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**Turnover for Scientific Research and Development
Norway**

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1 Introduction

The paper will present Division 72, Scientific Research and Development (R&D) in Norway. Definition of the sector will be made and a short description of the most important R&D activities will follow. The paper will present two surveys Statistics Norway currently has in production, which includes turnover as statistical variable.

Another survey in Statistics Norway concerning R&D will be presented in the end of the paper. This survey gives an indication of the total expenditure level within R&D activities in Norway. The paper will finish with short summary.

2 Definition of the sector

Norway uses the Nace classification. In Nace Rev 2 R&D is classified in division 72. The division is divided into three classes.

Table1. Nace rev 2 and Isic Rev.4

NACE Rev. 2 Group	Class	ISIC Rev. 4
72.1 Research and experimental development on natural sciences and engineering	72.11 Research and development on biotechnology	72.10
	72.19 Other research and experimental development on natural sciences and engineering	72.10
72.2 Research and development on social sciences and humanities	72.20 Research and development on social sciences and humanities	72.2

The relation between Nace Rev. 1.1 and Nace Rev 2 is illustrated in table 2

Table 2 Relation between Nace Rev.1.1 and Nace Rev2.

Nace Rev 1.1	Description		Nace Rev 2.	Description
73.100	Research and experimental development on natural sciences and engineering		72.110	Research and experimental development on biotechnology
73.100	Research and experimental development on natural sciences and engineering		72.190	Other research and experimental development on natural sciences and engineering
73.100	Research and experimental development on natural sciences and engineering		72.200	Research and experimental development on social sciences and humanities
73.200	Research and experimental development on social sciences and humanities		72.200	Research and experimental development on social sciences and humanities

Table 3 shows the part of enterprises and turnover transferred from 73.1/73.2 to 72.1/72.2

Table 3. No of units and turnover transferred from Nace Rev 1.1 to Nace Rev. 2

Nace Rev.1.1	Nace Rev. 2	Turnover	Frequency
73100	72190	86 %	74,1742
73100	72110	12 %	21,3213
73100	72200	2 %	4,5045
73200	72200	100	100

- 98 per cent of the turnover is transferred from Nace 73.1 to Nace 72.1
- All turnover from Nace 73.2 is transferred to Nace 72.2.
- 2 percent of the turnover in Nace 73.1 is transferred to Nace 72.2. These units accounts for around 10 per cent of the total turnover in Nace 72.2

At division level figures are directly comparable, but at group level there are some differences, especially between Nace 73.2 and 72.2.

3 R&D activities in Norway

The following will briefly describe the areas for R&D activities in Norway.

3.1 Activities within Nace 72.110

Activities among the largest units are quite heterogeneous

- Development of vaccines for salmon and other fish-arts
- Testing of medical products for the medical industry
- Projects within specific medical fields (Alzheimer, Cardiovascular, alcoholics etc.) and PoC (Point of Care)
- R&D on products/processes where fibres from trees are used as raw-material
- R&D seafood processing research

3.2 Activities within Nace 72.190

This industry group is the largest within Nace 72, accounting for 74 per cent of the total turnover. R&D Activities takes place within several different areas:

- **Materials and chemistry:** *biotechnology, nanotechnology, modelling and simulation, processtechnology etc.*
- **Energy technology:** *Renewable energysources, nuclear research, etc.*
- **Fisheries technology:** *Marine resources, processing of sea products, etc*
- **Building and infrastructure:** *concrete types, construction techniques, energy effective buildings etc.*
- **ICT:** *Micro and censor systems, control and communicationsystems, informationsystems etc.*
- **Petroleum:** *Productuion technology, drilling constructions etc.*
- Geoscientific
- Protection of water bodies and water quality (fresh/marine waters).

3.3 Activities within Nace 72.200

The largest player within Nace 72.200 has significant activity within Business and Management Consulting. It delivers research, analysis and advisory services within social economics to both the private and the public sector within several areas.

In general we find activities within the following areas among the largest players:

- Industrial economics
- Public welfare services
- Macro, pensions and working life
- Culture and societies
- Language
- Computing
- Transport and communication

4 Surveys on turnover

Norway is obliged to provide Eurostat with data concerning turnover:

1. Regulation No. 295/2008 concerning Structural business statistics. The structural business statistic is an annually statistic. Data to be delivered covers also many other variables than turnover. Deadline for delivery of final data is 18 months after the end of the reference year. Preliminary data (no. of enterprises, employment and turnover at 3- digit level) should be delivered 10 months after the end of the reference year.
2. Nace 72 is not covered by the regulation concerning short-term statistics. Anyways Statistics Norway produces a quarterly turnover index for this division. Data are released 60 days after the end of the reference period
3. National accounts are depending on the Structural Business Statistics to create the final year national account and on the Short term statistic for the quarterly national account.

