EMPLOYMENT STRUCTURE AND MOBILITY IN INFORMATION INDUSTRIES

PRELIMINARY RESULTS

(Session 3)

Abstract: The objective of this paper is twofold. Firstly, industry aggregates related to the information sector are defined by using a breakdown into goods-producing, services producing and content industries. The issues and the methodology related to the definition of information sector are discussed in brief. Secondly, the employment data related to information industry aggregates are presented from 1990 to 1992. The main elements of the employment structure and mobility in the information industry groups are studied i.e. gender, age, education and income levels.

Note: The figures used in this paper are indicative. All the figures are subject to revision.

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Employment Structure and Mobility in Information Industries, Preliminary Results

0. Background

Questions frequently arise on how Statistics Finland should view the on-going process towards the information society, including the social and economic impact of change. New information products have caused economic and social change and introduced gaps in the measurement programmes.

While drafting the subject during 1995, Statistics Finland launched a project to develop statistics for the information society. Among the main tasks are:

- to chart and fix the essential concepts, their definitions, variables and classifications
- to make a proposal for an indicator system to describe the information society and its development
- to define and describe typical branches in the information society, their significance on the economy and employment.

By the concept 'Information Society' we mean a society that makes extensive use of information networks and information technology, produces large quantities of information and communication products and services, and has a diversified content industry.

Starting a project without any commonly accepted international framework naturally means a great challenge. Conceptual problems involved in the development of statistics for the information society must be solved. It will be important to improve the definitions and classifications for information activities, including the definition for information industries, information products, information services etc.

The objective of this paper is twofold. Firstly, related to the project described above, Statistics Finland has been working on defining the industries of the information sector. Our hope is that this paper will serve as an input to that discussion. We also welcome all feedback on the approach adopted in this paper to promote the work carried out in this field.

Secondly, the information industries are frequently considered as one of the most rapidly growing fields of the economy. Consequently, the implications to labour markets are of major concern, particularly when the overall demand for labour in several industries is decreasing. This study includes some key variables related to employment in information industries, such as sex, age and education to assess the qualitative aspect of employment.

1. Defining the Information Industries

No internationally or commonly accepted definition of the information sector that covers several different points of view exists yet.

The ITU World Telecommunication Development Report 1995 defines the Information Industry as including the computer industry, the telecommunications industry and the entertainment industry. ITU also uses another definition on the Information Sector that includes

- telecommunications services and equipment

- computer software, services and equipment
- sound and television broadcasting and equipment
- audio-visual entertainment.

Clear-cut boundaries between the information industries are difficult to define because of the currently ongoing information/ telecommunications technology integration process. In addition, industrial and service activities which have not yet been broadly acknowledged as elements of the information technology system - such as written and audio-visual communication media - are rapidly being integrated into the IT-industry. Furthermore, telecommunications and various services under its umbrella belong to the information industry family. (ICCP Reviews of information and communications policies: Finland, OECD 1992)

An example of a new kind of approach is the North American Industry Classification System, which defines the Information Sector by using industries which were earlier included in other industries, such as manufacturing, trade, telecommunications and computer services.

The Canadians have used a breakdown of GII-GIS industries into three major components, goods-producing, service-producing and content industries[1]. The definition of the information sector is broad since content industries, sometimes considered as borderline cases, are included. A broad concept of the information sector offers a better overall view of the phenomenon. Furthermore, it also allows a separate study of different components of the information sector in the chosen framework.

The goods and services related to information technologies are dynamic. It is more and more difficult to make a clear-cut breakdown on the basis of industry. For example, information and telecommunication technologies and printed and audio-visual products are integrating rapidly. As a consequence, a too narrow scope of the definition of information industry aggregates would not be able to capture the actual development.

In the Finnish provisional framework, the relevant industries in this context are classified into two categories. The 'core' industries are defined in the first place to be generally applied in the analysis. In addition, some related industries, such as research and development, are defined to be taken into account depending on the analysis requirements and data availability. Public sector activities, e.g. education are here excluded from the core industries.

