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Research and development at international enterprises 2003

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Research and Development at International Enterprises 2003

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Summary

Studies of R&D at international enterprises are organised into three separate areas. Two are at group level – one examines on 20 major Swedish controlled enterprise groups and the other eight major foreign controlled enterprise groups (new study). In the third, ITPS's register of foreign controlled enterprises is run against SCB's regular R&D survey, which looks at legally constituted enterprises with 50 employees or more.

In 2003, Sweden's total investments in R&D were still among the highest in the world relative to GDP, despite a fall from 4.3 per cent to 4 per cent. Sweden's total R&D expenditure amounted to SEK 97 billion in that year. Enterprises accounted for the major share (around 75 per cent), and its expenditure was also down from 2001. Between 2001 and 2003, R&D expenditure at enterprises declined from SEK 75 billion to SEK 72 billion, a fall of 8 per cent in fixed prices.

In 2003, the 20 largest Swedish controlled enterprise groups reduced their R&D expenditure by just over 20 per cent both in Sweden and abroad, indicating that their R&D investments remain higher in Sweden than abroad. In terms of R&D personnel, the reduction was higher abroad than in Sweden. The areas of highest R&D investment are the EU 15, the USA and the Nordic region.

A recent survey of 8 major foreign controlled groups shows that in the 1993-2003 period, R&D expenditure in these groups increased from 20 to 35 per cent of the total for manufacturing industry, while R&D person-years rose from 16 to 25 per cent.

The study running ITPS's register of foreign controlled enterprises against SCB's regular R&D survey reveals that 45 per cent of R&D expenditure in Swedish business sector was foreign controlled in 2003. In 2001, the corresponding figure was 41 per cent.

Swedish enterprise groups expand their R&D activities mainly through acquisitions of enterprises with an R&D programme. Reductions of R&D in Sweden take place within existing operations, and abroad via relocation or sale of R&D activities. Foreign controlled groups generally increase their R&D operations in Sweden through expansion of existing activities.

The question, as to which government measures are felt by the groups to be the most urgently needed to enable the groups to maintain or expand their R&D expenditure in Sweden, brought different responses. Those advocated by Swedish controlled groups were tax breaks and training/education initiatives, while foreign enterprise groups mentioned the need for financed research at universities and various institutions and Sweden's ability to attract foreign experts.

Introduction

The following report presents statistics on research and development at international enterprises, i.e. Swedish controlled enterprises with subsidiaries abroad and foreign controlled enterprises in Sweden. The report is structured in three sections:

- **R&D at major Swedish controlled manufacturing groups:** This section is based on a questionnaire, sent to the twenty largest Swedish controlled enterprise groups in manufacturing industry – those that are engaged in R&D activities – concerning the number of employees abroad. These groups account for a major share of total R&D resources in Swedish business sector. The data relates to R&D person-years and R&D expenditure in Sweden and abroad. The survey is carried out every two years.
- **R&D at major formerly Swedish controlled manufacturing groups:** This section is based on a questionnaire sent to eight major foreign controlled enterprise groups. The common denominator for these groups is that they were formerly Swedish controlled and formed part of the population "R&D at major Swedish controlled manufacturing groups". The data relates to R&D personnel and R&D expenditure in Sweden. This survey, presented for the first time here, refers to the year 2003.
- **R&D at Swedish and foreign controlled enterprises in Sweden:** This section is based on information from SCB's regular R&D survey, comprising classifications into foreign controlled, Swedish controlled international and domestic enterprises. The survey extends over around 1,700 enterprises with 50 employees or more in Sweden.

Definitions

Foreign controlled enterprises**:** Enterprises that are controlled by one or more foreign owners via ownership of 50 per cent or more of the voting rights represented by the shares.

Swedish controlled international enterprises**:** Swedish controlled enterprises with at least one subsidiary and at least one employee abroad.

Domestic enterprises: Swedish controlled enterprises without subsidiaries abroad. This category also includes industrial research institutions serving the enterprise sector.

R&D at major Swedish controlled manufacturing groups 2003

International enterprises dominate R&D in Sweden

Among OECD countries, Sweden is still the top investor in R&D relative to GDP, a placing the country has held for ten years. This is despite a decline in total R&D as a share of GDP[1] in Sweden from 4.3 per cent to 4 per cent between 2001 and 2003. Enterprises account for the major share of Sweden's investments in R&D, and it was in the business sector that the decline relative to 2001 occurred. Roughly three quarters of R&D takes place in the business sector. In addition, R&D investments in Sweden are highly concentrated among a few major internationally active enterprise groups, measured by both expenditure and personnel.

The dominance of Swedish R&D programmes linked to major manufacturing enterprise groups is clear. In 2003, twenty major Swedish controlled enterprise groups invested SEK 47.4 billion in R&D, of which SEK 27 billion in Sweden. This may be viewed in the context of the SEK 58 billion for manufacturing industry as a whole or the SEK 72 billion for business sector as a whole.

The major Swedish enterprise groups, most of which operate in the engineering industry, account for just over half of R&D expenditure and person-years, respectively, in Swedish manufacturing industry[2]. The enterprise groups' shares of R&D in business sector overall[3] measured by expenditure and person-years were 37 and 40 per cent, respectively. The dominance of a few enterprise groups is considerable. The six largest enterprise groups together accounted for a share of around 45 per cent of the manufacturing industry.

[1] *It should be observed that R&D expenditure relative to GDP is a ratio that is influenced not only by changes in R&D expenditure but also by changes in the GDP.*
[2] *R&D activities in the business sector (SCB's regular R&D survey) excludes enterprises with fewer than 50 employees, while the survey of the 20 largest enterprise groups includes all enterprises meeting the criteria of the category, irrespective of size. This implies a certain overestimation of the dominance by the groups.*
[3] *The business sector also includes industrial research institutions.*

Figure 1 Share of R&D person-years in manufacturing industry at the major enterprise groups in Sweden 1995–2003

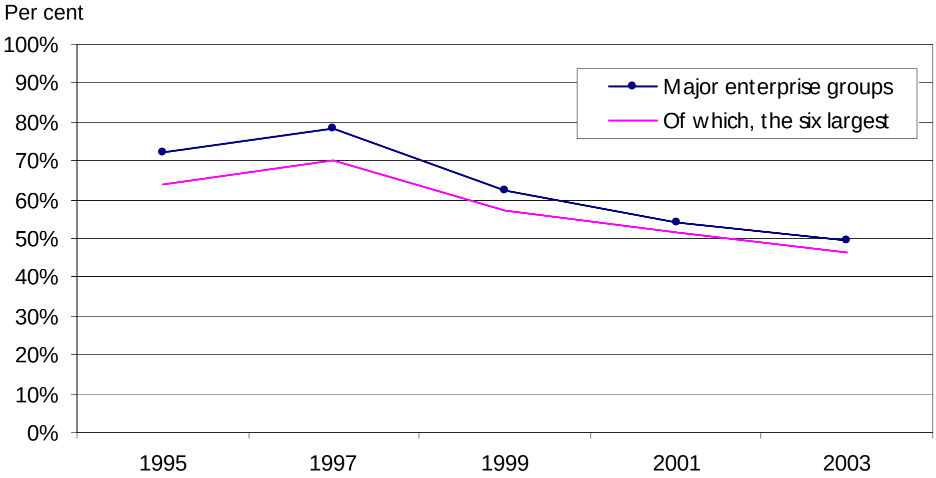
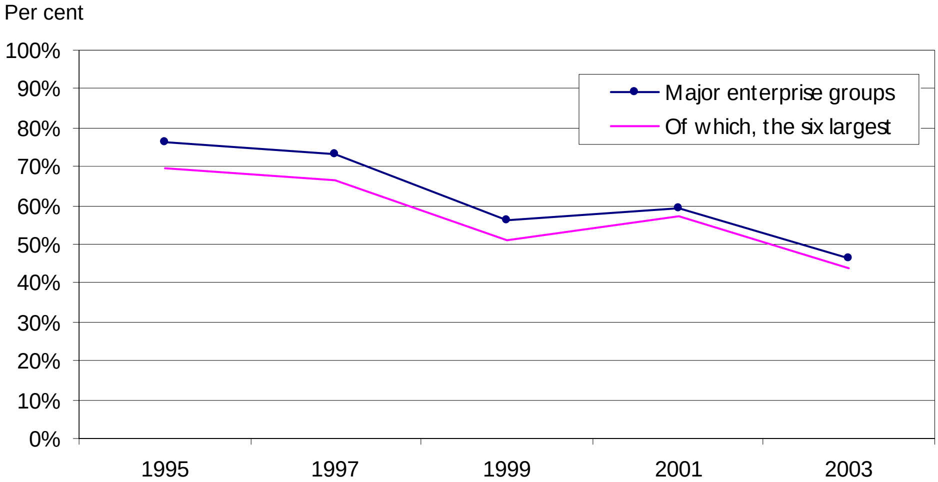


Figure 2 Share of R&D expenditure in manufacturing industry at the major enterprise groups in Sweden 1995-2003



Note: The decline from 1997–2001 owed largely to the fact that a number of major Swedish enterprise groups were taken over by foreign owners. The decline in the 2001–2003 period was real, in that the population was mainly unchanged in these years.

In a comparison over time, it is important to bear in mind that the population of enterprise groups included in the study has changed, above all because a number of Swedish controlled groups have gone into foreign control. In several cases, a major Swedish enterprise group has been taken over by a foreign owner. As a result, a new group with R&D activities on a lesser scale has come within the compass of the study. This is an important factor in the negative trend of R&D expenditure shown in the figures above. Between 2001 and 2003, however, no major changes took place in the population, indicating that R&D at the groups surveyed in the 2003-2001 period underwent a real decline.

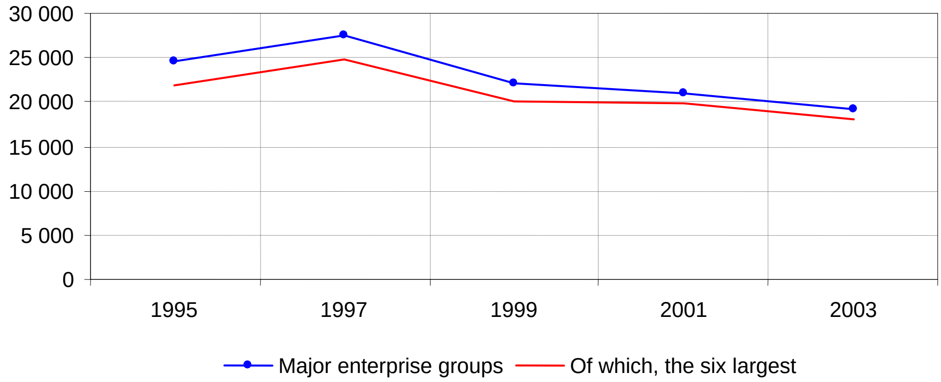
The less-intense concentration of R&D within major Swedish controlled enterprise groups in the business sector is mainly because groups have gone into foreign control and thus no longer fall within the population of major Swedish controlled manufacturing groups. The groups taken over by foreign owners were also sent questionnaires, partly to shed light on developments after the change of control. The results are reported in section 2: R&D at major foreign controlled manufacturing groups.

R&D at major Swedish enterprise groups in Sweden and abroad

The number of R&D person-years performed – both in Sweden and abroad – at the 20 largest Swedish enterprise groups totalled 30 803 in 2003, compared to 40 037 in 2001. The groups' R&D investments are still higher in Sweden than abroad. In 2003, 19 085 person-years were performed in Sweden and 11 718 abroad. These figures may be compared with the 20 923 in Sweden and 19 114 abroad in 2001, showing a much greater decrease in R&D person-years abroad than in Sweden. The decline abroad may be in part explained by under-representation in the data collected via the questionnaires.

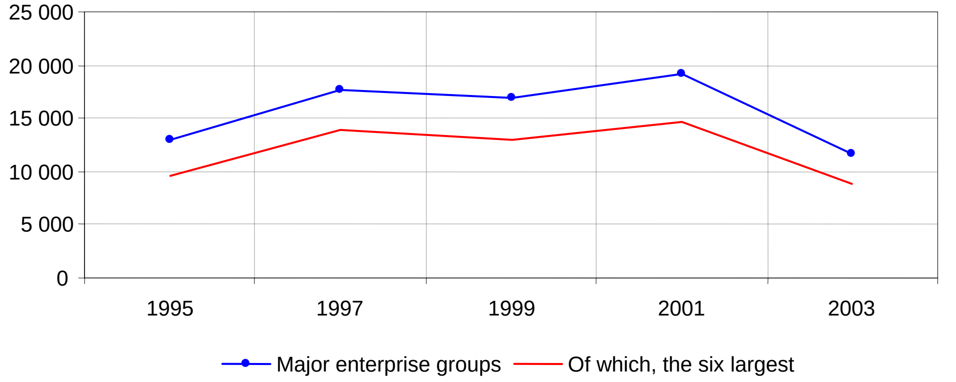
The R&D expenditure of the major enterprise groups has fallen both in and outside Sweden. In 2003, the groups spent – both in Sweden and abroad – SEK 47 billion in R&D, of which SEK 27 billion was invested in Sweden. In 2001, SEK 60 billion was invested in R&D, including SEK 35 billion in Sweden. This indicates a reduction of 22 per cent for the groups overall, both in Sweden and abroad.