4.1 Structural Business Statistics

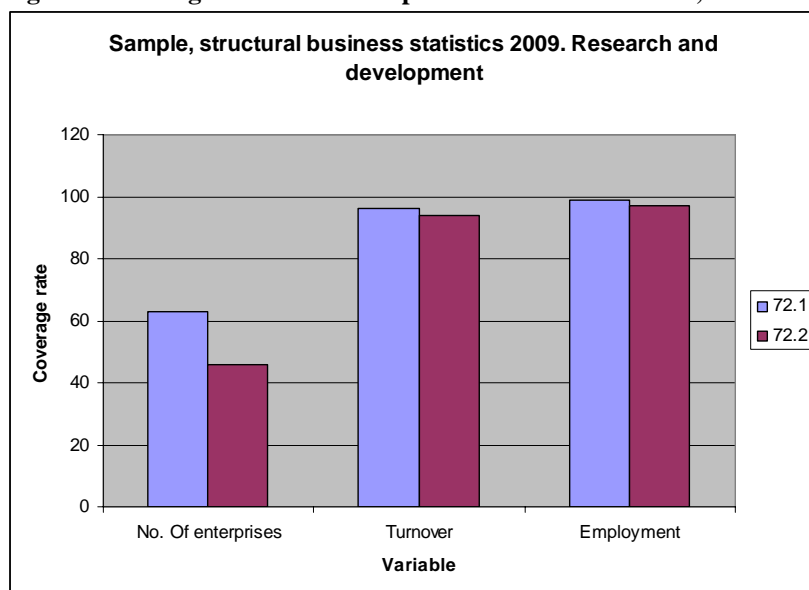
The statistic is an annually statistic, which produce absolute figures. It covers all units (no cut-off according to size) within the business sector

4.1.1 Methodology

The statistic is based on a sample. The sample is stratified after employment groups and 5-digit nace level, based on information from the Business register. Statistical unit is enterprise, but data at the establishment level are also produced.

Coverage rate for the sample, reference year 2009, is illustrated in figure 1.

Figure1. Coverage rate for the sample for Nace 72.1 and 72.2, Structural Business Statistics 2009



The coverage rate is high compared to other industries. This is due to both the size structure and the few number of units in the population. Table 4 shows the structure divided by employment groups, based on the Structural Business Statistic 2008.

Table 4. Selected variables, divided by employmentgroups. Nace 72.

Structural Business Statistics 2008			
Employmentgroups	Enterprises	Employment	Turnover
0-9	81 %	6 %	10 %
10-19	4 %	4 %	3 %
20-49	7 %	13 %	15 %
50+	8 %	77 %	72 %
Total	100,0 %	100,0 %	100,0 %

Table 4 shows that enterprises with more than 20 persons employed stands for almost 90 % of the total turnover, but represents only 15 per cent of the total number of units.

The enterprises in the sample should deliver their annual accounts, either by paper or electronically to Statistics Norway. In addition they have to deliver an questionnaire.

If the enterprise consists of more than one establishment, the respondent is asked to divide turnover, operational income, wages and gross investments (acquisitions and sales) between the establishments. The questionnaire also includes other questions, which do not concern turnover. Information concerning employment is collected from an administrative register.

In addition, information about turnover is also collected for enterprises **outside** the sample after the following priority of sources:

1. Annual accounts from the tax-authorities, electronic versions. Paper versions are not collected by Statistics Norway
2. If turnover is not available from 1) the next source is the Register of Annual Company Reports. This register has turnover information for the joint-stock companies.
3. If turnover information is not available from 1) or 2) we use the VAT-register
4. If turnover information is not available from 1), 2) or 3) questionnaires are send out to the remaining enterprises, asking for turnover.

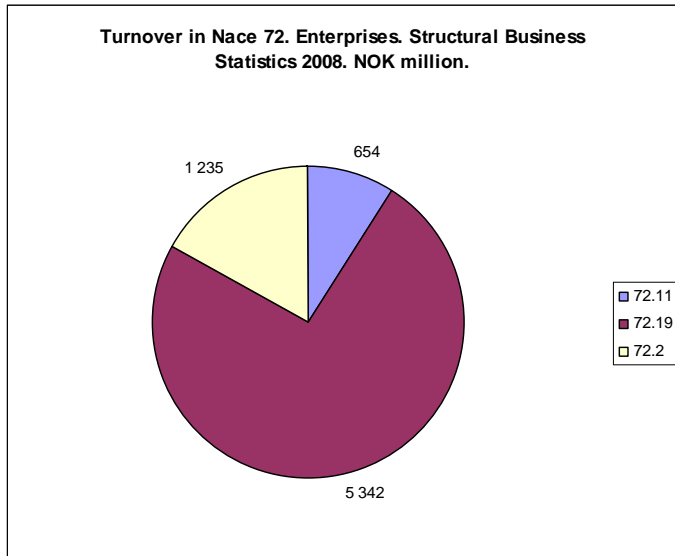
The summary of the above is that the turnover is not estimated for any units in the population.

