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Qualifications of ICT sector employees and ICT educated persons on the labour market – new research possibilities arising from register-based statistical systems

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ABSTRACT

This paper provides some examples of how register-based statistical systems can be used to monitor ICT sector employees and ICT educated persons on the labour market. Longitudinal data files make it possible to study how graduated cohorts are entering the labour force. It also allows us to monitor changes in the personnel within an industry and how the mobility of the highly educated population, job changes of employed persons and other employee mobility follow economic fluctuations and which employee characteristics (industry of workplace, education, age, gender) are linked with the rate of mobility.

1 Introduction

Sequential annual employment statistics data at the individual level are used to obtain information about the changes occurring in each individual's activities. The system generates data on movements between classes of main activity and branches of industry, and on the integration into working life of those with a tertiary degree.

The traditional statistical analysis only provides cross-sectional data on the numbers employed, out of work, etc. A system that is based on individual follow-up provides more information on how changes on the labour market take place:

- Entries into the labour force and structure of the new labour
- Exits from the labour force and structure and reasons for the exit
- What kind of labour is recruited in different industries
- How people move from studies into work in different branches and at different levels of education
- Impact of business cycles on recruitment
- Impact of the area in which education is provided.

1.1 Persons with qualifications in information technology and media studies

The list of degrees and qualifications in information technology and media studies is based on a national definition as no international agreement exists on the definition. The examples given here illustrate the content of the definition: Vocational Qualification in Information Technology; Diploma in Systems Design, Vocational Qualification; M.Sc., Computer Science; Graduate Engineer, Information Technology; M.Sc. in Technology, Information Technology; Bachelor of Business Administration, Information Processing; Diploma in Media Technology.

In 1999 a total of some 5,300 degrees and qualifications were completed in information technology and media studies, accounting for six per cent of all qualifications obtained in vocational education at polytechnics and universities. Men accounted for 79 per cent of the qualifications completed in information technology and media studies. From 1997 to 1999 the proportion of men among those completing qualifications increased to some extent.

By year-end 1999 some 73,800 persons had completed an education in information technology and media studies; for 53,200 persons this was their highest educational degree. Men accounted for 70 per cent of this figure.

Over half of the population with degrees or qualifications in information technology and media studies were aged under 35, as compared with 39 per cent of the whole population with post-compulsory qualifications other than the matriculation examination.

1.2 Employment structure in the production of goods and services in the information sector

A limited international recommendation has been drawn up for the information sector. The branches to be used for describing the production of goods and services of the ICT - that is, information and communication technology - industry were confirmed by the OECD in summer 1998. The information sector mainly refers to branches involving the production of goods, services or content, although in some employment surveys it may be preferable to refer to the broadly defined information sector. The broadly defined information sector may also contain libraries that provide information services and the like as no established definition exists for it. (See Appendix with Finnish SIC codes)

Preliminary figures from the 1999 regional employment statistics indicate that a total of some 103,000 persons were employed in the production of goods and services in the information sector in 1999.

Close on two thirds of those working in goods production were men. Compared with industrial manufacturing, where 70 per cent were males, it seems that goods production in the information sector has recruited a somewhat larger number of women. In the single biggest branch, i.e. the manufacture of television and radio transmitters, which includes the manufacture of mobile phones, 64 per cent of those employed were males.

The proportion of women working in service production was higher than that in services overall. In the information sector men accounted for 68 per cent of employees in service production, while the figure for services in general was 53 per cent. The proportion of men was particularly high in the wholesale of telecommunications equipment (73%) and computer services (70%).

Table 1 Information sector (goods and services production) personnel structure in 1999*.

		Goods	Service	Whole-	Tele-	Computer	Goods and	Manufacturin	Services
		production	production	sale	comms	services	production, total	g	
	Total	42 869	60 126	16 067	16 949	27 110	102 995	431 445	801 202
	Men, %	63	68	73	59	70	66	70	53
Age	<35 years	58	44	45	39	46	50	36	38
	35-44 years	26	31	32	28	32	29	27	27
	45-54 years	14	21	19	27	20	19	29	26
	>55 years	3	4	4	6	3	4	8	9
Level of	Comprehens	15	13	16	16	8	14	26	27
education	ive								
	Upper	40	35	36	38	34	37	49	41
	secondary								
	Tertiary	46	52	49	46	58	49	25	31

Source: Statistics Finland, Regional Employment Statistics, 1999*.