Figure 3 R&D person-years at the major Swedish enterprise groups in Sweden 1995–2003. Person-years



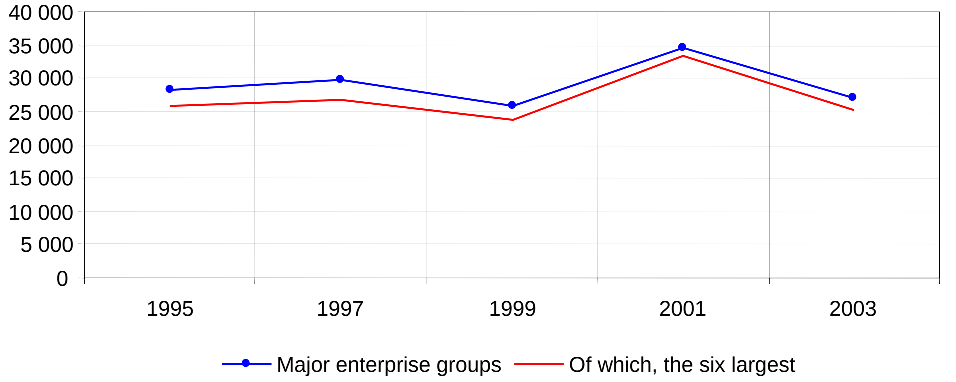
Note: The decline from 1997–2001 owed largely to the fact that a number of major Swedish enterprise groups went into foreign control. The decline in the 2001–2003 period was real in that the population was mainly unchanged in these years.

Figure 4 R&D person-years at the major Swedish enterprise groups abroad 1995–2003. Person-years



Note: The decline from 1997–2001 owed largely to the fact that a number of major Swedish enterprise groups went into foreign control. The decline in the 2001–2003 period was real in that the population was mainly unchanged in these years.

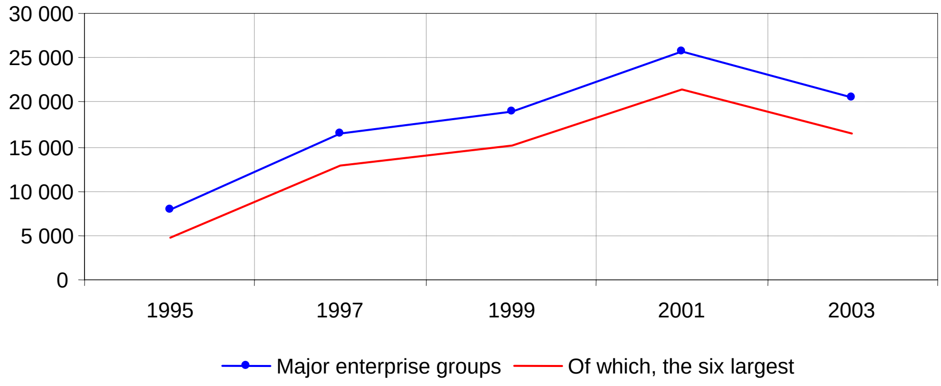
Figure 5 R&D expenditure at the major Swedish enterprise groups in Sweden 1995–2003. SEK m.



Note: The decline from 1997–2001 owed largely to the fact that a number of major Swedish enterprise groups went into foreign control. The decline in the 2001–2003 period was real in that the population was mainly unchanged in these years.

The increase in 1999–2001 and the decrease in 2001–2003 to a certain extent owes to the use of consultants in enterprises' own R&D activities. Consultancy costs are normally accounted for only as an expenditure item – under consultancy fees – and not under personnel costs, as a result of which the same development is not reflected in diagram 3, R&D person-years in Sweden.

Figure 6 R&D expenditure at the major Swedish enterprise groups abroad 1995–2003, Mnkr



Note: The decline from 1997–2001 owed largely to the fact that a number of major Swedish enterprise groups went into foreign control. The decline in the 2001–2003 period was real in that the population was mainly unchanged in these years.

Table 1 R&D person-years and R&D expenditures at the major Swedish enterprise groups, with expenditure (SEK billion) and number of employees 1999–2003

Location	**R&D expenditure**			**R&D person-years**			**Average number of employees**		
	2003	2001	1999	2003	2001	1999	2003	2001	1999
Total, world	**47**	**60**	**45**	**30 803**	**40 037**	**38 846**	**475 629**	**548 683**	**532 720**
Sweden	**27**	**35**	**26**	**19 085**	**20 923**	**22 022**	**119 398**	**137 312**	**153 617**
Abroad	**20**	**26**	**19**	**11 718**	**19 114**	**16 824**	**356 231**	**411 371**	**379 103**
EU15	11	12	9	7 053	10 475	8 814	161 368	187 745	168 324
NAFTA	7	11	7	2 941	5 708	5 660	93 226	103 980	102 125
Nordic region	2	3	2	1 103	2 304	1 669	16 718	19 281	20 214

Note: Some Swedish enterprise groups went into foreign control during 1999–2001. Denmark and Finland are included in the data for both the Nordic region and the EU 15.

Equal decline in R&D expenditure in Sweden and abroad

R&D expenditure shows an equal decline – of around 22 per cent – in and outside Sweden. The more or less stable trend of person-years relative to expenditure in Sweden is attributable above all to the use of consultants in R&D activities. In 1999–2001, the use of consultants rose sharply as enterprises expanded their R&D programmes, but consultants also accounted for the major share of the decline when R&D activities were scaled down in 2001–2003.

The major enterprise groups cut back their R&D personnel in most major countries. In the NAFTA region[4], R&D personnel underwent substantial reductions in 2003. The decline in R&D person-years is higher than the decrease in the number of employees in the region. Within NAFTA, the highest reductions took place in the USA. Otherwise, the USA is the country from which the major enterprise groups conduct most R&D activities abroad. Other countries in which the major enterprise groups conduct substantial R&D operations are Germany, Italy and France, together with the Nordic region, excluding Sweden. R&D activities

[4] *USA, Canada and Mexico*

in other, non-EU and –NAFTA countries remain on a relatively small scale, and these countries, too, reported a decline in 2001–2003, although some regions showed an increase.

The major enterprise groups' R&D activities in Eastern Europe and Asia (excluding Japan) rose sharply between 1997 and 2001. This increase tailed off somewhat in 2003. In Asia (excluding Japan), R&D activities expanded by 9 per cent in 2001–2003. In Eastern Europe, the increase was about 30 per cent in this period. However, the increase in Eastern Europe in 1999-2001 was just 13 per cent, while R&D in Asia more than doubled in the same period. Even if the increase was high in percentage terms, the scale of R&D operations remains relatively low in these regions.[5]

Figure 7 R&D expenditure at major Swedish enterprise groups by Sweden and foreign region 1995–2003, SEK million

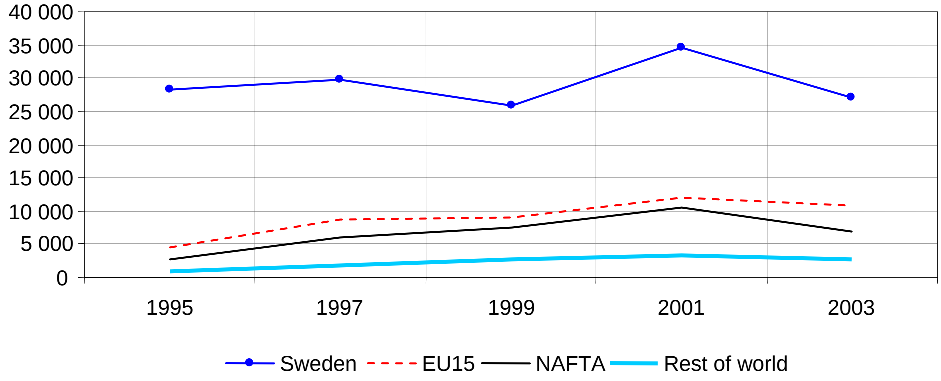
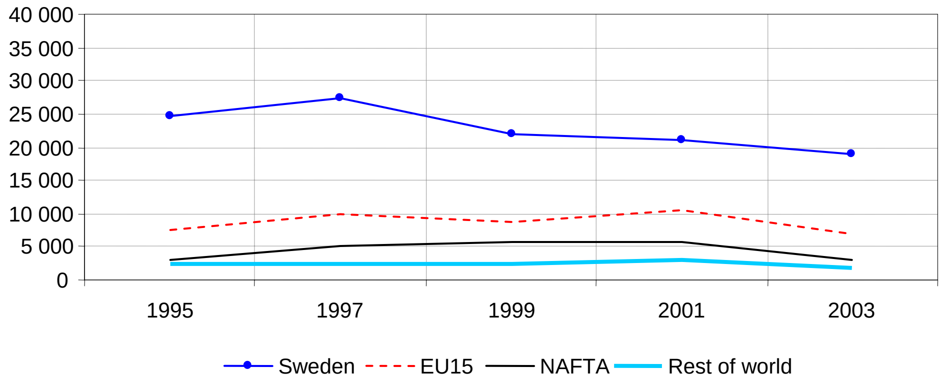


Figure 8 R&D person-years at major Swedish enterprise groups by Sweden and foreign region 1995–2003

Person-years



Internationalisation of research and development

Total R&D expenditure by the major enterprise groups on intramural (in-house) R&D totalled fully SEK 47 billion in 2003, of which Sweden accounted for SEK 27 billion. The Swedish share of R&D performed by the major enterprise groups remained roughly the same in 2003 as in 2001, at around 57 per cent. The degree of internationalisation of R&D varies sharply among the groups. The following is an alternative classification, by degree of R&D conducted abroad:

[5] *For reasons of confidentiality, no figures are presented for these regions.*

- Groups with a high percentage of R&D abroad, i.e. 50 per cent or more.
- Groups with a low percentage if R&D abroad, i.e. less than 50 per cent.

In 2003, 8 out of 20 groups performed more than half of their R&D abroad, unchanged from 2001. These groups carried out close to 75 per cent (80 per cent in 2001) of their R&D activities abroad, accounting for 11 per cent (9 per cent in 2001) of total R&D expenditure by the major enterprise groups.

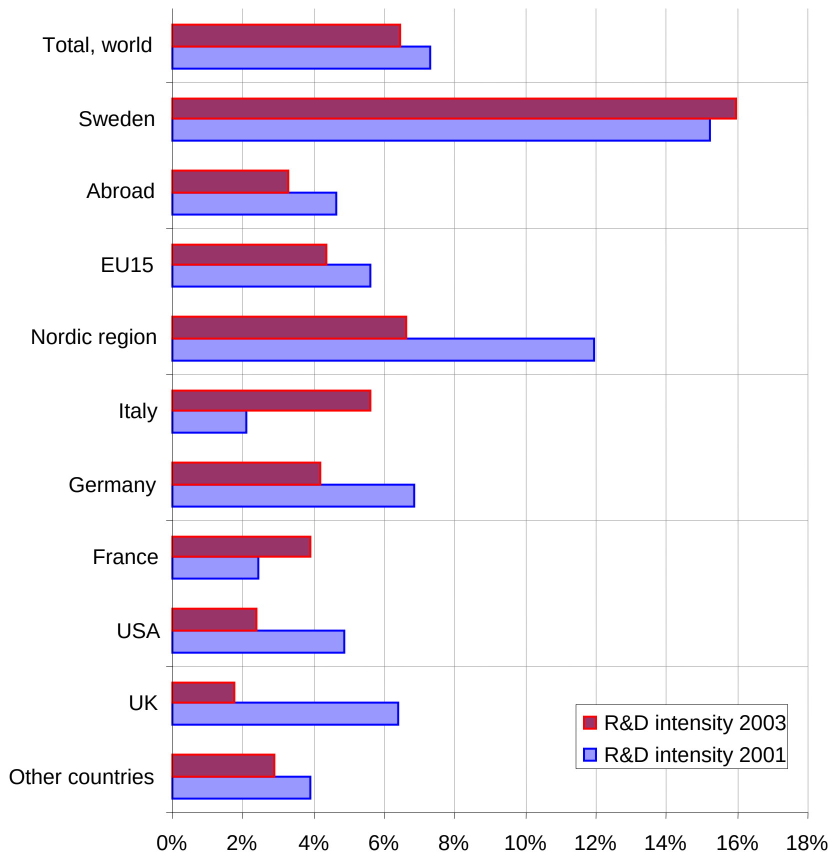
The second category – groups with a low degree of R&D activities abroad –nevertheless comprises those that invest most in R&D overall. In these groups, the proportion of R&D activities conducted abroad was 39 per cent, the same as in 2001. The category consists of 2-3 enterprise groups that account for a large share of R&D investment overall among the major groups.

