</b>				
<i>Manufacturing industry</i>	Foreign-owned enterprises	912	1 040	877
	Swedish-owned enterprises	2 226	2 177	1 023
	Total	3 138	3 216	976
<i>Services</i>	Foreign-owned enterprises	-	-	-
	Swedish-owned enterprises	1 075	932	1 153
	Total	1 075	932	1 153
<b>Labour-intensive</b>				
<i>Manufacturing industry</i>	Foreign-owned enterprises	341	446	765
	Swedish-owned enterprises	1 072	1 299	826
	Total	1 413	1 745	810
<i>Services</i>	Foreign-owned enterprises	466	299	1 561
	Swedish-owned enterprises	454	462	982
	Total	920	761	1 209
<b>Total manufacturing industry</b>	Foreign-owned enterprises	7 952	7 196	1 105
	Swedish-owned enterprises	32 732	28 138	1 163
	Total	40 684	35 334	1 151
<b>Total services</b>	Foreign-owned enterprises	1 403	1 259	1 114
	Swedish-owned enterprises	7 719	7 007	1 101
	Total	9 121	8 266	1 103
<b>Other activity</b>	Foreign-owned enterprises	-	-	-
	Swedish-owned enterprises	346	281	1 230
	Total	346	281	1 230
<b>The business sector</b>	Foreign-owned enterprises	9 355	8 455	1 106
	Swedish-owned enterprises	40 796	35 427	1 152
	Total	50 151	43 881	1 143

*Notes*

1. The information is gathered from the survey, "R&D in the Business Enterprise Sector 1997", covering non-financial enterprises with at least 50 employees.

2. SEK thousands

Table 21  
**R&D expenditures (MSEK) and person-years in the business sector 1997. Distribution by type of enterprise <sup>1)</sup>**

Business sector	Type of enterprise	R&D expend.	R&D person- years	R&D expend./ <sup>2)</sup> person-years
<b>Knowledge-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	25 108	20 346	1 234
	Foreign-owned enterprises	6 699	5 710	1 173
	Other enterprises	4 325	4316	1 002
	Total	36 132	30 373	1 190
<i>Services</i>	The large manufacturing groups	3 778	2 851	1 325
	Foreign-owned enterprises	937	960	976
	Other enterprises	2 412	2762	873
	Total	7 126	6 573	1 084
<b>Capital-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	1 605	1 502	1 068
	Foreign-owned enterprises	912	1 040	877
	Other enterprises	622	675	921
	Total	3 138	3 216	976
<i>Services</i>	The large manufacturing groups	-	-	-
	Foreign-owned enterprises	-	-	-
	Other enterprises	1 075	932	1 153
	Total	1 075	932	1 153
<b>Labour-intensive</b>				
<i>Manufacturing industry</i>	The large manufacturing groups	690	800	863
	Foreign-owned enterprises	341	446	765
	Other enterprises	382	499	766
	Total	1 413	1 745	810
<i>Services</i>	The large manufacturing groups	105	77	1 353
	Foreign-owned enterprises	466	299	1 561
	Other enterprises	349	385	907
	Total	920	761	1 209
<b>Total manufacturing industry</b>	The large manufacturing groups	27 403	22 648	1 210
	Foreign-owned enterprises	7 952	7 196	1 105
	Other enterprises	5 329	5490	971
	Total	40 684	35 334	1 151
<b>Total services</b>	The large manufacturing groups	3 883	2 929	1 326
	Foreign-owned enterprises	1 403	1 259	1 114
	Other enterprises	5 239	4079	1 284
	Total	9 121	8 266	1 103
<b>Other activity</b>	The large manufacturing groups	12	16	719
	Foreign-owned enterprises	-	-	-
	Other enterprises	334	265	1 261
	Total	346	281	1 230
<b>The business sector</b>	The large manufacturing groups	31 297	25 593	1 223
	Foreign-owned enterprises	9 355	8 455	1 106
	Other enterprises	9 500	9834	966
	Total	50 151	43 881	1 143

*Notes*

1. The information in this table is not from the survey to the 20 largest manufacturing groups. The information is from the survey, "R&D in the Business Enterprise Sector 1997", covering non-financial enterprises with at least 50 employees.