The use of product classifications is not discussed here. The problem that arises is the data availability on services, although the goods-producing part is generally well covered. We consider that using product data, when available, would essentially supplement the industry approach and deepen our understanding of the ongoing process.

The provisional framework adopted here breaks the industries down into goods-producing, service-producing and content industries. This approach follows rather closely the Canadian concept of GII-GIS, with some modifications.

2. Framework

By defining the information industries it is possible to study their development and structure by using the existing databases. The definition here is made by using the Finnish application of NACE Rev.1 (SIC-95) on the most detailed 5-digit level. In fact, the data based on NACE Rev.1 on this level of detail is available only for more recent years (1993, 1994 or 1995 depending on the statistics). When studying the earlier years, as in this paper, we do not always have a one to one match with SIC-95.

The main industries chosen here for the information industry aggregates are presented below. Several problems related to the defition of industries arise. For instance, it is not completely clear if the advertising, market research and consultancy activities should be included or excluded. More detailed information of the classes based on SIC-95 are presented in Annex I.

Goods-producing industries:

- Manufacture of office machinery and computers
- Manufacture of radio, tv and communications equipment and apparatus
- Manufacture of medical, precision and opt. instruments, watches and clocks
- Manufacture of insulated wire and cable

Services producing industries:

- Telecommunications
- Computer and related activities
- Mechanical and processing engineering design
- Wholesale of radio and television goods
- Wholesale of computer hardware
- Wholesale of telecommunications equipment and elec. components

Content industries:

- Publishing, printing and reproduction of recorded media
- Advertising
- Market research and public opinion polling
- Business and management consultancy activities
- Motion picture and video activities
- Radio and television activities
- News agency activities.

The following analysis, however, is based on SIC-88 and there remain some conversion problems, mainly in the wholesale industries. Some small industries are also left out from study[2].

3. Employment Structure and Mobility in 1990-1992, Preliminary Results

One of the reasons why the developed countries focus on GII-GIS is that it is one of the few growth areas creating not only new employment but also high value added on average. New forms of production as well as the building up of the infrastructure lead to a need for more employees with specific skills.

The results presented here for 1990-1992 are the *first preliminary results* based on Employment Statistics data. In the near future the time series will be extended to cover more years. This initial study follows the breakdown into goods-producing, service producing and content industries. The behaviour of more detailed subgroups of these industry aggregates are not studied here. Annex II gives more details of the methodology describing labour structure and mobility based on employment register data.

The recession period in Finland started in the beginning of the 1990's, causing a dramatic increase in unemployment. The employment in information industries also decreased in this period, but at a remarkably slower rate than in the whole private sector. According to the register based Employment Statistics, in 1992 the information industries employed roughly 120 000 persons, 5.9 per cent of the total employed labour force. The goods-producing industries accounted for 25 000, of which the largest industry was telecommunication equipment manufacture (8 000 employed). Services-producing industries employed about 45 000, where both computer and telecommunications employed around 15 000 persons. Content industries accounted for about 50 000 of the employed (34 000 employed were in publishing and printing).

Table 1 below shows the entrances and exits in information industry aggregates during 1990-1992. In 1990, the movements in and out form the employed labour force appeared to be less frequent in information industries than the total average of employed labour force. For several years, the total exits and entrances (including also those changing the industry) were intensive exceeding 20 per cent.

Table 1: Labour mobility in information industries 1990-1992 and total employed labour force in 1990, per cent

	Entrances				Exits		
	1990	1990 from outside empl. labour force	1991	1992	1990	1990 out of empl. labour force	1991
Goods-producing	21.7	(7.2)	15.8	20.2	22.4	(12.4)	19.1
Services-producing	17.6	(4.9)	17.8	12.9	18.2	(8.8)	19.3
Content	18.1	(6.8)	13.2	12.6	20.4	(12.1)	19.7
Employed persons, total		(8.8)				(14.2)	

Source: Statistics Finland
Note: The percentages show the share of employed e.g. in 1990 that were not classified in a corresponding industry in 1989 (Entrances) and those not classified in 1991 in a corresponding industry (Exits). More details are given in Annex II.