Persons aged under 35 accounted for 36 per cent of the total industrial labour force, which is a significantly lower figure than that in the production of goods in the information sector. In the services sector 38 per cent of employees were aged under 35, while the corresponding figure for services production in the information sector was 44 per cent.

In manufacturing, persons with a tertiary qualification accounted for 25 per cent of the labour force; in goods production in the information sector the figure was 46 per cent. In services production the difference was even greater, the figure for the information sector standing at 52 per cent and that for the total services branch at 31 per cent.

2 Changes in the labour market according to the register-based statistical system

In all the Nordic Countries employment statistics are compiled from the dual data sources of population registers and other administrative records. Among the main advantages of register-based statistics production are its lower costs, elimination of any additional response burden, and further uses of the available register data. The most important feature is the annual availability of total data for the whole nation and for smaller geographical areas and small population subgroups. For example, the register captures short spells of activity or conditions, as well as multiple or side activities, such as employment among students, second or third jobs, and so on. Data quality is also improved for items that would otherwise involve long-term memory or detailed records. The coverage of the data is usually high. There is much supportive information for instance for the coding of occupations, educational data, and data describing employers (size and industry of employer). The ability to link various types of datasets such as demographic and business information is also essential for research purposes.

2.1 The register-based system

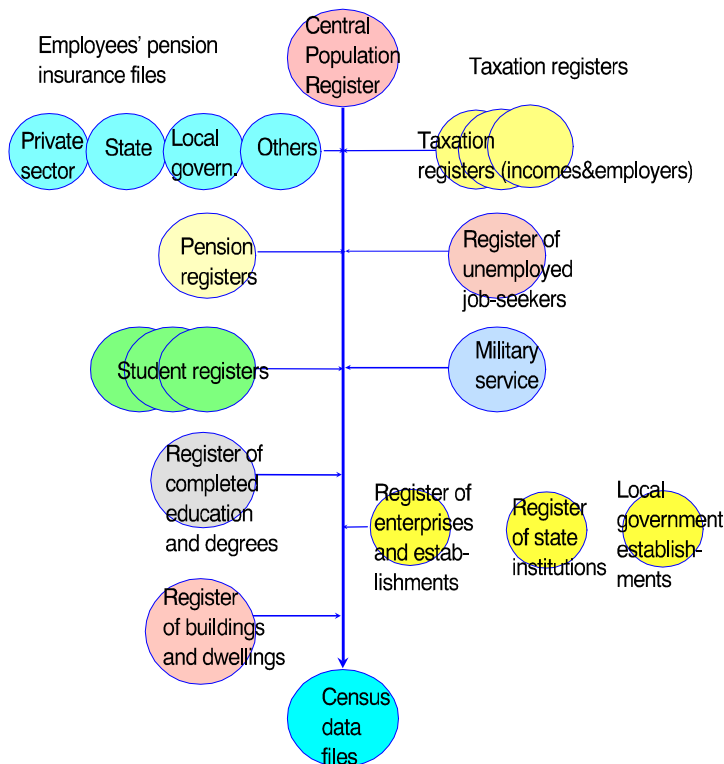
All the relevant data are compiled into annual databases. A greater number of cross-tabulations of data from different databases will be made in a census year than during normal years of data compilation. Data concerning the population's economic activity are compiled yearly into employment statistics, the main data sources for which are the following:

- The Population Information System of the Population Register Centre (including data on buildings and dwellings)
- Registers maintained by the tax authorities (on incomes, wages and salaries, benefits, etc.)

- Employment registers maintained by the Central Pension Security Institute, the State Treasury and the Municipal Pension Institution
- Statistics Finland's Register of Enterprises and Establishments and Register of the Non-corporate Public Sector
- The National Pensions Institute's and the Central Pension Security Institute's pensioner registers
- Student registers
- Ministry of Labour's Register of Job-seekers
- Statistics Finland's Register of Completed Education and Degrees, and
- The Register of Conscripts.

Data are linked between persons, incomes, employment, unemployment, pension periods, buildings, dwellings, enterprises, workplaces (establishments), education and places of graduation.