Statistics Norway also publishes other variables inn connection with Structural Business Statistic, e.g. persons employed, compensation of employees, production value, value added and gross investment.

4.1.2 Results from the Structural Business Statistics

According to the Structural Business Statistics 2008, Nace 72 consisted of 501 enterprises, with a total turnover of NOK 7.2 billion.

Figure 2. Turnover in Nace 72. Structural Business Statistics 2008



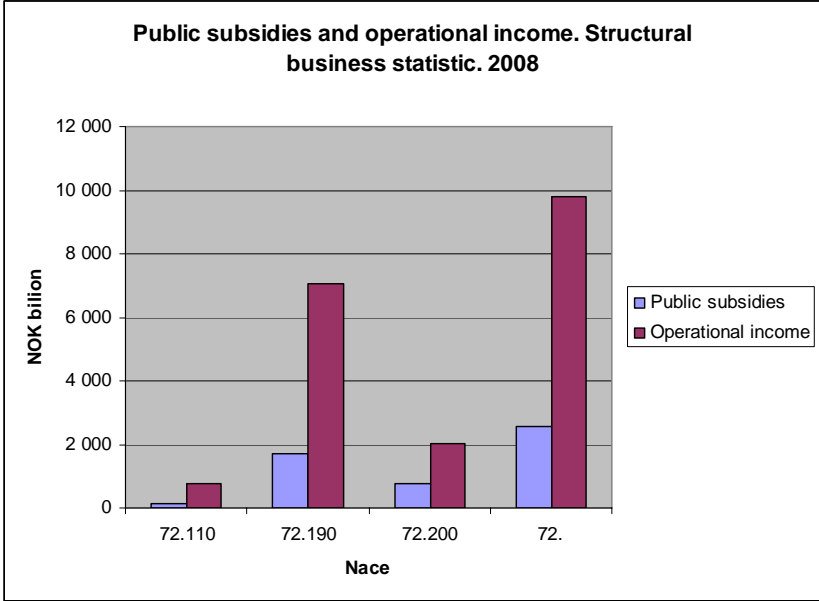
Nace 72.19 is dominating the division, accounting for almost 75 per cent of the turnover. Nace 72.11 is the smallest class, with only 9 per cent of the total turnover.

Table 5. Selected variables. Structural Business Statistics. 2008

	No. Of Enterprises	Employees	Turnover (NOK million)
72.110 Research and experimental development on biotechnology	81	653	654,4
72.190 Other research and experimental development on natural sciences and engineering	285	5 516	5 341,80
72.200 Research and experimental development on social sciences and humanities	135	2 134	1 235,30
Total Nace 72	501	8 303	7 232

A special characteristic for Nace 72 in Norway is that it receives relatively large public subsidies compared to many other industries. Figure 3 shows public subsidies as a part of the total operational income in Nace 72, divided by industry class.

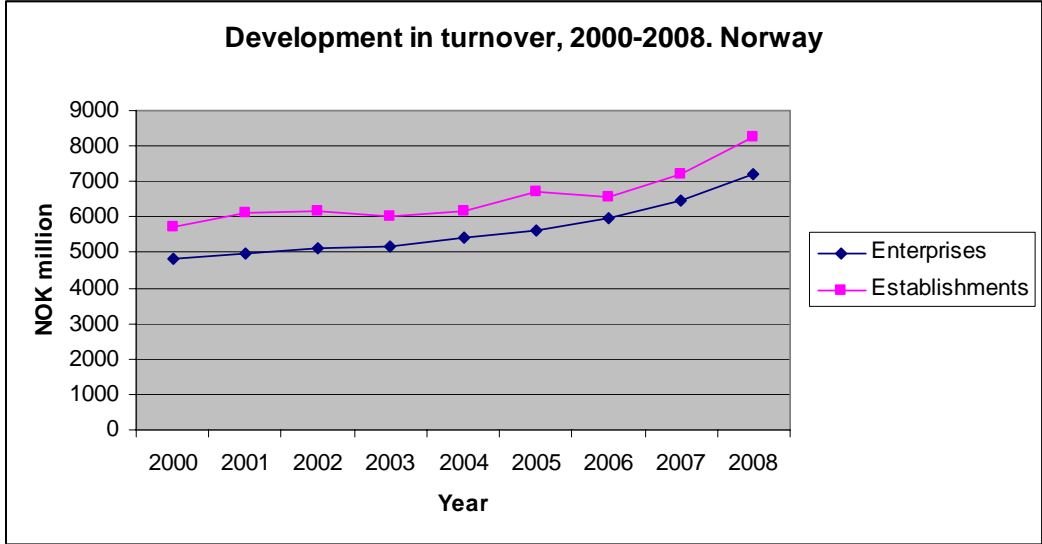
Figure 3. Public subsidies vs. operational income. 2008. divided by industry class