2. SEK thousands



# Facts on Survey

This section presents the methodological and quality aspects of the survey. The survey is described in respect to the scope, method of selection, sources, definitions and quality.

## Background

As of July 1, 1994 the National Board for Industrial and Technical Development (NUTEK) assumed responsibility for statistical data covering international enterprises. Via this reform all surveys covering international enterprises have been gathered together and now form part of the Official Statistics in Sweden. Some surveys are carried out in co-operation with Statistics Sweden.

As of 1st January, 2001, the Swedish Institute for Growth Policy Studies, (ITPS) is responsible government authority for official statistics on International business. The surveys include foreign owned enterprises in Sweden, Swedish enterprise groups having subsidiaries abroad and the structure of the total business sector according to the degree of internationalisation.

### Users and areas of use

For policymakers, the impact of globalisation on the Swedish business sector is an important input in the decision-making process. The authority that currently has most use of data concerning international enterprises is ITPS, which utilises such information to provide the government with relevant statistical information and analyses. Other users are international organisations such as the OECD, the European Union, UNCTAD, trade and industrial organisations as well as researchers.

## Definitions

The statistics on R&D used definitions and classifications developed by the OECD. R&D activities are aimed at increasing the level of competence (including knowledge about people, culture and society) in a company as well as using this competence in new areas in order to create new or better products, systems or methods.

**Statistical unit** = Enterprise and Enterprise group

**Person-year / Number of employees** = The full time equivalent during the financial year

### Basic research

To pursue in a systematic and methodological fashion new knowledge and ideas without any predetermined application of such new knowledge or ideas. The concept includes pure basic research, where no limits are set on the direction of research, to oriented basic research, where research can become a foundation for specific application.

### Applied research

Where the aim is to exploit in a systematic and methodological fashion the results of research or scientific knowledge towards a specific application.

### Development work

Where the aim is to exploit in a systematic and methodological fashion research results, scientific knowledge or new ideas in order to create new products, processes, systems or substantial improvement to already existing products, processes or systems.

## Variables

The variables studied are those that are relevant to the own R&D of an enterprise, i.e. R&D carried out by their own employees.

### R&D person-years

One person-year is the labour of one full-time employee during one year. A full-time employee who devotes half of his/her time towards R&D has thus executed one-half a person-year of R&D.

### Educational level for a person-year

The level of education of an employee of an enterprise group is recorded as R&D person-years according to the following classification:

- Education at research level: licentiate and doctoral level. A master's exam does not qualify to be recorded as research level.
- Post-secondary education of at least 3 years: basic university studies, civil engineer.

In addition, the number of R&D person-years carried out by academics with technical education shall be recorded. Technical education refers to all categories of engineering education and training, including architects (who have at least 3 years of post-secondary education).

### Total R&D expenditure

Spending attributed to R&D activities executed by the employees of the enterprise group. This comprises labour costs (wages and other wage-related costs), other costs as well as possible investment in material goods and/or capital during the year.

### Classification of enterprises

A classification of the manufacturing industry has been developed by Ohlsson/Vinell based on the relative use of productive resources by various industries. The service sector is not usually divided into knowledge-, capital- and labour-intensive groups. NUTEK, however, has classified enterprises in all parts of the business sector into *knowledge-, capital- and labour-intensive groups*. In this survey enterprises were divided as follows:

#### Manufacturing industry

*Knowledge-intensive:* publishing, electrical and telecommunication products, machines, transport, pharmaceutical, detergents preparations, office machinery and computers, precision instruments.

*Capital-intensive:* mining and quarrying, pulp and paper, petrochemical, chemicals (excluding pharmaceuticals and detergents), other chemical.

*Labour-intensive:* food, textiles, wearing apparel and leather, wood, rubber and metal products, other manufacturing.

#### Services

*Knowledge-intensive:* business services, education, health, culture, sports etc.

*Capital-intensive:* transport and communication.

*Labour-intensive:* construction, wholesale and retail trade, repair shop, hotel and restaurant.