The mobility within the industry group concerned and also between information industry aggregates show no clear pattern. The flows inside the industry (measured here as a change in local unit between the years) are on average more frequent compared to mobility between information industry groups. The behaviour of content industries is the most rigid in terms of movements within the industry or between the other information industries.

Table 2: Labour mobility within the information industries 1990-1992, per cent of total persons employed. Entrances compared to the previous year from other information industry groups and within the same industry group (change in local unit).

	From other information industries			Within the industry		
	1990	1991	1992	1990	1991	1992
Goods-producing	1.6	1.4	1.4	5.6	3.9	4.6
Services-producing	2.1	1.3	1.0	2.5	2.5	3.3
Content	0.6	0.7	0.4	1.4	1.1	1.0

Source: Statistics Finland

a) Gender and age structure

The information industries appeared to be male dominated. In all industries the share of females was less than 50 per cent, and females accounted for only a third of personnel in services producing industries. It is also interesting that the proportion of female workers has decreased in all the industries between 1990 and 1992, when also the overall demand for labour decreased considerably.

Figure 1: The proportion of female employees in goods-producing, service producing and content industries 1990-1992, per cent.
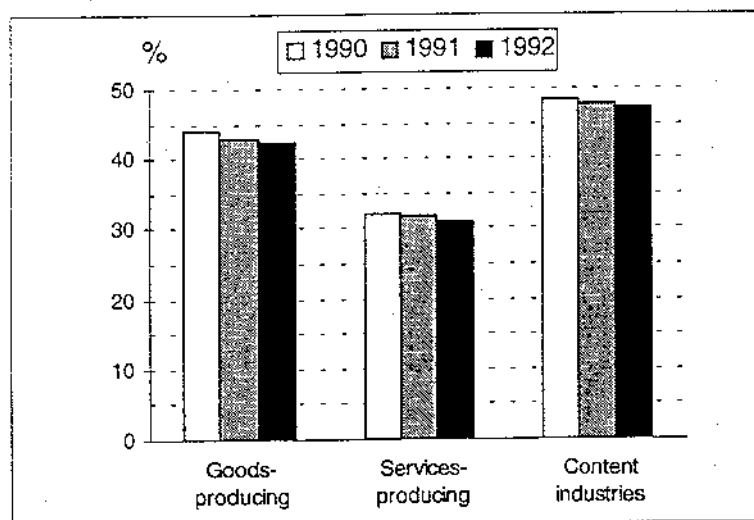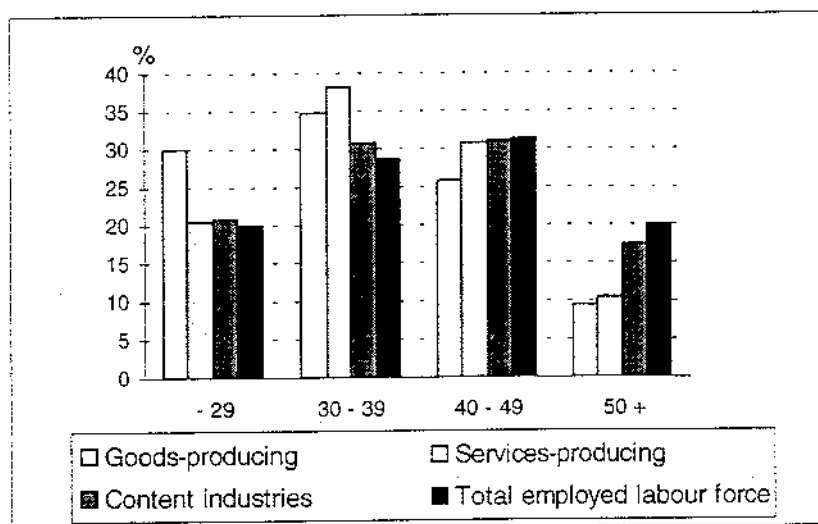

Source: Statistics Finland

In general the mobility of women has exceeded that of men in goods- and services-producing industries, while in the content industries the differences are not so clear. In all the industries females have exited the employed labour force more often than their male counterparts. The pattern is also similar in all the age groups studied.