Public subsidies in Nace 72 accounted for approximately 25 per cent of the total operational income in 2008

The development of turnover within enterprises and establishments from 2000-2008 is shown in figure 4

Figure 4 Development in turnover. 2000-2008. Strucutral Business Statistics



From 2000-2003 the turnover rose by 6.7 per cent for the enterprises. From 2003-2006 turnover increased 15.7 per cent and from 2006-2008 by 21.3 per cent. Preliminary data from Short-term-statistics (which will be presented later) indicates that turnover will decrease from 2008-2009. But whether this is a trend or just an isolated response to the financial crisis is too early to say.

4.1.3 Limitations and uncertainty

The survey does not collect data at the product level for Nace 72.1 and 72.2. In some units R&D activities takes place but turnover are not measured as a Nace 72-activity, since the activities are not organized in a single establishment with Nace code 72. It indicates that we might underestimate the turnover level for establishments

In the structural business statistics, administrative registers are used in order to define the population. Errors in these administrative registers - like time gaps in registration, incorrectly identified unit characteristics etc. may therefore be a potential source of uncertainty in the survey

The turnover by establishments which deliver intramural R&D services in an enterprise are not measured in the structural business.

R&D activities within units in sectors outside the scope of the structural business statistics are not covered. This topic will be discussed in chapter 7.

The statistic is published on http://www.ssb.no/english/subjects/10/14/stefu_en

4.2 Short-term statistic. Quarterly turnover

The statistic is an quarterly turnover-index and no absolute figures are published. It covers the same population as Structural Business Statistic.

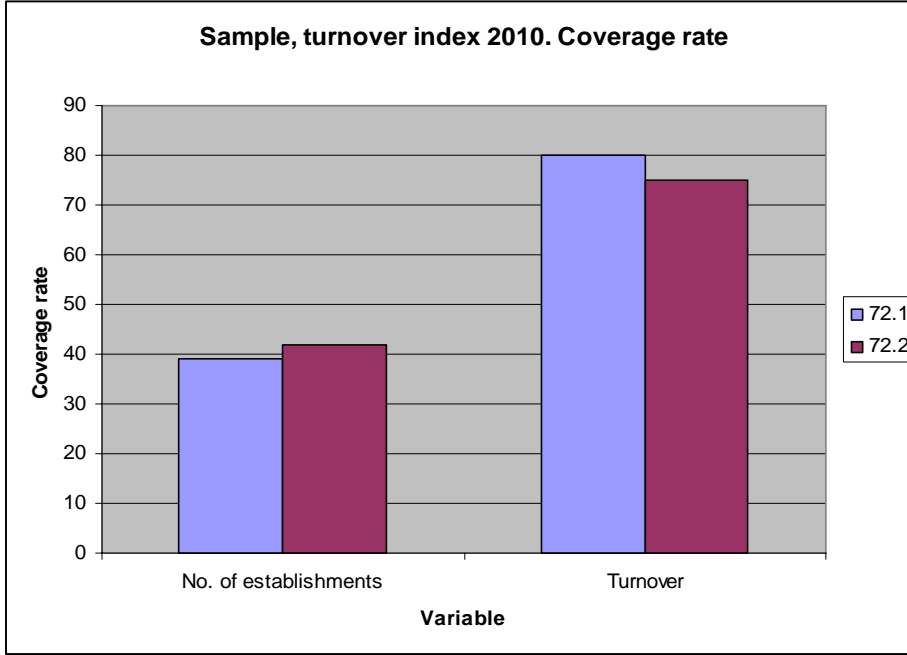
4.2.1 Methodology for the short-term statistic

The survey is a sample survey. The Business register, combined with the latest information from the SBS-survey is used to obtain necessary information about the population. The statistical unit in this survey is establishment. Sample is drawn once a year.