#### Other

*Other activities:* agriculture, forestry, fishing, electricity, gas, and water supply.

## R&D in Swedish large manufacturing groups

The survey highlights the economic and personnel resources in the 20 largest Swedish manufacturing groups, dominating number of employees abroad and R&D-work in Sweden. Personnel resources are measured in relation to educational level. Economic resources are measured as spending on R&D.

### Object and population

The survey covers the 20 largest Swedish owned manufacturing groups in relation to the number of employees abroad. In some cases sub-groups were studied rather than the enterprise group as a whole. In all cases these sub-groups were the dominating R & D activities of an enterprise group.

### Statistical unit

By enterprise group is meant those enterprises that are consolidated in the balance sheet.

The large manufacturing groups in the survey were: AGA, AssaAbloy, AssiDomän, Astra, Atlas Copco, Cardo, Electrolux, Incentive, L M Ericsson, Perstorp, Saab, Sandvik, SCA, Scancem, Scania, SKF, Stora, Svedala Industri, Volvo.

### R&D expenditure

Some enterprise groups booked R&D expenditure in a different country than where the actual R&D took place. In some cases this has resulted in that the amount of R&D spending associated with a particular country is far too low or even non existent despite the claim that there are employees involved in R&D there (see Credibility in total).

### Total R&D person-years

This survey also showed that the questions concerning educational levels cannot be answered with the aid of enterprises' accounting systems. Some respondents have made estimations and it is very difficult to know the accuracy of these qualified guesses. Total R&D person-years are understated. R&D person-years however give a better picture than R&D spending of where R&D was executed geographically.

### Educational level

- *Post-secondary education  $\geq 3$  years*

The problem many times is that information about educational levels is difficult to get hold of. Furthermore, for enterprises with R&D abroad personal contact with those responsible for R&D outside Sweden is necessary in order to make an estimate of educational levels.

- *Personnel with technical education*

This variable is often prone to rough estimates. In addition, making comparisons between Swedish and foreign qualifications is problematic.

### Consistency over time

It can be hazardous to define the dividing line between Swedish and foreign-owned enterprises. Through changes in share ownership large enterprise groups can change 'nationality'. This means that the population transforms over time. On the other hand, the principles for the selection of large manufacturing groups are consistent.

### Credibility in total

In previous surveys some enterprises booked R&D in a different country than where the actual R&D was executed. This phenomenon has occurred in the 1997 survey too – the R&D costs associated with some countries/regions are far too low (or even non existent) given the recorded number of personnel involved with R&D. The situation in this survey, however, is somewhat better. This is the result of a greater focus

on R&D in foreign countries, and that the stakeholders have made greater demands on company management. This greater emphasis on R&D abroad has meant a substantial increase in R&D carried out abroad and thus a reduction of R&D in Sweden. In some enterprises the problem of understating R&D abroad remains, but this does not affect the geographical distribution of R&D between Sweden and abroad to the same extent as previously. Despite the improvements in this survey one can still claim that the geographical distribution of R&D activities, particularly between Sweden and foreign countries, is far more credible if R&D is measured in terms of R&D person-years than expenditure.

**Non-response**

There were 20 large enterprise groups in the survey of which all have returned the questionnaire. Two enterprise groups however were not able to record the number of R&D person-years.

**Review**

All material has been checked against information recorded in the previous survey. Any errors have been corrected after contact with the specific enterprise group.

**R&D in foreign-owned enterprises**

ITPS register of foreign-owned enterprises has been coordinated with the R&D data of Statistics Sweden, which is collected every other year. The corresponding R&D survey by Statistics Sweden was published in Statistical Report U14 SM 9901. In this, 1 000 non-financial enterprises with more than 50 employees were included in the survey. In 1997 a total of 285 foreign-owned enterprises in Sweden returned data to the R&D survey. This information was gathered at enterprise level and only concerns R&D in Sweden – no R&D carried out abroad is included in the survey.

**Foreign-owned enterprises**

Foreign-owned enterprises are defined as enterprises in which a foreign investor holds more than half of the voting power in an enterprise. This is the OECD definition of foreign-owned enterprises. In the survey a unit represents one enterprise. Only enterprises with more than 50 employees are included in this R&D survey.