The overall age structure shows that in 1992 the goods-producing industries employed relatively more frequently young people under 29-years of age. Almost 40 per cent of those employed in service industries belong to the age category of 30-39 years. The content industries had the 'oldest' employees, where 50-years or over represented close to one fifth of the personnel.

Figure 2: The age structure of personnel in goods-producing, services-producing, content industries and total employed labour force 1992, per cent.
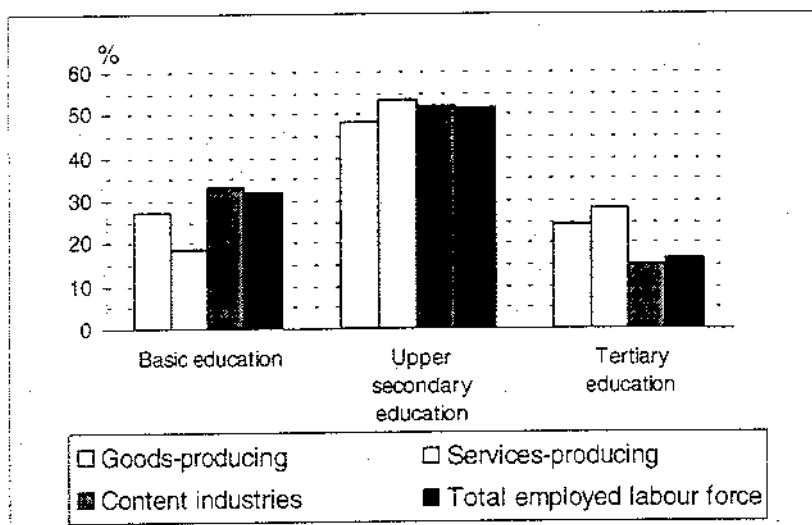

Source: Statistics Finland

In content industries close to a fifth of young people with less than 30 years of age exited the employed labour force in 1990 and 1991. Particularly in services-producing industries the young employed were clearly more often able to keep their jobs. This might also be connected to the high proportion of employed with only basic education in content industries.

A comparison of the age structure of information industries with the total employed labour force indicated that the persons working in information industries are younger than the average for all employed. Frequencies in age groups less than 29-years and 30-40-years are higher in all the information industry groups.

b) The Field and Level of Education

There are remarkable differences in educational attainment across the information industry aggregates. In general, the educational attainment was higher in information industries than in total employed labour force. The most highly educated personnel are found in services-producing industries, where close to 30 per cent of the employed had tertiary education. In comparison, only some 15 per cent of the persons employed in content industries recorded equivalent educational attainment. A third of the employed in content industries had only basic education, which was about the same proportion as for total employed labour force.

Figure 3: The profile of educational attainment according to the level of FSCED[3] in goods-producing. services-producing, content industries and total employed labour force 1992, per cent.

Source: Statistics Finland

The development of employment in information industries 1990-1992 has been favourable to people with tertiary education. They have entered in all the industries in 1990-1992 (except goods-producing industries for 1992) much more frequently than the average. Also their exits and particularly the exits outside the employed labour force have been considerably lower than the average, causing a structural shift in favour of tertiary education within information industries.
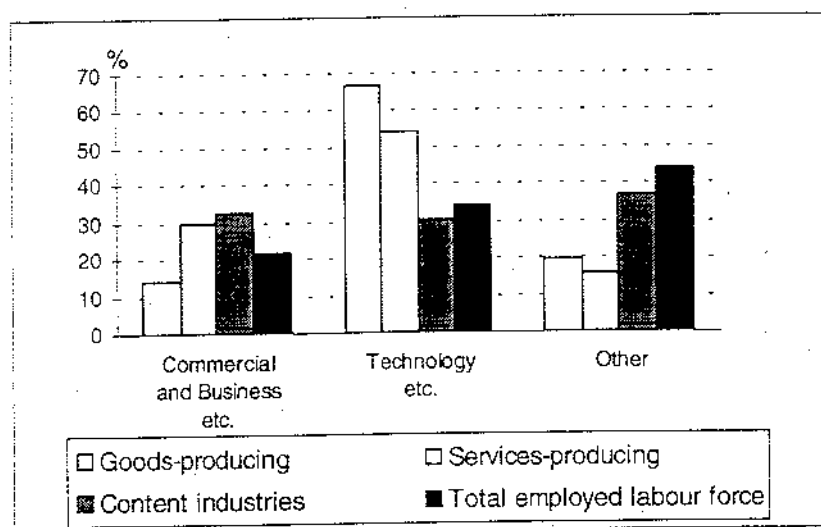
It is also evident that the persons with only basic education have in general exited the employed labour force more often than the ones with upper secondary or tertiary education.