The sample is stratified after:

- Nacegroup,
- Size (turnover)
- Type (if the enterprise consists of one or multiple businesses)
- Age of the business.
- Identical/new units

Figure 5. Coverage rate for the sample for Nace 72.1 and 72.2. Turnover index 2010



Units in the sample receive a questionnaire each quarter, asking for quarterly turnover questionnaire is available electronically around the 1st after the end of each quarter.

It is distinguished between identical units and new units in the estimation procedure. The turnover for the population of identical units is estimated based on turnover data from a sample of identical units. A ratio estimator is applied to each stratum to inflate sample data to population level.

$$\hat{T}_{h,s}^{ID}(q) = \sum_{i \in \text{sample}_{h,s}^{ID}(C,q)} V_{i,h,s}^{ID}(q) \frac{\sum_{i \in \text{pop}_{h,s}^{ID}(C,q)} V_{i,h,s}^{ID}(C)}{\sum_{i \in \text{sample}_{h,s}^{ID}(C,q)} V_{i,h,s}^{ID}(C)}$$

where

$\hat{T}_{h,s}^{ID}(q)$ is the estimated turnover for identical units in subclass h , stratum s , in the statistical quarter q

$V_{i,h,s}^{ID}(q)$ is the turnover for an identical unit i in subclass h , stratum s , in the statistical quarter q

$\frac{\sum_{i \in \text{pop}_{h,s}^{ID}(C,q)} V_{i,h,s}^{ID}(C)}{\sum_{i \in \text{sample}_{h,s}^{ID}(C,q)} V_{i,h,s}^{ID}(C)}$ is the ratio between the population's and the sample's turnover for identical units in subclass h , stratum s , in the comparison period C .

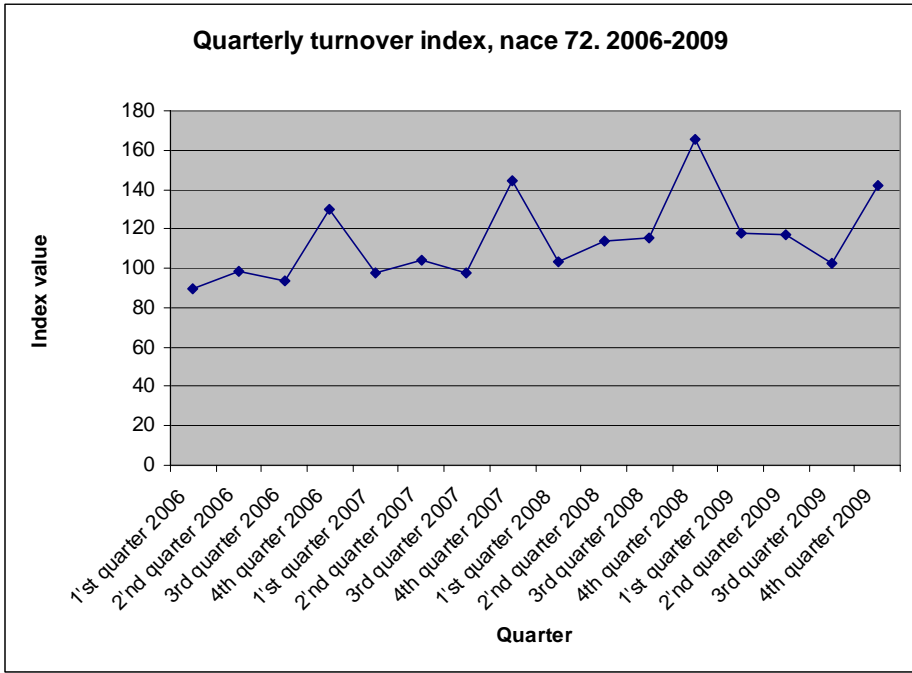
Next, we aggregate the turnover figures for the different strata s in each subclass h :

$$\hat{T}_h^{ID}(q) = \sum_s \hat{T}_{h,s}^{ID}(q)$$

Turnover for the population of new units is estimated based on a ratio from turnover and employment (which is administrative collected) from the sample of new units. For new units outside the sample we have information about employment and use the ratio to estimate turnover.

Figure 6 shows the development of the turnover index in the period 2006-2009

Figure 6. Quarterly turnover index, Nace 72. 2006-2009



The figure shows that there is a peak in the 4'th quarter of every reference year, not unlike many other industries.

4.2.2 Limitations and uncertainties

Errors in administrative registers - like time gaps in registration, incorrectly identified unit characteristics etc. may be a potential source of uncertainty.

The turnover by establishments which deliver intramural R&D services in an enterprise are not measured in the structural business.

In some units R&D activities takes place but turnover is not measured within Nace 72 since the activities are not organized in a single establishment with code 72.