R&D intensity much higher in Sweden than abroad

R&D intensity refers to the percentage of available resources that are invested in research and development. R&D intensity is measured here as R&D person-years relative to the total number of employees.[6] The R&D intensity at the major enterprise groups was substantially higher in Sweden than abroad. R&D intensity in Sweden totalled 16 per cent in 2003, as against just 3 per cent abroad. Outside Sweden, R&D intensity at major enterprise groups was highest in the other Nordic countries and Italy.

[6] *R&D intensity is a ratio that is determined not only by R&D person-years but also by the total number of employees. This implies that R&D intensity may decline even if R&D person-years rise sharply. It should also be borne in mind that R&D intensity will vary substantially among different industry categories, as well as among different enterprise groups within the same industry category.*

Figure 9 R&D intensity at major Swedish enterprise groups by country 2001 and 2003
(R&D person-years/number of employees)



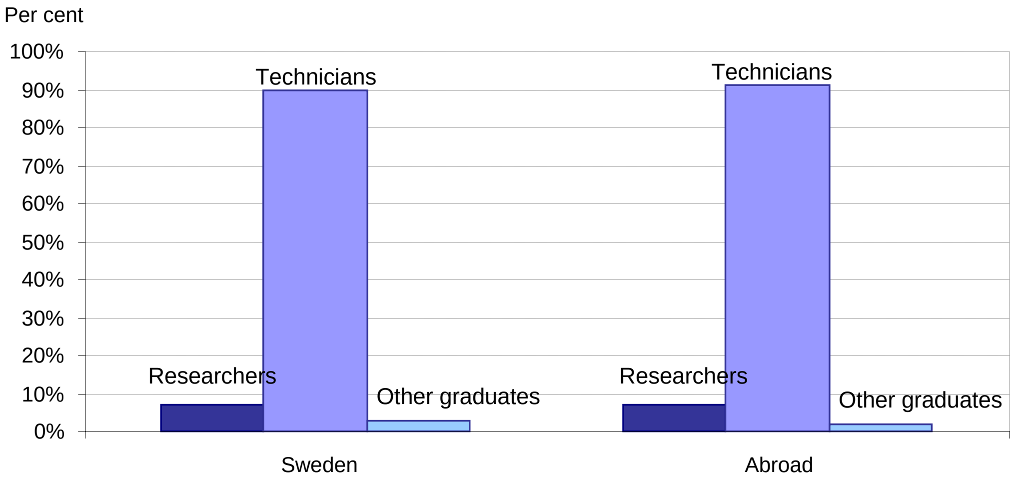
Technical qualifications most common

In all, 30 803 R&D person-years were performed at the major Swedish enterprise groups in Sweden and abroad in 2003, of which 18 320 were performed by university graduates. This represents a quota of just over 60 per cent, which is in line with the business sector as a whole in Sweden.

In Sweden, the structure of educational qualifications does not differ markedly from that in other countries, on an overall level. However, regional deviations occur. For example, the proportion of university graduates is higher in the Nordic region (68 per cent) than in the EU (61 per cent) and NAFTA (60 per cent). Similarly, the proportion of postgraduates (PhD) is somewhat higher in Sweden and the rest of the Nordic region (5 per cent) than in the EU and NAFTA (4 per cent).

The proportion of researchers is somewhat lower at the major Swedish enterprise groups than the average for the business sector in Sweden. This is because a considerably higher proportion of researchers are engaged in R&D in the pharmaceutical industry, which is largely foreign controlled, but research institutions (which include industrial research institutions) also carry out R&D using a considerably higher proportion of researchers. Of the university graduates without a PhD, the majority have technical qualifications. In this context, “technical qualifications” include all categories of technicians, including architectural diplomas. It is difficult, however, to find Swedish equivalents for qualifications from other countries, and so caution should be exercised in interpreting information in this area.

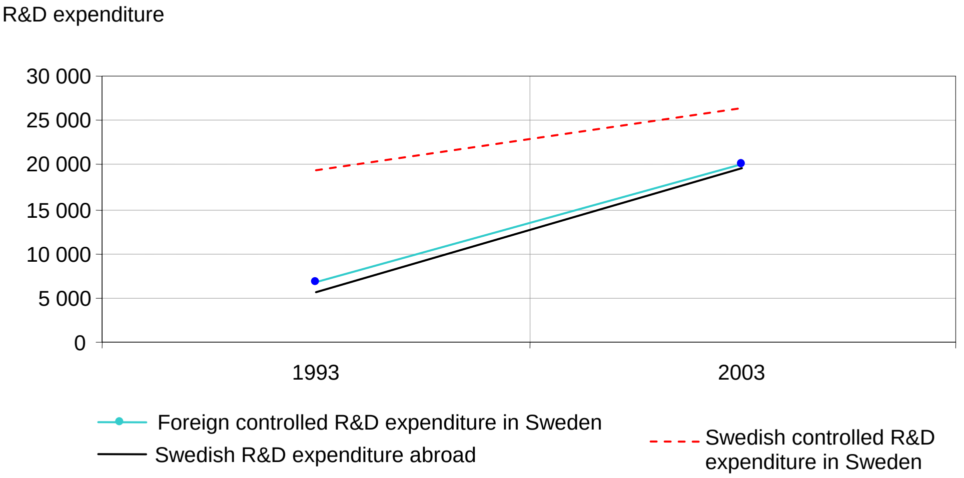
Figure 10 Structure of educational qualifications among university graduates engaged in R&D activities at major Swedish enterprise groups 2003



R&D at major foreign controlled manufacturing groups 2003

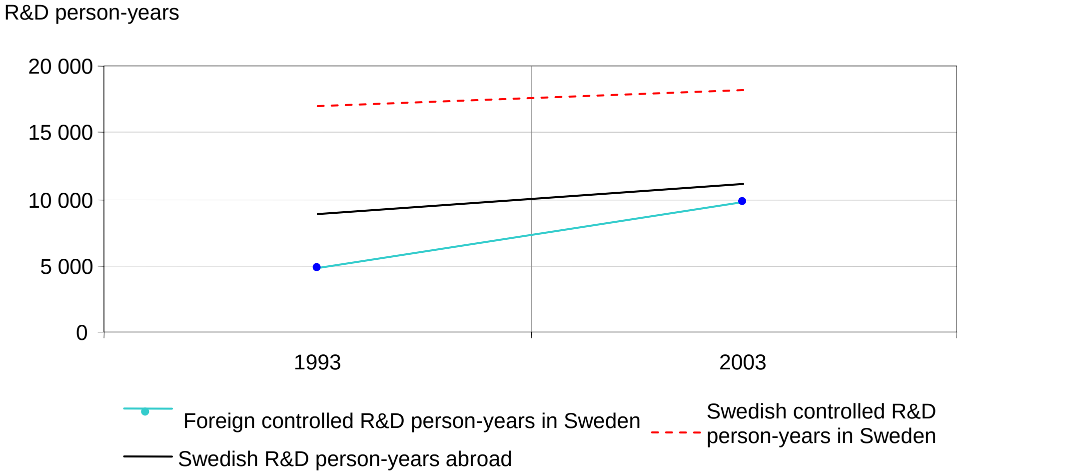
This section is based on a questionnaire-format survey conducted for the first time among eight formerly Swedish-, and now foreign controlled manufacturing groups in Sweden for the reference year 2003. The common denominator for these groups is that they were all formerly Swedish controlled and formed part of the population of R&D at major Swedish controlled manufacturing groups. The data refers person-years and expenditure for R&D conducted in Sweden.

Figure 11 R&D expenditure at 11 Swedish controlled in Sweden and abroad and 8 major foreign controlled enterprise groups in Sweden in 1993 and 2003, fixed prices – a comparison. SEK million



Note – Swedish controlled: Only includes those major enterprise groups that had been Swedish controlled during the entire period of comparison, i.e. for ten years or more. Note – Foreign controlled: In the case of those enterprise groups that went into foreign control during the period of comparison, figures in R&D have been obtained from SCB"s regular R&D survey. This survey includes only enterprises with 50 employees or more.

Figure 12 R&D person-years at 11 Swedish controlled in Sweden and abroad and 8 major foreign controlled enterprise groups in Sweden in 1993 and 2003 – a comparison



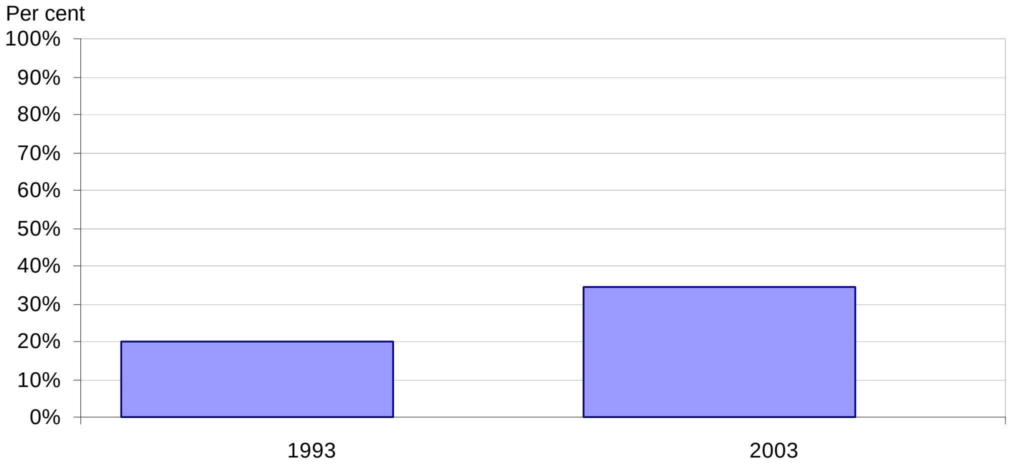
Note –Swedish controlled: Only includes those major enterprise groups that had been Swedish controlled during the entire period of comparison, i.e. for ten years or more. Note – Foreign controlled: In the case of those enterprise groups that went into foreign control during the period of comparison, figures in R&D have been obtained from SCB''s regular R&D survey. This survey includes only enterprises with 50 employees or more.

The figures above illustrates the trend in the major foreign controlled enterprise groups surveyed, relative to the trend in Swedish controlled enterprise groups surveyed.[7] The increase among major foreign controlled enterprise groups was somewhat higher than for major Swedish controlled enterprise groups, in terms of both of R&D expenditure and R&D person-years. The R&D expenditure of the foreign controlled groups rose from SEK 6 852 million to SEK 20 million in fixed prices, an increase of 190 per cent. The increase in R&D expenditure at the major Swedish-controlled enterprise groups in the same period was 35 per cent, from SEK 19 476 million to SEK 26 292 million. However, the above comparison is based on certain simplifications and must be interpreted cautiously.

R&D person-years performed by major foreign and Swedish controlled enterprise groups, respectively, show the same pattern as for R&D expenditure. At the foreign controlled groups, R&D person-years doubled from 4 822 to 9 741, while the increase at the Swedish controlled groups was 7 per cent, from 16 979 to 18 210. One development that was common to all major enterprise groups, whether Swedish or foreign controlled, is that the increase in R&D expenditure recorded is higher than the increase for person-years, even after an adjustment for inflation.