The two dominant fields of study in information industries are technology and natural sciences together with commercial and business administration etc. In goods-producing industries close to 70 per cent and in services-producing industries more than half of those employed with upper secondary or tertiary education had the field of technical or natural sciences. In content industries the behaviour was more heterogeneous: the field of study was more often commercial than technical and furthermore the group 'other field' accounted for close to 40 per cent.

If a person had commercial or technical education, the probability to exit the employed labour force in 1990 and 1991 was less than the average. This was true for all the industry aggregates. However, also the entrances outside the employed labour force with technical or commercial education were less frequent than the average.

Figure 4: The field of education in information industries of persons with upper secondary or tertiary education in 1992, per cent.
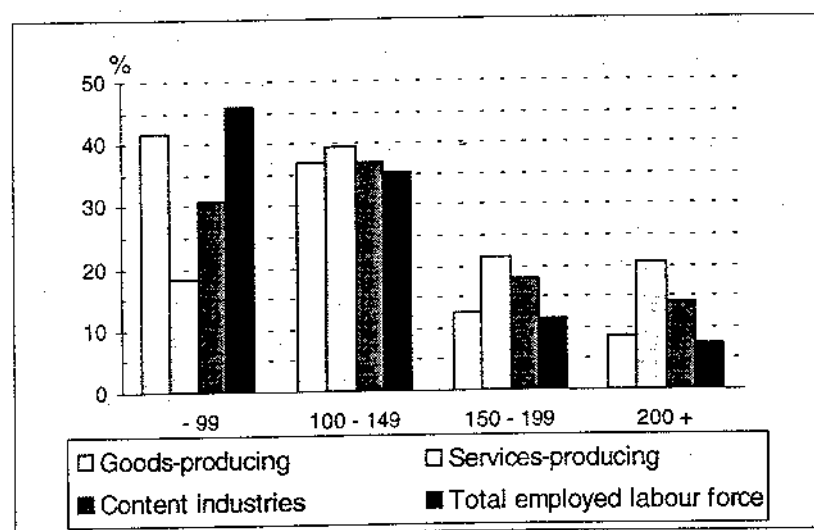
c) Income level

Income levels[4] by information industry groups show quite a fragmented pattern. The employment in goods-producing industries is clearly more concentrated in the two lowest income categories and followed closely the average income distribution of all employed labour force. The highest income averages were recorded for services-producing industries.

Figure 5: The profile of income levels in goods-producing, services-producing and content industries 1992 (FIM 1000), per cent.

In general, the higher the income level the lower the probability is to exit the employed labour force. For instance, over 10 per cent of those employed in goods producing industries in 1991 ended outside the employed labour force in 1992. The

4   Income level used here is the total taxable income, which may also include other income

corresponding figure for an income category of FIM 200 000 and over was only 2.6 per cent. However, the mobility of persons with high income to other industries is quite usual.

The entrances into information industry groups are concentrated on the low income category. These people often come from outside the employed labour force, which is not the case in the higher income classes. Also the mobility within and between the information industry groups has been considerably larger in the high income groups (FIM 200 000 +).

4. Summary of the Results

- The goods-producing industries accounted for 25 000, services-producing industries for about 45 000 and content industries for about 50 000 employed totalling 120 000 in 1992 equalling 5.9 per cent of total employed labour force.

- All the industry groups are male dominated. In 1992 females were most often employed in content industries (47%) and less frequently (31%) in services-producing industries.