In the questionnaire, units are asked to specify public subsidies, in order to exclude this from the estimation of turnover. Anyway, public subsidies are from time to time placed at another post in the questionnaire, which are included in the estimation of turnover. Data are revised at micro level and major errors are usually discovered before the release, but it represents a source for error.

The statistic is published 55-60 days after the end of the reference period on and can be found on http://www.ssb.no/english/subjects/08/03/20/efuoi_en/

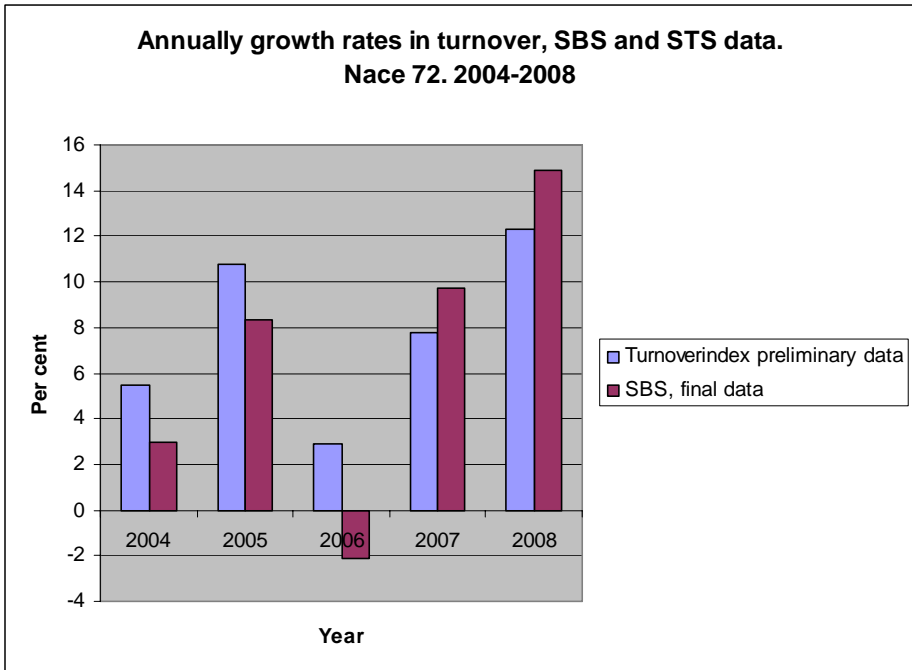
5 Comparison between the statistics

5.1 Comparison between SBS and STS

When finishing the Structural Business Statistic, the annual growth rates are always compared with the quarterly turnover index. Data in the turnover index can be revised until the Structural Business Statistics for the same reference year is finished. Figures published on quarterly basis should be considered as preliminary 5-8 quarters after the first release.

Figure 7 shows the comparison between the STS data published the first time versus the final Structural business statistic. It gives an indication of how well we have predicted the growth, since the results from the structural business statistic is considered as the final figures.

Figure7. Annually growth rates in turnover within SBS and STS, Nace 72. 2004-2008.



There can be several reasons differences in the results

- Sometimes errors in the questionnaire from the (where subsidies are specified as an own post) are first discovered, when we receive the annually account in connection with the SBS.
- Differences in Nace code are a potential source for error, but usually wrong classification at division level is not a large problem within Nace 72.
- In practice the survey for structural business statistic is a census when it comes to the turnover variable, where as the quarterly turnover index is a sample survey.

6 Other statistics within Research and development

The turnover in Research & Development, measured by the Structural Business Statistics in turnover, does not include all activity in this industry. This is due to the following reasons.

- R&D activities at Norwegian universities contribute significantly to the total activity level. This sector is not covered by the structural business statistic
- R&D activities takes place in several enterprises, which core activity is not Nace 72. If the activities are not organized in a single establishment/enterprise with Nace code 72, it will not be captured by the structural business statistic as an activity in this industry

6.1 Total Scope of activity within the business sector

Statistics Norway has a survey within R&D, covering the business sector. In this survey, the total scope of R&D activities/expenditures are measured, independent of Nace codes.

The statistic produces the following data

- Intra/extramural R&D expenditures, number of R&D personnel and man-years. All divided by employmentgroups (cut off 0-4 employees) and by industry (manufacturing, service, others).
- Number of females employed and number of man-years with higher education
- Intra/extramural R&D expenditures, divided by industry and employmentgroup
- Funding of R&D expenditures, by source
- Extramural R&D by industry and size class
- Intramural R&D expenditures by technology field, industry and size classes
- Intramural R&D expenditures, by thematic fields, Industry and size class

1. Intramural expenditures are defined as expenditures for R&D performed within the statistical unit. Intramural R&D expenditures encompass labour costs, other current costs and capital expenditures on R&D.