[7] *The primary purpose of the figures is to illustrate differences in the respective trends for major Swedish and foreign controlled enterprise groups, and not differences in levels between these categories.*

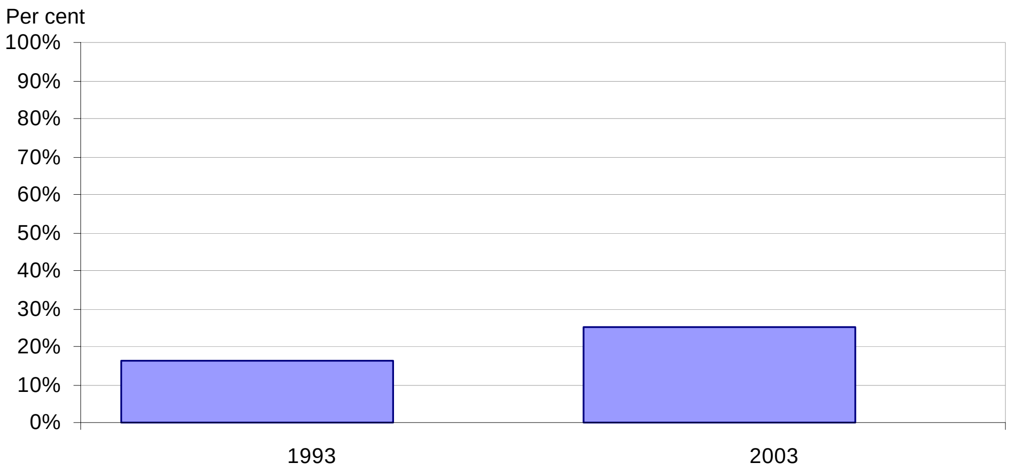
Figure 13 R&D expenditure at major foreign controlled enterprise groups as a share of total 1993–2003



Note: This comparison must be interpreted cautiously. Some of the enterprise groups included above were not surveyed in 1993. In those cases, the information has been supplemented by data from SCB''s regular R&D survey of enterprises.
***Enterprise groups surveyed**: AstraZeneca, ABB, Volvo Car (Ford), AGA (Linde), Pharmacia (Pfizer), Stora Enso, BT Industries (Toyoda), Svedala Industri (Metso).*

The share of industry's R&D expenditure represented by the major foreign controlled enterprise groups surveyed was 35 per cent in 2003. In 1993, the share represented by these enterprise groups totalled 20 per cent. A sharp increase is also recorded for R&D person-years between 1993 and 2003, from 16 per cent to 25 per cent.

Figure 14 R&D person-years at major foreign controlled enterprise groups as percentage of total



Note: This comparison must be interpreted cautiously. Some of the enterprise groups included above were not surveyed in 1993. In those cases, the information has been supplemented by data from SCB''s regular R&D survey of enterprises.
***Enterprise groups surveyed**: AstraZeneca, ABB, Volvo Car, AGA, Pharmacia, Stora Enso, BT Industries, Svedala Industri.*

R&D activities by the foreign controlled enterprise groups in Sweden amounted on average to 11–12 per cent of the groups' global R&D. However, variations among the groups are considerable. The corresponding share for major Swedish controlled enterprise groups in Sweden is more than 50 per cent.

Table 2 R&D activities in Sweden by foreign (formerly Swedish) controlled groups 2003

Regional breakdown	**R&D expenditure SEK million**	**Number of R&D person-years**			
			Of which University graduates ≥ 3 years		Researchers
			Total	Of which technicians	
8 major foreign controlled groups in Sweden	**20 007**	**9 741**	**4 226**	**3 171**	**1 310**
R&D activities in Sweden, as a share of their global R&D activities, %	**12**	**11**			

Note: In the case of groups that only provided an estimated percentage for R&D expenditure, the same percentage has also been used for person-years.

Changes in R&D and the role of the government

The largest Swedish controlled manufacturing groups and major foreign controlled manufacturing groups were requested to respond to questions about how and why changes in R&D activities had taken place in different countries. In addition, a question was posed regarding the government's ability to influence the scale of the groups' R&D activities in Sweden.

Expansion of R&D activities at Swedish enterprise groups mostly takes place via the acquisition of enterprises that include R&D activities. In Sweden, R&D activities decline within existing operations, and abroad via relocation or the sale of businesses. Foreign controlled enterprise groups generally expand their R&D activities in Sweden by increased investment in existing business.

The most common reasons why Swedish controlled enterprise groups increase R&D activities abroad are that the company must have a presence in the country to be able to adapt a product or process to specific customer/market requirements and that production units need their own R&D capacity. The reasons most usually quoted by the foreign groups for increasing R&D activities in Sweden are that production units need their own R&D capacity, and access to research at universities, colleges and other institutions.

Table 3 How and why R&D activities have changed in Sweden and abroad between 2001 and 2003

How have major changes of R&D activities been made between 2001 and 2003	Number of responses		
	Major Swedish enterprise groups abroad	Major Swedish enterprise groups in Sweden	Foreign controlled enterprise groups in Sweden
Increases			
Acquisition of enterprise incorporating R&D activities	6	3	1
The group established new R&D activities	3	0	0
The group increased R&D activities within existing business	2	1	4
The group relocated R&D activities to this country	0	1	0
Decreases			
Sale of business incorporating R&D	4	1	2
Closure of business incorporating R&D	1	1	1
The group relocated R&D activities from this country	7	0	1
The group decreased R&D activities within existing business	3	3	2
No significant change	14	5	2
Total	**40**	**15**	**13**

Table 3 cont.

Most important reasons for big changes in R&D activities	Number of responses		
	Major Swedish enterprise groups abroad	Major Swedish enterprise groups in Sweden	Foreign controlled enterprise groups in Sweden
The group has to have a presence in this country to be able to adapt a product or process to specific customer/market requirements	18	1	
The group´s own production unit(s) required own R&D capacity	12	3	6
Access to research at universities, colleges and other institutions is necessary to meet the enterprise’s development needs	3	2	5
Access to skilled labour in R&D activities is available	3	1	1
Access to suppliers of advanced components and systems with in-house R&D capacity available	2	1	1
Other reasons		1	2
Total	**38**	**9**	**15**

Most enterprise groups that responded to the question felt that the government could take measures that would enable them to maintain or expand their R&D activities in Sweden, at least in the long term. The measures most commonly mentioned by Swedish controlled groups were tax concessions – for example in connection with the engagement of foreign experts – and financial support, generally to companies or within a specific product area. They also call for training initiatives and other measures to facilitate recruitment of individuals with the right skills and to maintain the infrastructure between universities, institutions and business, which also includes financing for research at those organisations.

There were two principal measures advocated by foreign controlled enterprise groups. The first was more government-funded research at universities and institutions, which also include the groups that had stated investments in applied research. The second measure listed by the groups was more government resources to attract foreign experts and postgraduate students.

Table 4 Are there any government measures that would enable your group to maintain or increase its investments in R&D in Sweden? Ranked by major enterprise groups as most urgent, by number of responses.

Major Swedish-controlled enterprise groups	**Responses**
Tax concessions, financial support	**5**
Training initiatives, individuals with right skills	**3**
Coordination/co-financing of universities/institutions/enterprises	**3**
Decreased tax burden for foreign R&D experts	**1**
Improved financial assistance to manufacturing industry	**1**
More investment in defence/defence materiel	**1**
Major foreign controlled enterprise groups	**Responses**
Increased State funding for research at universities and institutions and applied research	**5**
Attract foreign experts and researchers	**4**
Improvements to education in technical subjects	**1**
No discrimination against ownership of diesel powered vehicles	**1**
Favour research in the environmental field	**1**
Not to provide anti-competitive support to other enterprises	**1**

Note: Some groups have mentioned several measures and some groups did not reply.

R&D at Swedish and foreign controlled enterprises in Sweden

The following section is based on the results from SCB's survey of R&D at enterprises with 50 or more employees. The survey is conducted every two years. The results on R&D from the survey are presented here for Swedish and foreign controlled enterprises. The survey refers only to R&D conducted in Sweden.

Percentage of R&D at foreign controlled enterprises continues to rise

In 2003, R&D expenditure to a value of SEK 72 billion was conducted by enterprises in Sweden, with Swedish and foreign controlled enterprises accounting for SEK 39.3 billion and SEK 32.6 billion, respectively. Of the R&D performed by enterprises in Sweden, foreign controlled enterprises are accounting for an ever-larger share. In 2003, 45 per cent of R&D expenditure was foreign controlled, 41 per cent in 2001, 36 per cent in 1999 and 19 per cent in 1997. What we are witnessing is a steady rise in the internationalisation of business sector. If the trend continues, a larger share of Sweden's R&D will soon be under foreign, rather than Swedish, control. In manufacturing industry, more than 50 per cent of R&D expenditure are already foreign controlled. The trend is the same, whatever measure is chosen, expenditure or person-years (full-time equivalent in R&D).

Figure 15 R&D expenditure at foreign and Swedish controlled enterprises in Sweden 1995–2003

SEK bn

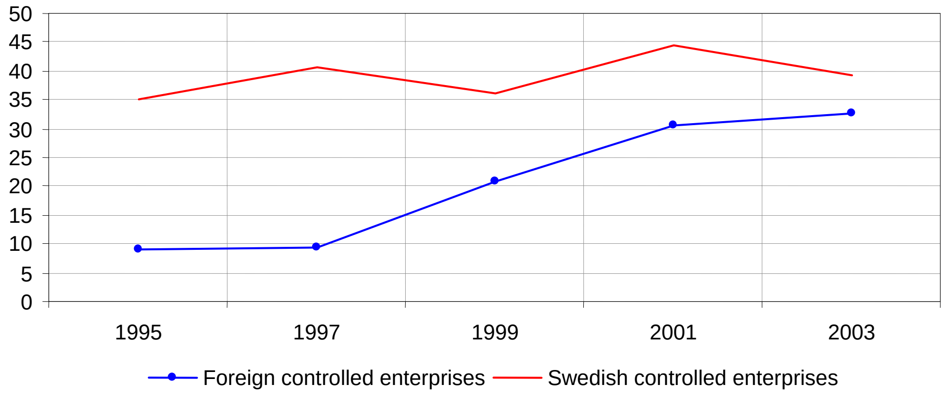
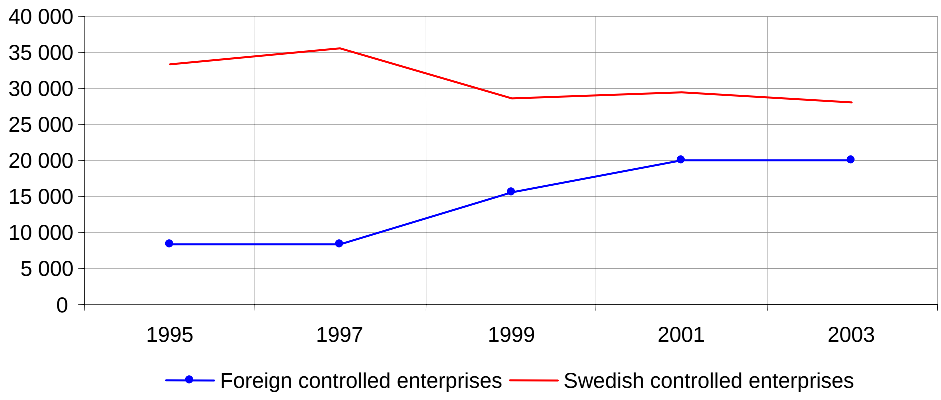


Figure 16 R&D person-years at foreign and Swedish controlled enterprises 1995–2003

Person-years



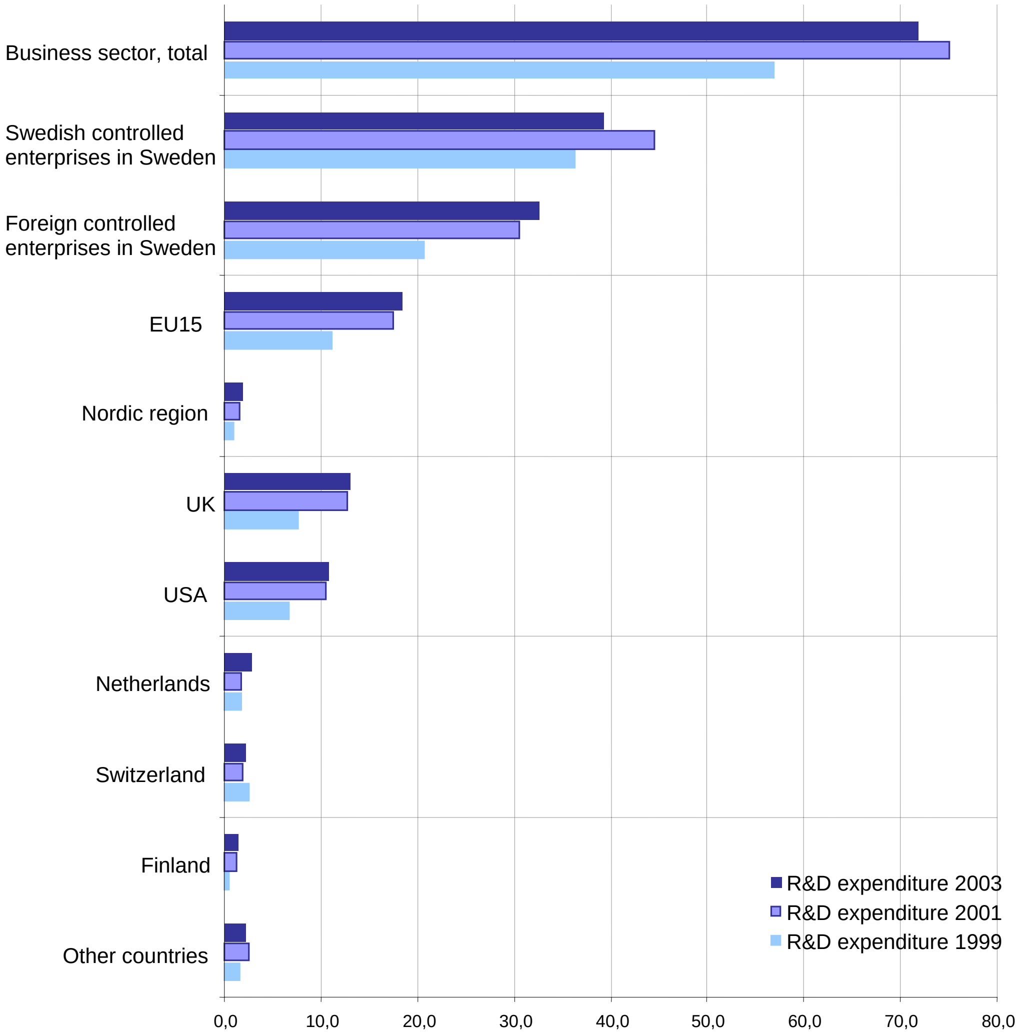
Note: The changes in 1997–1999 are attributable in large part to a number of foreign acquisitions of Swedish enterprise groups.