Use of registers and administrative records in register-based statistics



2.2 New research opportunities

All register units as well as addresses are updated continuously or at least once a year. Registers can also be used to draw samples of certain populations such as age or income groups or specific geographical areas. Registers are furthermore used to reduce the number of questions that respondents are asked in sample surveys on subjects like demographics, education and family (family and household combinations). Their third usage is to determine the characteristics of survey non-respondents (for example, age, gender, employment status, place of residence). Since 1987, Statistics Finland has produced an annual and even a monthly database for the entire population. Information is produced for the whole country as well as for smaller areas such as municipalities and parts of cities.

Census data and employment data are used to compile longitudinal data files in which each resident of the country is linked with his or her data in different Censuses (1970, 1975, 1980, 1985, 1990, 1995 and 2000). A further data file combines the annual data for 1987–2000 into a “**short longitudinal data file**”, with a much more comprehensive data content. This allows us to follow the life course of each person and the changes in that life course over a period of thirty or so years. It also allows us to study how **graduated cohorts are entering the labour force** and to monitor **changes in occupation and industry**, place of residence and work, and related characteristics such as unemployment, receipt of pensions, and disability. With this database, Statistics Finland can determine how various age and educational groups fare on the labour market and how their work compares with their educational attainment. It is also possible to determine whether school leavers find employment in or around

the city where they have studied after their graduation and, accordingly, how many of them have gone to work farther away.

Longitudinal data files provide a useful tool for monitoring the entry into the labour market of all graduates as well as their other movements on the labour market. The discussion below gives some examples of these new research possibilities.

2.3 Components of labour force changes

Data on structural changes in the labour force have been compiled by monitoring population and labour force flows from one status to another in sequential years. Usually, annual statistics only provide cross-section data relating to different points of time on population numbers, numbers of employed, etc.; from the obtained figures we can then ascertain how much these phenomena have changed during a year or between censuses. With the register system, we can explain how these changes have occurred and whose labour market situation has changed.

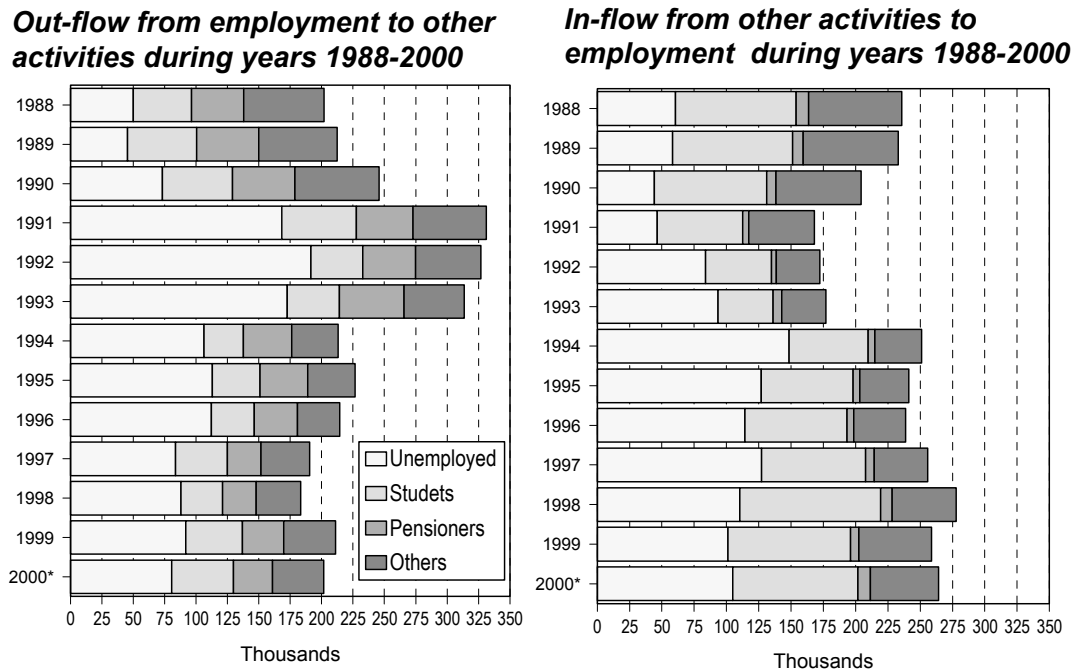
Each year an average of 30,000 to 50,000 persons retire from working life. Escalation of unemployment may decrease the number of persons retiring because of invalidity. A large proportion of those moving from employment to homemaking and vice versa are women beginning or ending their maternity leaves.