## List of Activities

The classification by activities has been made according to the Swedish Standard Classification of Economic Activities (SNI) which is based on the statistical classification of economic activities in the European Union, NACE Rev.1.

01-05,40-41	Agriculture, forestry, fishing, electricity, gas and water supply	34	Manufacture of motor vehicles, trailers and semi-trailers
10-37	Mining, quarrying and manufacturing	35	Manufacture of other transport equipments
10-14	Mining and quarrying	36-37	Other manufacturing industry
15-16	Manufacture of food, beverage and tobacco	36.1	Manufacture of furniture
15	Manufacture of food and beverages	33.20	Man. of instr. and appliances for measuring, checking, testing, navigating and other purposes, except ind. process control equipment
15.1-15.6	Processing and preserving of meat, fish, vegetable and animal oils, dairy and grain mill	45	Construction
15.8	Manufacture of other food products	50-99	Service sector
17-19	Textile, wearing apparel and leather industries	50	Sales and maintenance of motor vehicles, retail sale of fuel
17.4	Manufacture of made-up textile articles	51	Wholesale trade and commission trade except of motor vehicles
17.5	Manufacture of other textiles		
20	Manufacture of wood and wood products	51.43	Wholesale of electrical household appliances and radio and television goods
21	Manufacture of pulp, paper and paper prod.		
22	Manufacture of publishing, printing and reproducing industries	51.46	Wholesale of pharmaceutical goods
		51.47	Wholesale of other household goods
23-25	Manufacture of chemicals and petroleum products, rubber and plastic industries	51.51	Wholesale of solid, liquid and gaseous fuels and related products
23.2	Manufacture of refined petroleum products	51.53	Wholesale of wood, construction materials and sanitary equipment
24	Manufacture of chemicals and chemical prod.		
24.1-24.3	Manufacture of basic chemicals, pesticides, paints, varnishes and similar coatings, printing ink and mastics	51.64	Wholesale of office machinery and equipment
		51.65	Wholesale of other machinery for use in industry, trade and navigation
24.41-24.42	Manufacture of pharmaceutical products and preparations	52	Retail trade
25	Manufacture of rubber and plastic products	55	Hotels and restaurants
26	Manufacture of other non-metallic mineral products	60-62	Land, sea and air transportation
		63-64	Travel agencies, forwarding agencies, post and telecommunications
27	Basic metal industries		
28-35	Manufacture of fabricated products, machinery and equipment	63.1-63.4	Supporting and auxiliary transport activities, activities of travel agencies
28	Manufacture of fabricated metal products except machinery and equipment	64.20	Telecommunications
		65-67	Financial intermediation
29	Manufacture of machinery and equipment	70	Real estate activities
30-33	Manufacture of electrical and optical equip.	71-72	Renting companies, dataconsultancy
30	Manufacture of office machinery and computers	71.33	Renting of office machinery and equipment including computers
30.01	Manufacture of office machinery	72.10	Hardware consultancy
30.02	Manufacture of computers and other information processing equipment	72.20	Software consultancy and supply
		72.30	Data processing
31	Manufacture of electrical machinery and apparatus n.e.c	72.40	Data base activities
		72.50	Maintenance and repair of office, accounting and computing machinery
31.30	Manufacture of insulated wire and cable		
32	Manufacture of radio, television and communication equipment and apparatus	72.60	Other computer related activities
		73-74	Research and development, other business activities
32.10	Manufacture of electronic valves and tubes and other electronic components	74.11-74.15	Law and business consultancy firms, holding companies
32.20	Manufacture of television and radio transm. and app. for line telephony and telegraphy	74.2-74.3	Architectural and engineering activities, technical testing and analysis
32.30	Man. of TV and radio receivers, sound or video rec. or reprod. app. and ass. goods	74.4	Advertising
33	Manufacture of medical, precision and optical instruments, watches and clocks	74.7	Industrial cleaning
		74.8	Other business activities n.e.c
33.30	Manufacture of industrial process control equipment	75-99	Other service activities