UK and USA dominate R&D activities in Sweden

The USA and the UK account for 73 per cent of expenditure and 66 per cent of person-years of the whole business sector in Sweden. Other major countries of origin include the Netherlands, Switzerland and Finland. Between 2001 and 2003, owners in the Netherlands accounted for the largest increase, but Finnish and Canadian owners also expanded their R&D activities in Sweden.

At the same time as the foreign control of R&D activities in Sweden is increasing, Swedish enterprises are also taking a larger stake in the control of R&D abroad. This development and trend are indicative of increased internationalisation of research and development.

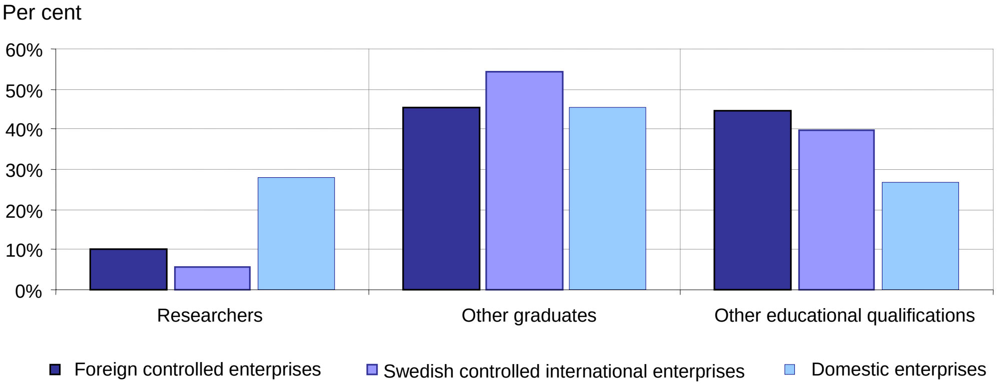
Figure 17 R&D expenditure at foreign and Swedish controlled enterprises in Sweden by country of origin 1999–2003. SEK billion



More graduates at Swedish controlled enterprises

A total of 48 113 person-years were performed in R&D in Sweden in 2003. Of that figure, university graduates accounted for 28 403. The percentage of graduates is somewhat higher at Swedish rather than foreign controlled enterprises. The category of graduates also includes those with the highest level of academic qualification, researchers. However, researchers are more commonly employed at foreign controlled enterprises. The percentages are more or less unchanged from those reported in the 2001 survey. The high level of academic qualification at other domestic enterprises is because the industrial research institutions are included. The industrial research institutions represent roughly half of the category.

Figure 18 Structure of academic qualifications among R&D personnel at foreign and Swedish controlled enterprises 2003



Note: Domestic enterprises include the industrial research institutions, whence the high proportion of postgraduate qualified personnel.

One in four for the ladies

One in four R&D person-years in Sweden is performed by a woman. Foreign controlled enterprises report a higher proportion of women R&D personnel than the Swedish controlled ones. However, the highest proportion is found among domestic enterprises. The extent of the changes since 2001 is very minor. The reason why a higher proportion of women are employed in R&D programmes at foreign controlled enterprises is to be found in the structure of industries. For example, women represent a high percentage of personnel in R&D in the pharmaceutical sector, a sector that is largely under foreign control in Sweden. The same pattern is found in person-years in research as for person-years in R&D. It should be observed, however, that the proportion of women is higher in research.

Table 5 Number of person-years in R&D activities 2003

Businesss sector	**Number and share of person-years in R&D**				
	Women	%	Men	%	Total
Business sector, total	**12 067**	***25***	**36 046**	***75***	**48 113**
Foreign controlled enterprises	6 128	*31*	13 862	*69*	19 990
Swedish controlled international enterprises	4 660	*19*	20 227	*81*	24 888
Domestic enterprises	1 278	*40*	1 957	*60*	3 235

Table 6 Number of person-years in research 2003

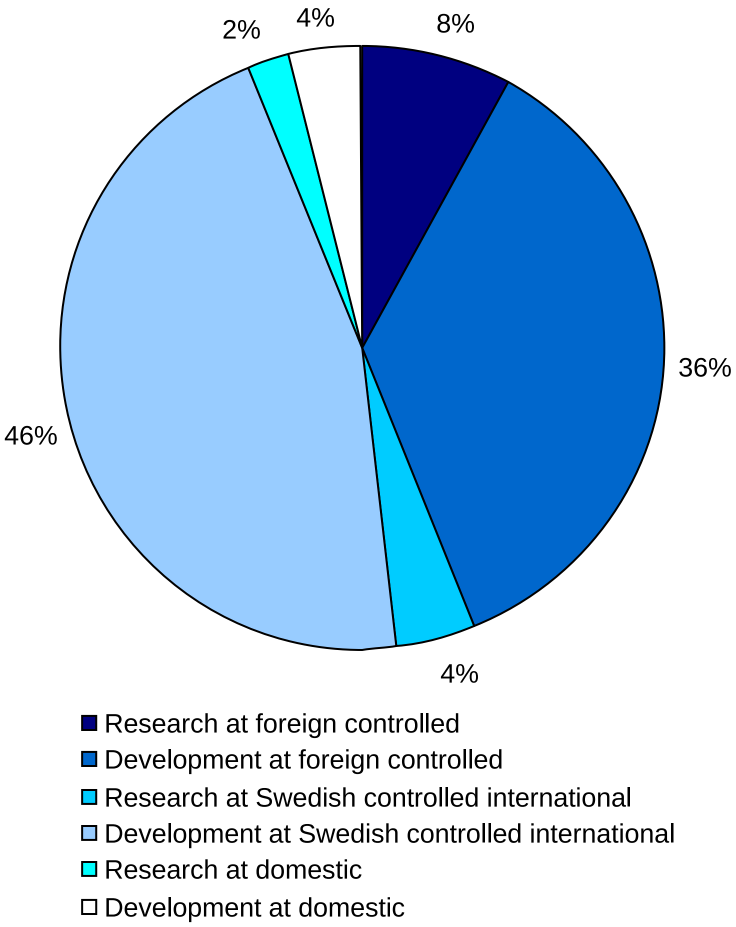
Business sector	**Number and share person-years in research**				
	Women	%	Men	%	Total
Business sector, total	**2 204**	***38***	**3 581**	***62***	**5 785**
Foreign controlled enterprises	1 138	*44*	1 421	*56*	2 559
Swedish controlled international enterprises	501	*27*	1 322	*72*	1 824
Domestic enterprises	565	*40*	837	*60*	1 402

Note: Domestic enterprises include the industrial research institutes.

Reduced resources going to research

Enterprises are spending an increasingly low proportion of their resources on research, as against development. In 2003, 12 per cent was spent on research and the remaining 88 per cent on development activities. This represents a considerable decline from 1999, when research accounted for 17 per cent of R&D. Foreign controlled enterprises perform twice as much research as Swedish controlled international enterprises. The largest proportion of research – relative to development – was carried out by domestic enterprises. This is because this category includes the industrial research institutes, which on average conduct more research than development activities.

Figure 19 Expenditure on Research and Development in 2003, by owner, per cent



Note: Domestic enterprises include the industrial research institutions.

Knowledge intensive sectors dominate R&D in industries

In 2003, R&D expenditure by enterprises amounted to SEK 72 billion. Knowledge intensive R&D dominates at both Swedish- and foreign controlled enterprises. Knowledge intensive R&D accounted for 90 per cent of all R&D at foreign controlled enterprises, 88 per cent at Swedish controlled international enterprises and 90 per cent at domestic enterprises. These shares have been relatively stable, subject to upward or downward fluctuations of a percentage point of so, for several years. Otherwise, more capital intensive R&D is performed than labour-intensive.[8]

[8] *For reasons of confidentiality, capital-intensive and labour intensive services have had to be combined with other operations.*

Table 7 R&D expenditure 2003 by foreign controlled, Swedish controlled international and domestic enterprises, and by industry sector, SEK million.

Industry sector	**Labour costs**			**Other operating costs and investments (in R&D)**			**Total R&D expenditure**		
	Foreign controlled enter-prises	Swedish contolled international enterprises	Domestic enterprises	Foreign controlled enter-prises	Swedish contolled international enterprises	Domestic enterprises	Foreign controlled enter-prises	Swedish contolled international enterprises	Domestic enterprises
Total	**12 928**	**17 188**	**2 119**	**19 680**	**18 244**	**1 794**	**32 608**	**35 432**	**3 913**
Industry									
Knowledge intensive	10 384	11 879	435	17 280	12 409	411	**27 664**	**24 288**	**846**
Capital intensive	959	931	20	988	859	23	**1 947**	**1 790**	**43**
Labour intensive	298	278	82	272	246	113	**570**	**524**	**195**
Services									
Knowledge intensive	936	3 160	1 499	572	3 884	1 189	**1 523**	**7 044**	**2 688**
Other activities	**350**	**940**	**82**	**568**	**845**	**58**	**904**	**1 785**	**140**

Major concentration of R&D within a small number of enterprises

In 2003, R&D activities in the business sector accounted for just over 75 per cent of all R&D expenditure in Sweden. This is high, compared to EU countries and the USA. In the business sector, R&D activities are to a large extent confined to a small number of enterprises. In 2003, the 20 largest enterprises represented 68 per cent of R&D expenditure. Similarly, the 20 largest foreign controlled enterprises represented 83 per cent of all R&D expenditure by foreign controlled enterprises. In all categories of ownership, the concentration is higher for R&D expenditure than for R&D person-years (full-time R&D employees).

Table 8 Concentration of R&D activities to the largest enterprises by number of enterprises and nationality 2003

A. R&D person-years

Order of size	Foreign controlled enterprises	Acc. (%)	Swedish controlled international enterprises	Acc. (%)	Domestic enterprises	Acc. (%)	Business sector	Acc. (%)
1-20	15 171	76	18 214	73	2 277	70	28 604	59
21-40	1 589	84	2 667	84	515	86	5 150	70
41-60	855	88	1 302	89	214	93	2 801	76
61-80	570	91	730	92	125	97	2 067	80
81-100	452	93	523	94	71	99	1 462	83
Other	1 354	100	1 452	100	33	100	8 029	100

B. R&D expenditure

Order of size	Foreign controlled enterprises	Acc. (%)	Swedish controlled international enterprises	Acc. (%)	Domestic enterprises	Acc. (%)	Business sector	Acc. (%)
1-20	26 967	83	27 727	78	2 871	73	48 821	68
21-40	2 034	89	3 088	87	614	89	6 429	77
41-60	1 080	92	1 595	91	222	95	3 484	82
61-80	656	94	938	94	118	98	2 345	85
81-100	483	96	631	96	56	99	1 819	87
Other	1 388	100	1 453	100	32	100	9 055	100

Note: Ranked by scale of R&D activities. These figures are reproduced from SCB's survey of R&D in the enterprise sector in 2003 and refer to enterprises with 50 employees or more. Acc=accumulated data.