2. Extramural expenditures encompass R&D services purchased from others; as research institutes, other enterprises, also including units in the same enterprise group

3. The manufacturing industry is defined as section C (Nace 10-33)

The service industry is defined as Nace 45-47, 49-53, 58-63, 64-66, 69-75, 77-82.

Other industries are defined as Nace 01-03, 05-09, 35, 36-38, 41-43

The following shows some of the results from the latest survey, which covers the reference year 2008.

Figure 8. Total R&D expenditures in the business sector. 2007-2008

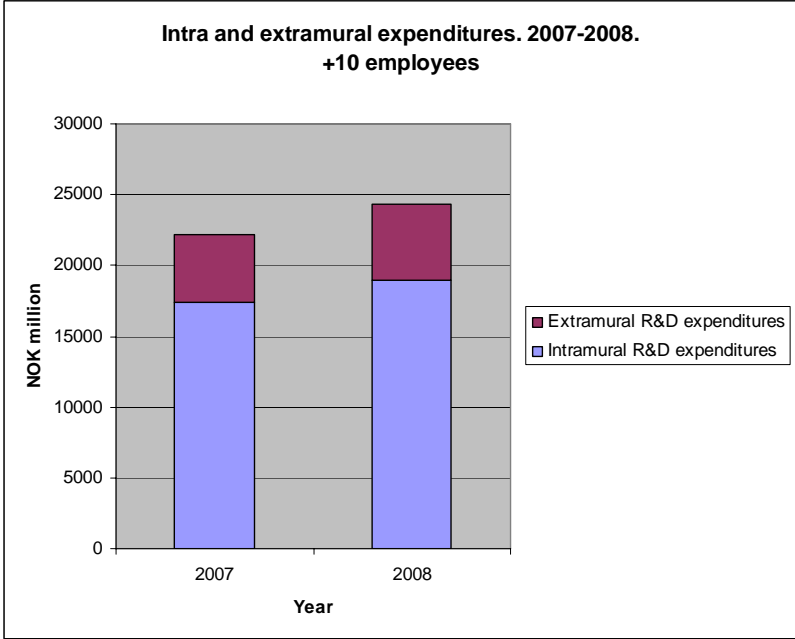


Figure 8 shows that in 2007 and 2008 approximately 75 per cent of the R&D expenditures in the business sector can be referred to activities performed inside the enterprise. It also shows that total expenditures within R&D in the business sector, are more two times higher than the total operational income in Nace 72, (figure 3).

It indicates, that the structural business statistic, is far from covering from all activity within R&D in the business sector

Figure 9 shows how the intramural expenditures are divided between industries 2005-2008

Figure 9. Intramural R&D expenditures in the business sector, divided by industry

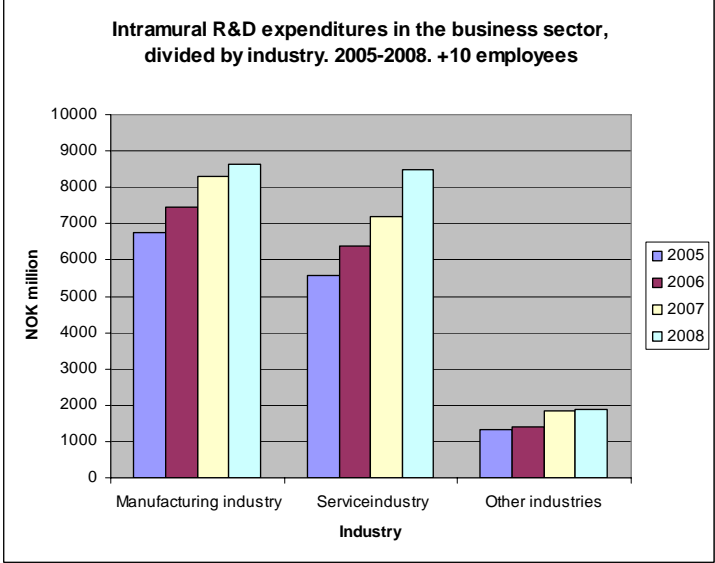
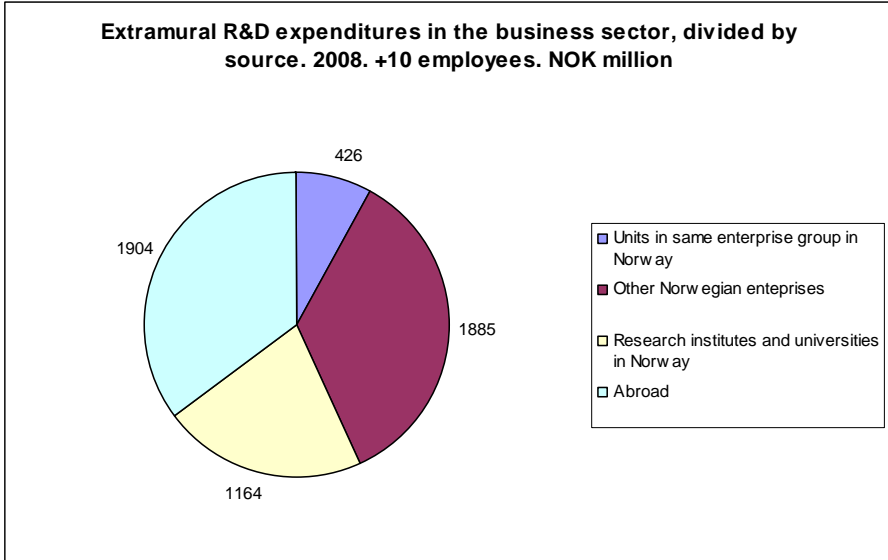