- The proportion of females decreased in all the information industry aggregates during the recession years 1990-1992. Female exits were higher for all industry groups and years.

- Goods-producing industries employed clearly more often young persons under 30-years of age (30 per cent of the total employed) than the other two industry groups. Services-producing industries employed most often persons of 30-40-years and the share of the age group of 50-years or older in content industries (18%) was almost twice as big as that of goods-producing industries.

- Information industries employed on average more often persons with higher education than in the total employed labour force. The highest educational attainments were recorded for services-producing industries.

- The differences in educational attainment between the industries are clear. Close to 35 per cent of the employed in content industries had only basic education, while the corresponding figure for service industries was less than 20 per cent. By contrast, almost 30 per cent of those employed in service industries had tertiary education while in content industries it was only 15 per cent.

- The mobility between and within the information industry groups seems more likely among persons with tertiary education, although the overall mobility between and within these groups remained quite low.

- The mobility of persons with tertiary education out of the industry groups was in general somewhat lower and the entrances more frequent than the averages. Clearly less persons with tertiary education ended outside the employed labour force. This pattern was particularly evident in the goods-producing industries.

- In general, mobility within and between the information industry groups has been considerably larger in the high income groups (FIM 200 000 +). Also the exits from the industries ended outside the employed labour much less frequently than on average.

- The dominant field of education in information industries was technology and natural sciences. This holds true particularly for goods-producing industries.

5. Concluding Remarks and Future Work

The study of the Finnish information industries showed that the employment in these industries decreased between 1990 and 1992, though the rate was clearly slower than the average in the private sector. The information industries on average seem to employ persons with higher educational attainment than the average for total employed labour force. Furthermore, all the groups were male dominated and the age profile for information sector employees was younger than that of the total employed labour force. The employed with upper secondary or tertiary education tend to have either technical or commercial education.

Detailed industry study will be carried out in the near future of the industry aggregates. Interesting comparisons of the behaviour of information industries with total employment was only made to a limited extent. Furthermore, comparisons of goods-producing industries with manufacturing and services- producing industries with total private services would hopefully reveal some specific features of the information industries.

By now the time series used was too short to be able to reveal any long term development trends. The recession period at the beginning on the 1990's was far from normal business cycles. Nevertheless, the time series will be extended in the near future to cover 1993-1994. The next step of the study will also include more cross-tabulations of the existing data, e.g. the level of education by gender and age.

We hope that further measures will be taken to build up an internationally comparable framework for analysing the development of information industries. This would naturally be only one step among various measures needed, economic and social, to capture the main features of emerging information societies.

*Provisional contents of information industries based on
the Finnish SIC-95*

1) Goods-producing industries

30 Manufacture of office machinery and computers
    3001 Manufacture of office machinery
    3002 Manufacture of computers and other information processing equipment

    313 Manufacture of insulated wire and cable

32 Manufacture of radio, television and communication equipment and apparatus
    321 Manufacture of electronic valves and tubes and other electronic
components
    322 Manufacture of television and radio transmitters and apparatus for line
telephony and line telegraphy
    323 Manufacture of television and radio receivers, sound or video recording
or reproducing apparatus and associated goods

33 Manufacture of medical, precision and optical instruments, watches and clocks
    331 Manufacture of medical and surgical equipment and orthopaedic
appliances
    332 Manufacture of instruments and appliances for measuring, checking,
testing navigating and other purposes, exept industrial process control equipment
    333 Manufacture of industrial process control equipment
    334 Manufacture of optical instruments and photographic equipment
    335 Manufacture of watches and clocks

2) Services-producing industries

    51432 Wholesale of radio and television goods
    51641 Wholesale of computer hardware
    51652 Wholesale of telecommunication equipment and electronic
components

The wholesale of computer and telecommunications are included, since the new
national nomenclature (SIC-95) allows the 5-digit level of detail. Furthermore,
e.g. wholesale of computer hardware is very closely related and often integrated to
computer and related activities and their volume is significant.

On the other hand, the retail sale of these products classified in the corresponding
classes in retail is very modest. The sales volumes can be better traced through
other sources e.g. sales statistics. The retailers are classified here in the closely
related activities and are not included in the core industries.