This concentration of R&D activities within the largest enterprises is also shown by the figures on the number of employees at the enterprises surveyed. The largest enterprises, those with 1 000 employees or more, account for 75 per cent of R&D expenditure. Here, too, the level of concentration is higher for foreign controlled enterprises, at least by the measure of R&D expenditure. Overall, the level of concentration has been constant over a period of ten years. In 2003, however, the level of concentration rose at foreign controlled and at the same time fell at Swedish controlled enterprises, relative to the level in 2001. Note that the concentration among other Swedish controlled enterprises does not in any way follow the same pattern as the above mentioned categories. This is partly because of the inclusion of the industrial research institutions, which on average spend 80 per cent of their revenue in R&D activities.

Table 9 Expenditure and person-years in R&D activities, by size class (number of employees) and nationality 2003

A. R&D person-years

Size of enterprise	Foreign controlled enterprises	Acc. (%)	Swedish controlled international enterprises	Acc. (%)	Domestic enterprises	Acc. (%)	Business sector, total	Acc. (%)
50-99	998	5	1 162	5	875	27	3 035	6
100-249	1 430	12	2 016	13	1 294	67	4 739	16
250-499	1 407	19	1 861	20	305	76	3 574	23
500-999	1 546	27	1 745	27	444	90	3 735	31
1 000-	14 610	100	18 103	100	317	100	33 030	100

B. R&D expenditure

Size of enterprise	Foreign controlled enterprises	Acc. (%)	Swedish controlled international enterprises	Acc. (%)	Domestic enterprises	Acc. (%)	Business sector, total	Acc. (%)
50-99	1 135	3	1 326	4	854	22	3 315	5
100-249	1 654	9	2 399	11	1 431	58	5 484	12
250-499	1 784	14	1 853	16	517	72	4 154	18
500-999	1 670	19	2 872	24	665	89	5 207	25
1 000-	26 365	100	26 982	100	446	100	53 793	100

Note: Acc = accumulated data

R&D activities generally financed in-house

R&D activities are 80 per cent financed in-house. The degree of self-financing is somewhat higher at foreign controlled than at Swedish controlled enterprises. The high level of government R&D funding paid to Swedish controlled enterprises is attributable totally to finance from military authorities, and the somewhat different structure of financing for domestic enterprises springs from the inclusion of the industrial research institutions, which are financed/owned by both government and private business. The Swedish controlled enterprises also report more R&D-targeted funding from the European Union. The heading “other foreign financing” comprises foreign government financing and funding from international organisations other than in the EU. Swedish controlled enterprises report considerably higher amounts than foreign controlled enterprises in both of these categories of financing for R&D performed in-house.

Table 10 Sources of funding for in-house R&D activities performed in Sweden by nationality 2003, SEK million.

Sources of financing	Foreign controlled enterprises	Swedish controlled international enterprises	Domestic enterprises	Total, business sector
Enterprise sector, total	**32 608**	**35 432**	**3 913**	**71 953**
In-house financing	28 557	27 495	1 872	57 924
Government financing	264	3 119	842	4 224
Private financing, sourced in Sweden	560	2 591	854	4 005
of which, from enterprises in Sweden	*557*	*2 527*	*672*	*3 756*
Private financing, sourced abroad	3 181	1 812	107	5 100
of which, from enterprises abroad	*3 178*	*1 712*	*86*	*4 976*
EU funding	30	71	183	284
Other financing sourced abroad	15	345	55	415

Note: These figures are reproduced from SCB's survey of R&D in the business sector in 2003 and refer to enterprises with 50 employees or more.

Concentration of R&D activities within major city regions in Sweden

The Stockholm, Västra Götaland and Skåne counties account for an overwhelming share of R&D in business sector, both at Swedish and foreign controlled enterprises. In all, the three counties represent 82 per cent of R&D expenditure at foreign controlled enterprises, 73 per cent at Swedish controlled international enterprises and 68 per cent of domestic enterprises. This concentration in and around the major cities has remained unchanged since 2001, although the level of concentration for Swedish controlled enterprises has fallen.

Most counties report more R&D linked to Swedish controlled enterprises than to foreign ones. The counties with a higher share of foreign than Swedish controlled R&D are: Västra Götaland, Västmanland, Uppsala, Värmland, Dalarna and Västerbotten.

Table 11 Expenditure and person-years in R&D by county and nationality 2003, SEK million.

County	R&D expenditure			R&D person-years		
	Foreign controlled enterprises	Swedish controlled international enterprises	Domestic enterprises	Foreign controlled enterprises	Swedish controlled international enterprises	Domestic enterprises
Business sector, total	**32 608**	**35 432**	**3 950**	**19 991**	**24 888**	**3 235**
Västra Götaland	17 918	6 391	557	9 186	4 878	547
Stockholm	5 017	14 286	1 850	3 379	9 995	1 415
Skåne	3 764	5 107	262	2 360	2 492	254
Västmanland	1 516	236	..	1 120	223	..
Uppsala	958	459	211	612	299	177
Värmland	705	33	16	715	32	13
Dalarna	455	118	..	359	117	..
Östergötland	409	3 420	321	387	2 321	210
Örebro	329	665	..	308	585	..
Blekinge	171	914	..	156	632	..
Jönköping	111	623	..	124	567	..
Södermanland	75	676	..	92	612	..
Gävleborg	49	716	..	63	595	..
Övriga län	1 131	1 788	619	1 130	1 540	551

Note: These data are reproduced from SCB's survey of R&D in the business sector in 2003 and refer to enterprises with 50 employees or more.

Payments for R&D work carried out by other organisations

In addition to the R&D conducted by the enterprises themselves in-house, they also pay or support for R&D activities that are performed by other organisations.[9] This is a measure of the flows of payments for R&D activities from sources of finance and to those who perform the R&D.

In 2003, enterprises in Sweden paid for R&D to the value of slightly more than SEK 20 billion to other organisations. More than half of these assignments were orders between centerprises within the group itself, primarily to subsidiaries abroad. The enterprises reported a fall in the value of assigned R&D activities from SEK 33 billion to SEK 20 billion, but if assignment flows within enterprise groups are excluded, the value rose from SEK 5 billion to SEK 7 billion. The largest flow is from Swedish controlled international enterprises to enterprises in the same group located abroad. R&D assignments to Swedish universities and colleges fell from a value of SEK 883 million to SEK 584 million. The value of foreign controlled R&D assignments declined from SEK 667 million to SEK 308 million, while the value of Swedish controlled R&D assignments rose from SEK 216 to SEK 276 million, of which domestic enterprises accounted for SEK 82 million.

[9] *Note that R&D activities conducted in-house at the enterprises cannot be totalled with assignments to other organisations since this would lead to duplication of value reported.*

Table 12 Payments made by enterprises in Sweden for R&D work carried out by other organisations (payee) 2003, SEK million.

Payee	**Foreign controlled enterprises**	**Swedish controlled international enterprises**	**Domestic enterprises**	**Total, business sector**
Business sector, total	**4 922**	**15 097**	**525**	**20 543**
Other enterprise in the same group in Sweden	188	313	59	560
Other enterprise in Sweden	1 046	1 165	150	2 360
Enterprise in the same group abroad	1 208	11 368	69	12 646
Other enterprise abroad	691	227	92	1 010
Higher education sector in Sweden	308	194	82	584
Industry organisations/ research institutes	65	204	45	314
Other units in Sweden	63	30	8	101
Other units abroad	1 353	1 596	20	2 968

Tables

Tables

Table 13 R&D expenditure at major Swedish controlled enterprise groups by country of location 1995–2003, SEK million

Country	R&D expenditure, SEK million				
	2 003	2 001	1 999	1 997	1 995
Total, world	**47 423**	**60 472**	**44 975**	**46 332**	**36 234**
Sweden	**26 965**	**34 688**	**25 922**	**29 767**	**28 298**
Abroad	**20 459**	**25 784**	**19 053**	**16 565**	**7 936**
EU15	**10 858**	**11 999**	**9 055**	**8 760**	**4 515**
NAFTA	**6 865**	**10 530**	**7 425**	**6 088**	**2 577**
Nordic region	**1 630**	**2 847**	**1 732**	**1 481**	**520**
USA	5 292	8 250	5 716	5 034	2 419
Germany	2 300	3 174	2 257	1 866	952
France	1 975	706	673	477	388
Denmark, Finland and Norway	1 630	2 847	1 732	1 481	520
Italy	1 229	1 428	1 147	993	510
UK	601	1 507	1 041	2 276	901
Other countries	7 462	7 872	6 487	4 438	2 246

Table 14 R&D person-years at major Swedish controlled enterprise groups by country of location 1995–2003

Country	R&D person-years				
	2003	2001	1999	1997	1995
Total, world	**30 803**	**40 037**	**38 846**	**45 135**	**37 623**
Sweden	**19 085**	**20 923**	**22 022**	**27 517**	**24 670**
Abroad	**11 718**	**19 114**	**16 824**	**17 618**	**12 953**
EU15	**7 053**	**10 475**	**8 814**	**10 013**	**7 437**
NAFTA	**2 941**	**5 708**	**5 660**	**5 170**	**3 117**
Nordic region	**1 103**	**2 304**	**1 669**	**1 740**	**1 462**
USA	1 814	4 249	4 440	3 865	2 997
Germany	1 377	2 483	1 990	1 894	1 453
Italy	1 368	1 760	1 246	1 166	971
France	1 271	805	679	543	473
Denmark, Finland and Norway	1 103	2 304	1 669	1 740	1 462
UK	360	652	954	2 469	1 523
Other countries	4 425	6 862	5 846	5 941	4 074

Table 15 R&D person-years at major Swedish controlled enterprise groups, by educational level and country of location 2003

Country	**Level of qualification**						**University graduates**
	Researchers	Researchers as % of total	Technicians	Techni-cians as % of total	Other graduates	Other graduates as % of total	**total**
Total, world	**1 256**	**7**	**16 594**	**91**	**470**	**3**	**18 320**
Sweden	**776**	**7**	**10 108**	**90**	**338**	**3**	**11 222**
Abroad	**480**	**7**	**6 486**	**91**	**132**	**2**	**7 098**
EU15	**279**	**6**	**3 614**	**84**	**402**	**9**	**4 295**
NAFTA	**117**	**7**	**1 630**	**93**	**9**	**1**	**1 756**
Nordic region	**53**	**7**	**674**	**90**	**22**	**3**	**749**
USA	62	7	831	92	9	1	902
Germany	55	6	790	92	12	1	857
Denmark, Finland and Norway	53	7	674	90	22	3	749
Italy	48	6	754	92	16	2	818
France	6	3	184	90	14	7	204
UK	11	6	179	93	2	1	192
Other countries	245	7	3 074	91	57	2	3 376

Note: An approximate estimation of the level of qualification, according to the respondents. "university graduates" refers to individuals with three years or more of university-level education. Difficulties in finding Swedish equivalents for foreign qualifications. A person-year is the work performed by a full-time employee in a year. For reasons of confidentiality, it has been necessary to merge the data for Denmark, Finland and Norway. ”Other countries” refers to the countries for which data cannot be presented separately for reasons of confidentiality.

Table 16 R&D person-years at major Swedish controlled enterprise groups by educational level and country of location 2001

Country	**Level of qualification**						**University graduates,**
	Researchers	Researchers as % of total	Techniciansl	Techni-cians as % of total	Other graduates	Other graduates as % of total	**total**
Total, world	**4 274**	**14**	**26 052**	**83**	**889**	**3**	**31 215**
Sweden	**2 093**	**13**	**13 176**	**85**	**293**	**2**	**15 562**
Abroad	**2 181**	**14**	**12 877**	**82**	**595**	**4**	**15 653**
EU15	**1 155**	**14**	**7 016**	**82**	**381**	**4**	**8 552**
NAFTA	**680**	**14**	**3 860**	**82**	**182**	**4**	**4 722**
Nordic region	**287**	**15**	**1 573**	**84**	**14**	**1**	**1 874**
USA	483	14	2 804	81	181	5	3 468
Germany	272	13	1 666	80	147	7	2 085
Denmark, Finland and Norway	287	15	1 573	84	14	1	1 874
Italy	155	11	1 161	80	139	10	1 455
France	50	9	485	88	18	3	553
UK	55	12	395	85	13	3	463
Other countries	878	15	4 793	83	83	1	5 754

Note: A number of Swedish enterprise groups went into foreign ownership in the 1999-2001 period, but were included in the 1995-2001 surveys. Five new industrial groups have instead been included. These changes should be taken into account in year-on-year comparisons. An approximate estimation of the level of qualification according to the respondents. "university graduates" refers to individuals with three years or more of university-level education. Difficulties in finding Swedish equivalents for foreign qualifications. A person-year is the work performed by a full-time employee in a year. For reasons of confidentiality, it has been necessary to merge the data for Denmark, Finland and Norway. ”Other countries” refers to the countries for which data cannot be presented separately for reasons of confidentiality.