Figure 9 shows that the service industries have had the largest growth in intramural R&D expenditures the recent years. In 2008 the expenditure level is about the same as for the manufacturing industry.

The extramural R&D services are purchased from different sources, which can be seen from figure 10.

Figure 10. Extramural R&D expenditures in the business sector



The statistic can be found on <http://www.ssb.no/english/subjects/10/03>

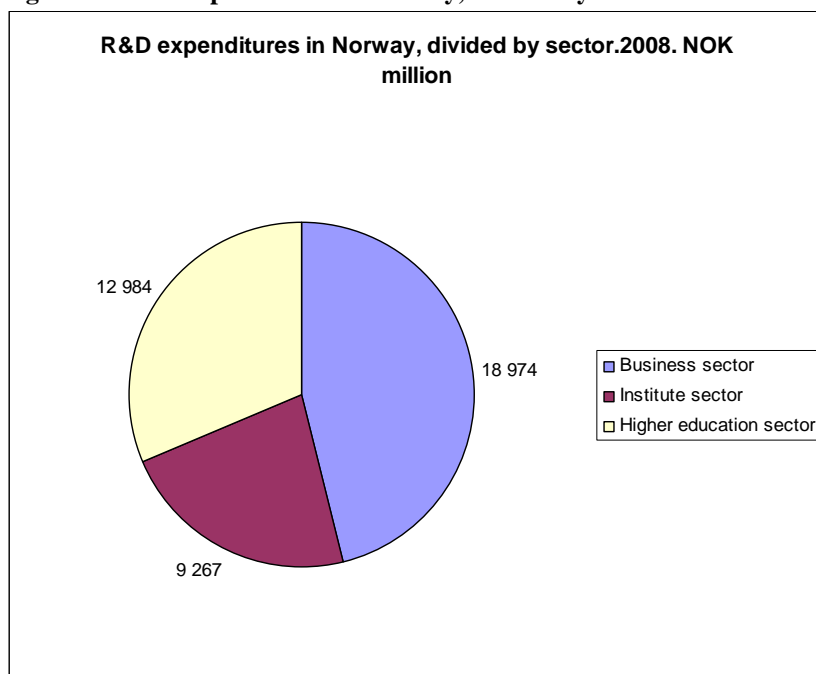
6.2 Total scope of activity in Norway

The Norwegian Institute for Studies in Innovation, Research and Education (NIFU STEP) has published figures, in cooperation with Statistics Norway for total R&D expenditures in Norway. For 2008, the total R&D expenditures in Norway was equal to NOK 41.200 million.

The expenditures are divided into 3 sectors:

- Business sector
- Institute sector
- Higher education sector

Figure11. R&D expenditures in Norway, divided by sector



Source: NIFU STEP

Figure 11 shows that the business sector stands for almost 50 per cent of all the R&D expenditures in Norway. The business sector has for many years had the largest part of the total R&D expenditures. Especially throughout the 90'ties the gap towards the other sectors increased.

The statistic can be found on <http://www.nifustep.no>

7 Summary

- Statistics Norway has two surveys, which produce turnover data for Nace 72. An annually statistic which produces absolute figures and a quarterly turnover index.
- There has been an increasingly positive yearly growth from 2003-2008, but preliminary data for 2009 indicates a negative development
- According to other statistics the business sector has the largest expenditure level in Norway. It indicates that there is a high degree of R&D activities within this sector which is not captured by the Structural Business Statistic.
- The service industries have increased their R&D activities the recent years and have in 2008 the same expenditure level as the manufacturing industry.