642 Telecommunications

    7133 Renting of office machinery including computers

72 Computer and related activities
    721 Hardware consultancy

722 Software consultancy and supply
723 Data processing
724 Data base activities
725 Maintenance and repair of office, accounting and computing machinery
726 Other computer related activities

74208 Mechanical and processing engineering design

The mechanical and processing engineering activities are significant in Finland. They are closely related to class 333 manufacture of industrial process control equipment from the goods producing industries.

3) Content industries

22 Publishing, printing and reproduction of recorded media

221 Publishing
    2211 Publishing of books
    2212 Publishing of newspapers
    2213 Publishing of journals and periodicals
    2214 Publishing of sound recordings
    2215 Other publishing

222 Printing and service activities related to printing
    2221 Printing of newspapers
    2222 Printing n.e.c.
    2223 Bookbinding and finishing
    2224 Composition and plate-making
    2225 Other activities related to printing

223 Reproduction of recorded media
    2231 Reproduction of sound recording
    2232 Reproduction of video recording
    2233 Reproduction of computer media

The class 22 publishing, printing and reproduction of recorded media is included on 2-digit level, since it forms a harmonised entity and is one of the core elements within content industries.

71401 Renting of videotapes

7413 Market research and public opinion polling

7414 Business and management consultancy activities

744 Advertising

7483 Secretarial and translation activities

In our opinion, the activities listed above (excl. 71401 and incl. 924 News agency activities) deal with information and create content to the extent that they are candidates to be included under content industries. For example, business and management consultants create, interpret and transmit information, even though their target group is limited. On the other hand the functions of advertising agencies are quite similar, but the output is generally aimed to be public.

921 Motion picture and video activities
    9211 Motion picture and video production
    9212 Motion picture and video distibution
    9213 Motion picture projection

922 Radio ja television activities

924 News agency activities

The audiovisual activities are considered to be more related to creation and transmission of content than being a part of service producing industries. Naturally, audiovisual activities comprise of the both type of elements.

Register-based employment statistics in the production of data by industry

In 1987 Statistics Finland implemented the use of administrative register data as a basis for producing the regional employment statistics. In the system all those with an "official" employment relationship in Finland (i.e. those with a recognised pension insurance) are merged with the establishment data of the Business Register of Statistics Finland. Each employed person is linked to the employer's enterprise and the activity unit of the enterprise (i.e. factory, branch of bank, hostel, municipal day care centre, etc.). The link produces precise data on the industry of the workplace, of its legal form and on the address of the workplace for each employed person. Exact data on the location of the establishments are produced by merging the address data with the Buildings and Dwellings Register: the municipality, the sub-region of the municipality, the post code area and the map co-ordinates. Next data on the level and field of education of the employed are linked from Statistics Finland's Register of Completed Education and Degrees, income data from the registers of tax authorities, and data on sex, occupational status, unemployment, retirement, conscription, etc. from the various material of the labour force statistics.

This project is concerned with only given industries related to the information society, so that with the use of the data in the Business Register the persons linked to the enterprises and local units of these enterprises are collected from the employment statistics on the basis of their employment relationships.

Thus we have information on those that worked in these industries at a given period of time T. By comparing two successive years e.g. T and $T-1$ we obtain information on the net changes that have occurred in the amount of employees in the year T according to age, gender, level and field of education and income.

In the next stage it is possible to find out who the newcomers in the field are and where they have come from, who those that have left the field are, and what happened to them after the termination of the employment contract. We therefore "cross-tabulate" the data of two successive years $T-1$ and T for each individual. Thus we discover that in the year T one person employed in information technology was at the end of the previous year a student, in a different branch of activity. And conversely, in the year $T-1$ a person working in the branch of activity is in the year T still in the field, changed to a different field, was made redundant, continued studying, retired, etc.

The employment statistics are an excellent tool in the monitoring of individual branches of activity. It reveals the number of jobs of a given field, the changes, the structure of the education of the employees, and in addition describes where the newcomers come from and where leavers end up, as well as displaying the mobility within the field.