Table 17 R&D intensity in major Swedish controlled enterprise groups by country of location 2003

Country	**R&D person-years**	**Average number of employees**	**R&D intensity (%)**
Total, world	**30 803**	**475 629**	**6**
Sweden	**19 085**	**119 398**	**16**
Abroad	**11 718**	**356 231**	**3**
EU15	**7 053**	**161 368**	**4**
NAFTA	**2 941**	**93 226**	**3**
Nordic region	**1 103**	**16 718**	**7**
USA	1 814	77 005	**2**
Germany	1 377	32 874	**4**
Denmark, Finland and Norway	1 103	16 718	**7**
UK	360	20 781	**2**
Italy	1 368	24 302	**6**
France	1 271	32 677	**4**
Other countries	4 425	151 874	**3**

Note: A person-year is the work performed by a full-time employee in a year. For reasons of confidentiality, it has been necessary to merge the data for Denmark, Finland and Norway. ”Other countries” refers to the countries for which data cannot be presented separately for reasons of confidentiality.

Table 18 R&D intensity in major Swedish controlled enterprise groups by country of location 2001.

Country	**R&D person-years**	**Average number of employees**	**R&D intensity (%)**
Total, world	**40 037**	**548 683**	**7**
Sweden	**20 923**	**137 312**	**15**
Abroad	**19 114**	**411 371**	**5**
EU15	**10 475**	**187 745**	**6**
NAFTA	**5 708**	**103 980**	**5**
Nordic region	**2 304**	**19 281**	**12**
USA	4 249	87 619	5
Germany	2 483	36 355	7
Denmark, Finland and Norway	2 304	19 281	12
UK	1 760	27 444	6
Italy	805	37 984	2
France	652	26 824	2
Other countries	6 862	175 864	4

Note: A number of major Swedish enterprise groups went into foreign ownership between 1997 and 1999. These changes should be taken into account in year-on-year comparisons. A person-year is the work performed by a full-time employee in a year. For reasons of confidentiality, it has been necessary to merge the data for Denmark, Finland and Norway. ”Other countries” refers to the countries for which data cannot be presented separately for reasons of confidentiality.

Table 19 R&D person-years och R&D expenditure in Swedish and foreign controlled enterprises in Sweden by country of origin 1999–2003.

Country	R&D person-years			R&D expenditure		
	2003	2001	1999	2003	2001	1999
Business sector, total	**48 113**	**49 433**	**44 171**	**72,0**	**75,1**	**57,0**
Swedish controlled enterprises in Sweden	28 123	29 508	28 488	39,3	44,6	36,2
Foreign controlled enterprises in Sweden	19 990	19 924	15 682	32,6	30,5	20,7
EU15	9 370	9 308	7 641	18,4	17,4	11,1
EFTA	8 686	8 631	5 523	11,6	10,9	6,8
Nordic region	1 888	1 242	1 014	1,9	1,6	0,9
Of which:						
UK	5 309	5 657	4 488	13,0	12,8	7,6
USA	7 986	8 185	5 481	10,9	10,5	6,7
Switzerland	1 497	1 660	2 127	2,2	1,9	2,5
Netherlands	1 741	1 336	1 525	2,8	1,7	1,8
Germany	246	530	702	0,4	0,8	0,8
Finland	1 529	891	571	1,5	1,3	0,5
Norway	212	140	328	0,2	0,2	0,3
France	152	391	155	0,2	0,5	0,2
Denmark	147	211	115	0,2	0,2	0,1
Canada	700	445	42	0,8	0,4	0,0
Other countries	471	477	148	0,4	0,4	0,1

Note: The data refers to enterprises with 50 employees or more. Denmark and Finland are included in data for both the Nordic region and the EU.

Table 20 Number of person-years for R&D 2003 by foreign, Swedish international and domestic enterprises by industry sector and gender.

Industry sector	**R&D person-years**					
	Men			**Women**		
	Foreign controlled enterprises	Swedish controlled international enterprises	Domestic enterprises	Foreign controlled enterprises	Swedish controlled international enterprises	Domestic enterprises
Business sector, total	**13 862**	**20 227**	**1 957**	**6 128**	**4 660**	**1 278**
Manufacturing industry						
Knowledge intensive	11 198	14 926	392	4 656	2 980	226
Capital intensive	1 002	1 038	33	712	420	22
Labour intensive	328	432	100	176	111	46
Services						
Knowledge intensive	1 171	2 990	1 360	301	811	941
Other activities	**163**	**841**	**73**	**283**	**339**	**43**

Note: These figures are reproduced from SCB's survey of R&D in the business sector in 2003 and refer to enterprises with 50 employees or more. Which industries are classified into each sector is described in the section ”Methods and quality assurance”. For reasons of confidentiality, it has been necessary to combine capital and labour intensive services with Other activities.

Table 21 R&D expenditure in foreign, Swedish international and domestic enterprises in Sweden by industry 2001–2003, SEK billion.

Industry sector	**Enterprise category**	**R&D expenditure** 2003	2001	**% of sector** 2003	2001
Knowledge intensive					
Manufacturing industry	Foreign controlled enterprises	27 664	26 263	52	49
	Swedish controlled international enterprises	24 288	26 711	46	50
	Domestic enterprises	846	535	2	1
	Total	52 797	53 509	100	100
Services	Foreign controlled enterprises	1 523	827	14	6
	Swedish controlled international enterprises	7 044	10 266	63	77
	Domestic enterprises	2 688	2 318	24	17
	Total	11 255	13 410	100	100
Capital intensive					
Manufacturing industry	Foreign controlled enterprises	1 946	1 865	51	49
	Swedish controlled international enterprises	1 790	1 844	47	48
	Domestic enterprises	43	118	1	3
	Total	3 780	3 827	100	100
Labour intensive					
Manufacturing industry	Foreign controlled enterprises	571	395	44	35
	Swedish controlled international enterprises	525	550	41	49
	Domestic enterprises	196	171	15	15
	Total	1 291	1 116	100	100
Total, manufacturing industry	Foreign controlled enterprises	30 181	28 523	52	49
	Swedish controlled international enterprises	26 602	29 105	46	50
	Domestic enterprises	1 085	824	2	1
	Total	57 868	58 452	100	100
Total, services	Foreign controlled enterprises	2 274	1 856	17	11
	Swedish controlled international enterprises	8 616	11 977	63	73
	Domestic enterprises	2 782	2 490	20	15
	Total	13 672	16 322	100	100
Other activities	Foreign controlled enterprises	904	1 194	32	36
	Swedish controlled international enterprises	1 786	1 858	63	57
	Domestic enterprises	140	221	5	7
	Total	2 830	3 274	100	100
Business sector	Foreign controlled enterprises	32 608	30 544	45	41
	Swedish controlled international enterprises	35 432	41 229	49%	55%
	Domestic enterprises	3 913	3 363	5%	4%
	Total	71 953	75 135	100%	100%

Note: All figures are reproduced from SCB's survey of R&D in the business sector in 2003 and refer to enterprises with 50 employees or more. Which industries are classified into each sector is described is described in the section "Methods and quality assurance". For reasons of confidentiality, it has been necessary to combine knowledge and capital intensive services and labour intensive services and Other activities.

Table 22 R&D person-years in foreign, Swedish and domestic enterprises in Sweden by industry sector 2001–2003, SEK million.

Industry sector	**Enterprise category**	**R&D person-years**		**% of sector**	
		2003	2001	2003	2001
Knowledge intensive					
Manufacturing industry	Foreign controlled enterprises	15 854	16 318	46	48
	Swedish controlled international enterprises	17 906	17 118	52	50
	Domestic enterprises	617	526	2	2
	Total	34 378	33 962	100	100
Services	Foreign controlled enterprises	1 472	802	19	9
	Swedish controlled international enterprises	3 801	5 807	50	67
	Domestic enterprises	2 301	2 113	30	24
	Total	7 574	8 722	100	100
Capital intensive					
Manufacturing industry	Foreign controlled enterprises	1 714	1 717	53	50
	Swedish controlled international enterprises	1 458	1 625	45	47
	Domestic enterprises	54	112	2	3
	Total	3 227	3 454	100	100
Labour intensive					
Manufacturing industry	Foreign controlled enterprises	504	419	42	36
	Swedish controlled international enterprises	543	584	46	50
	Domestic enterprises	146	166	12	14
	Total	1 192	1 169	100	100
Total, manufacturing industry	Foreign controlled enterprises	18 072	18 454	47	48
	Swedish controlled international enterprises	19 907	19 327	51	50
	Domestic enterprises	817	804	2	2
	Total	38 797	38 584	100	100
Total, services	Foreign controlled enterprises	1 875	1 373	21	13
	Swedish controlled international enterprises	4 807	6 926	53	66
	Domestic enterprises	2 381	2 232	26	21
	Total	9 063	10 531	100	100
Other activities	Foreign controlled enterprises	446	668	26	31
	Swedish controlled international enterprises	1179	1300	68	61
	Domestic enterprises	117	158	7	7
	Total	1742	2126	100	100
Manufacturing industry	Foreign controlled enterprises	19 990	19 924	42	40
	Swedish controlled international enterprises	24 888	26 434	52	53
	Domestic enterprises	3 235	3 074	7	6
	Total	48 113	49 433	100	100

Note: All figures are reproduced from SCB's survey of R&D in the enterprise sector in 2003 and refer to enterprises with 50 employees or more. Which industries are classified into each sector is described is described in the section "Methods and quality assurance". For reasons of confidentiality, it has been necessary to combine knowledge and capita -intensive services and labour intensive services and Other activities.

Table 23 R&D expenditure per person year at foreign, Swedish international and domestic enterprises in Sweden by industry sector 2001–2003, SEK million.

Industry sector	Enterprise category	R&D expenditure		R&D person-years		Expenditure/ person-year SEK M.	
		2003	2001	2003	2001	2003	2001
Knowledge intensive							
Manufacturing							
industry	Foreign controlled enterprises	27 664	26 263	15 854	16 318	1,745	1,609
	Swedish controlled international enterprises	24 288	26 711	17 906	17 118	1,356	1,560
	Domestic enterprises	846	535	617	526	1,370	1,017
	Total	52 797	53 509	34 378	33 962	1,536	1,576
Services	Foreign controlled enterprises	1 523	827	1 472	802	1,034	1,031
	Swedish controlled international enterprises	7 044	10 266	3 801	5 807	1,853	1,768
	Domestic enterprises	2 688	2 318	2 301	2 113	1,168	1,097
	Total	11 255	13 410	7 574	8 722	1,486	1,537
Capital intensive							
Manufacturing							
industry	Foreign controlled enterprises	1 946	1 865	1 714	1 717	1,135	1,086
	Swedish controlled international enterprises	1 790	1 844	1 458	1 625	1,228	1,135
	Domestic enterprises	43	118	54	112	0,799	1,057
	Total	3 780	3 827	3 227	3 454	1,171	1,108
Labour intensive							
Manufacturing							
industry	Foreign controlled enterprises	571	395	504	419	1,133	0,942
	Swedish controlled international enterprises	525	550	543	584	0,966	0,942
	Domestic enterprises	196	171	146	166	1,344	1,031
	Total	1 291	1 116	1 192	1 169	1,083	0,955
Total, manufacturing							
industry	Foreign controlled enterprises	30 181	28 523	18 072	18 454	1,670	1,546
	Swedish controlled international enterprises	26 602	29 105	19 907	19 327	1,336	1,506
	Domestic enterprises	1 085	824	817	804	1,327	1,025
	Total	57 868	58 452	38 797	38 584	1,492	1,515
Total, services	Foreign controlled enterprises	2 274	1 856	1 875	1 373	1,213	1,352
	Swedish controlled international enterprises	8 616	11 977	4 807	6 926	1,792	1,729
	Domestic enterprises	2 782	2 490	2 381	2 232	1,168	1,116
	Total	13 672	16 322	9 063	10 531	1,509	1,550
Other activities	Foreign controlled enterprises	904	1 194	446	668	2,027	1,787
	Swedish controlled international enterprises	1 786	1 858	1 179	1 300	1,515	1,429
	Domestic enterprises	140	221	117	158	1,197	1,399
	Total	2 830	3 274	1 742	2 126	1,625	1,540
Business sector	Foreign controlled enterprises	32 608	30 544	19 990	19 924	1,631	1,533
	Swedish controlled international enterprises	35 432	41 229	24 888	26 434	1,424	1,560
	Domestic enterprises	3 913	3 363	3 235	3 074	1,210	1,094
	Total	71 953	75 135	48 113	49 433	1,495	1,520

Note: All figures are reproduced from SCB's survey of R&D in the enterprise sector in 2003 and refer to enterprises with 50 employees or more. Which industries are classified into each sector is described is described in the section ”Methods and quality assurance”. For reasons of confidentiality, it has been necessary to combine knowledge and capital intensive services and labour intensive services and Other activities.

Methods and quality assurance

This section describes methods, selection and quality assurance in the study, and defines a number of important terms used.

Background

The Swedish Institute for Growth Policy Studies (ITPS) is a government agency that is responsible for official statistics on *International Enterprises* under the Act on Official Statistics (2001:99) and the Appendix to the Ordinance on Statistics (2001:100). The assignment includes responsibility for a study into research and development in international enterprises, i.e. Swedish-controlled enterprises with subsidiaries abroad and foreign-controlled enterprises operating in Sweden. This study was performed in association with Statistics Sweden (SCB). The results from the preceding study were published, for example, in the report *Research and Development at International Enterprises 2001*. Statistical reports (including past reports) are available free of charge on at www.itps.se.

Use of statistics

The Swedish economy and growth in Sweden are to a large extent determined by the activities of international enterprises. For example, research and development is highly concentrated among a small number of major enterprise groups mainly in manufacturing industry.

Information on the trend and scope of the R&D activities of these enterprises in and outside Sweden provides an important source of knowledge for industrial policy.

ITPS, one of the major users of the statistics, supplies the government and the Swedish Parliament with this knowledge. It is also used by researchers, journalists, trade unions and interest organisations. ITPS supplies information on globalisation by enterprises, to several international organisations. The EU, OECD and UNCTAD, for example, are developing their own databases and issue publications.

Definitions

The definitions and classifications used to describe R&D activities are based on those agreed within the OECD and published in the Frascati Manual.

Research and Experimental Development is work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise new applications and to achieve new or improved products, systems and processes.

Basic research is systematic and methodical work to acquire new knowledge and new ideas without any particular application in view.

Applied research is also systematic and methodical work to acquire new knowledge and ideas, but it is directed at a specific application.

Experimental development is systematic and methodical work drawing on existing knowledge gained from research experience, scientific knowledge and new ideas that is directed at creating new products or new processes or substantial improvements to those already existing.

Variables

The variables studied consisted primarily of those relating to intramural (in-house) R&D activities, i.e. R&D conducted by and within the enterprise/group itself.

R&D person-years: A person-year is the work that a full-time employee carries out in the course of a year. A person employed on a full-time basis but only spending half of his/her working hours in R&D is regarded as performing 0.5 person-years in R&D.

Educational qualifications: Person-years in R&D performed by the groups' own personnel are shown by educational qualification in the following categories:

- Researchers, comprising licentiates and doctoral degrees. In this study, a Master's degree is not regarded as a postgraduate qualification.
- University graduate of at least three years or more includes first degrees and engineering and other university diplomas.
- Technician refers to all categories of technical qualifications, including architectural.

Expenditure on in-house R&D: Expenditure on intramural (in-house) R&D is expenditure on R&D that the enterprise/group conducts itself, as distinct from extramural R&D (performed outside the enterprise/group). Expenditure on in-house R&D consists of labour costs (salaries and payroll overheads), other operational costs (rent, telephone etc.) and any investments during the year in tangible assets for R&D purposes, together with consultancy fees where a project is managed and conducted by the enterprise and its personnel work with consultants.

Major Swedish controlled enterprise groups

The study is based on a questionnaire sent to the twenty largest Swedish controlled manufacturing groups by number of employees abroad. The selection is based on an annual survey of all enterprise groups in Sweden with at least one subsidiary abroad. The major groups dominate in terms both of the number of employees in the business sector outside Sweden and R&D performance in Sweden. This selection should present an accurate picture of R&D activities abroad. The statistical unit is the enterprise group, i.e. the group of enterprises that have been consolidated into the annual accounts of the group. In some cases, a sub-group has been studied instead of the group as a whole, for technical reasons.

Groups studied

Six largest: LM Ericsson, Saab, Scania, Volvo, Sandvik and SCA.

Other groups: Alfa Laval, Assa Abloy, Atlas Copco, Cardo, Duni, Electrolux, Gambro, Getinge Industrier, Haldex, Hexagon, L E Lundbergföretagen, Lindéngruppen, SKF and Sydsvenska Kemi. The classification into the six largest and other groups was based on each group's R&D expenditure in Sweden.

Changes in the major enterprise groups

A certain change in the study population between past and present studies, arising from reorganisations, may make comparisons more difficult. The year-on-year comparison is complicated by the fact that some groups become foreign controlled and are replaced in the main by others with R&D activities on a smaller scale. On the other hand, the principles of selection of the groups have remained the same.

Because of the change in the 2003 study population, a number of enterprise groups with lesser R&D activities were replaced by other groups, new to the population, also with relatively little R&D. In addition, some groups were unable to provide complete personnel data on their R&D personnel in other countries, and so the report focuses on R&D expenditure rather in R&D person-years in these comparisons over time.

The questionnaire remained largely unchanged in 1993–1997. In 1999 and 2001, a number of questions were added on how and why major changes had taken place in each country. In addition, a question was included on whether the government had any influence over the scale of R&D activities in Sweden. No further changes were made in the 2003 study.

Comparability with other statistics

The report contains comparisons relating the major enterprises to manufacturing industry and the business sector as a whole. Because R&D statistics do not include all enterprises, the totals for manufacturing industry and the business sector, respectively, are underestimates. Only enterprises with 50 employees or more are included in the total figures. The results from the study of the major enterprises represent an overestimate in these comparisons, in that these groups also comprise service sectors as well as enterprises with less than 50 employees.

Reliability overall

In earlier years, it occurred that individual groups accounted for the costs of R&D in a country other than the one in which the activity was carried out. This again transpired this year, with the result that certain enterprise groups stated that they had employees in countries in which the costs they reported were either too low or non-existent. Since the 1997 survey, the situation has changed for the better. The improvement in the reporting of R&D performed abroad is attributable to an increased focus on R&D and greater demands for improvement from various interested parties. This change led in 1997 to a sharp increase in reported R&D expenditure abroad and a reduction of the same in the Swedish parties of the groups, compared to the results reported in the studies for 1993–1995. The problem remains in certain groups, but it does not affect as much as before the geographical breakdown between Sweden and abroad. Despite the improvement observed in the most recent studies, it may still be said that a geographical breakdown of R&D activities – especially between Sweden and abroad – is much more reliable if it is measured by the number of person-years rather than by R&D expenditure.

Response rate

The study comprised twenty enterprise groups. Two of the smaller groups did not respond to the questionnaire. The none-response, in terms of the number of groups, is ten per cent. If the none-response is instead measured in terms of SEK invested in R&D, it is considerably less – presumably less than one per cent – because the groups not returning a completed questionnaire conduct R&D activities on a lesser scale.

A partial non-response arose from the inability of two groups to provide data on the number of person-years in R&D activities. Certain respondents supplied estimates of the number of person-years. The total number of R&D person-years is somewhat underestimated. In the 2003 study, a somewhat greater non-response was noted with regard to R&D person-years abroad than was the case earlier. No values have been imputed for non-response. Educational qualifications and, in particular, technicians are in some cases based on estimates. In addition, it is difficult to establish exact Swedish equivalents for foreign qualifications.

Foreign controlled enterprise groups in Sweden

The study is based on a questionnaire to eight major foreign controlled enterprise groups and their R&D activities in Sweden. The common denominator is that they were formerly Swedish controlled. The statistical unit is the group, i.e. the group of companies that have been consolidated into the consolidated accounts of the group.

Groups studied

AstraZeneca, Pharmacia (Pfizer), Volvo Car (Ford), Stora Enso, ABB, AGA (Linde), Svedala Industri (Metso), BT Industries (Toyoda)

Scope of questionnaire

The questionnaire includes questions in R&D expenditure and R&D person-years, by educational qualification, R&D in Sweden as a percentage of the group's global R&D activities and questions on changes in R&D activities and whether the government has any influence on the scale of R&D activities in Sweden.

Comparisons

The report includes comparisons of the groups' R&D activities in 2003 and the R&D activities conducted by the then Swedish-controlled groups as stated in the study of major enterprise groups in 1993. In the case of the groups not included in the enterprise group study in 1993, supplementary data was obtained from Statistics Sweden's regular R&D survey.

Response rate

All eight groups in the study responded to the questionnaire. The study was preceded by a preliminary survey of ten groups, the purpose of which was to investigate the possibility of data collection on R&D activities in Sweden. Eight of these ten groups seemed to be able to respond to the required questions. As a result of close contacts with the respondents and the limited amount of information sought, there was practically no non-response.

Foreign controlled enterprises

The ITPS register of foreign-controlled enterprises was run against Statistics Sweden's regular R&D statistics. The study comprises enterprises with 50 employees or more. The information refers only to their operations in Sweden. The statistical unit is the enterprise. Foreign controlled enterprises are enterprises in which 50 per cent or more of the voting rights represented by the shares are controlled by a foreign owner, the definition agreed within the EU and the OECD**.**

Accounting categories

Ohlsson/Vinell[10] have devised a classification of the manufacturing industry based on the relative use of production resources by different industries. The service sector is not usually classified into knowledge-, capital- and labour-intensive sectors. As a result, the government agency NUTEK, drew up prior to its long-term survey (LU 99), a classification of enterprises in all industries based on knowledge, capital and labour

[10] *Tillväxtens drivkrafter – En studie av industriers framtidsvillkor (The driving forces of growth - a study of the future conditions of industries) by Lennart Ohlsson and Lars Vinell.*

intensive activities. It is this classification that has been used. The enterprises that appear in this report have been classified according to the list of sectors on the next page. The use of this classification is due to problems of confidentiality.

Industry classification

Industries are classified according to the Swedish Standard Classification of Economic Activities, SNI 02, which is based on the EU's Statistical Classification of Economic Activities, NACE Version 1.1

22	Publishing, printing and reproduction of recorded media
29	Manufacture of machinery and equipment
30	Manufacture of office machinery and computers
33	Manufacture of medical, precision and optical instruments, watches and clocks
24.4-5	Manufacture of pharmaceutical products, soaps and detergents
31	Manufacture of electrical machinery and apparatus
32	Manufacture of radio, television and communication equipment and apparatus
34-35	Manufacture of transport equipment
	Total, knowledge intensive industry
21	Manufacture of pulp, paper and paper products
23	Manufacture of coke, refined petroleum products and nuclear fuel
26	Manufacture of other non-metallic products
27	Manufacture of basic metals and fabricated metal products
10-14	Mining and quarrying
24	Manufacture of chemicals and chemical products
	Total, capital intensive industry
20	Manufacture of wood and wood products; except furniture
25	Manufacture of rubber and plastic products
28	Manufacture of fabricated metal products, except machinery and equipment
15-16	Manufacture of food, beverage and tobacco products
17-19	Manufacture of textiles, textile products, wearing apparel, leather and leather products
36-37	Other manufacturing industry
	Total, labour intensive industry
65-67	Financial intermediation
71-74	Business services
80-85	Education, health services etc.
90-93	Other community, social and personal services
	Total, knowledge intensive services
70	Real estate activities
60-64	Transport and communication
	Total, capital intensive services
45	Construction
55	Hotels and restaurants
50-52	Wholesale and retail trade, maintenance and repair of motor vehicles
	Total, labour intensive services
01-05	Agriculture, forestry and fishing
40-41	Electricity, gas, heating and water supply
	Total, other activities

The Swedish Institute for Growth Policy Studies (ITPS) is a Government Agency responsible for providing policy intelligence to strengthen growth policy in Sweden. ITPS primarily provides the Government Offices, Members of the Swedish Parliament, other state authorities and agencies with briefings based on statistical material, policy papers and key analyses. Business policy and regional development policy are areas given high priority.

Changes in policy should be based on:

- Statistic data and analyses of the structure and dynamics of industry
  – to obtain an up-to-date view of future challenges and opportunities.
- Evaluation of results and effects of policy measures and programmes
  – to provide benchmarks and learn from measures implemented earlier.
- Policy intelligence in order to look outwards and ahead
  – what issues are likely to come on the growth policy agenda in the future?

These represent the principal missions of ITPS.

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