The numbers entering the labour market were at their lowest in 1991-1993. After the onset of mass unemployment the majority, or 53%, of those starting in paid employment were unemployed in 1993; in 1994 the figure climbed further to 59%. Since then the proportion of students among new recruits has been increasing and stood at 40% in 1998.

The numbers entering the labour market began to increase in 1994. In 1998 a total of 280,000 new people were recruited into the labour market. At the same time the number of exits was only 190,000, which meant that the total number of people in employment increased by almost 90,000. Students accounted for 70,000 of all new recruits in one year.

The number of exits from the labour market has dropped from the peak figure of around 330,000 in 1991-1992 to 180,000 in 1998. Redundancy remains the main reason for exit (46%), although the probability of being made redundant is clearly lower now than it was when the situation was at its worst. The second most common reason for exiting the labour market is to begin studies (20%). The figures for those moving into homemaking and retirement have remained more or less unchanged.

Figure 1. From employment to other activities and vice versa.



Source: Statistics Finland, Regional Employment Statistics.

During the year 1998, the number of employed persons increased by 87,500 and most of them were students who entered the labour market. Altogether 108,987 students moved into the employed labour force and 37,315 employ-

ees moved from the labour force back to school. During the year 1998 the net influence of the group of unemployed persons was 23,000 persons.

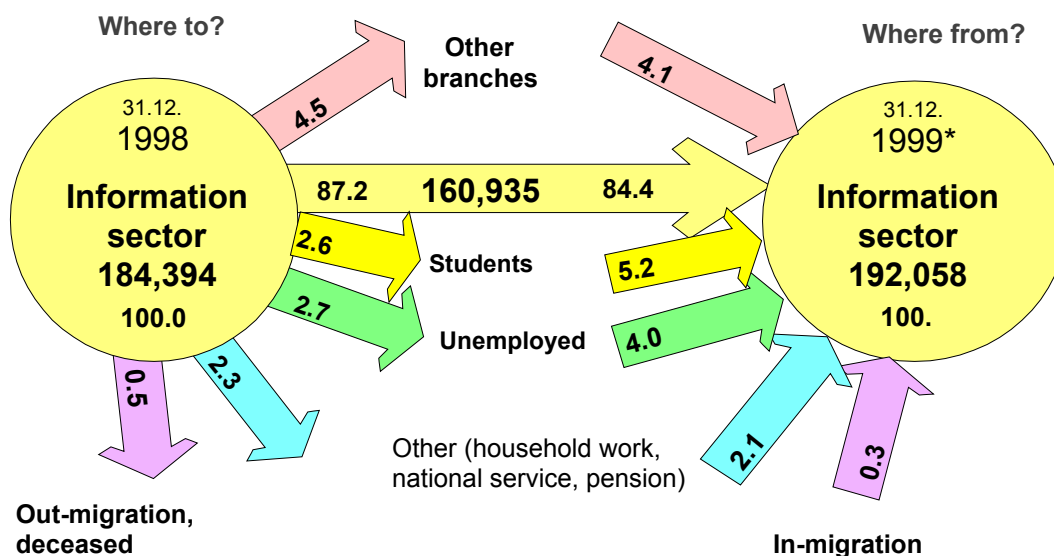
The number of the unemployed decreased by 32,386 persons and in the same year 37,019 students became unemployed while 26,416 unemployed persons started further education in some educational institution. Additionally 2,432 unemployed persons were received from abroad.

2.4 Changes in information sector labour force in 1997–1999

From 1997 to 1999 the number employed in the broadly defined information sector increased by 26,100, showing strong growth compared to the previous two-year period. The number entering the sector increased slightly to 56,500, but the background of the newcomers changed in that the proportion of those who had been unemployed fell to 14 per cent while that of those entering the sector direct from educational institutions rose to 35 per cent. The proportion of those who had started in the sector within the past two years remained at close on one third (29%). The proportion of those entering the sector from other branches remained at almost 40 per cent. The number leaving, at 30,400 (18%), and its structure remained almost exactly the same as in 1993–1995 and in 1995–1997.

In 1999 the figure increased by no more than 7,700 persons, but it is important to bear in mind that this is based on preliminary data and that the information on branch of employment remains unknown for quite substantial numbers. In the 1997 material there was a 4 per cent difference between the preliminary and the final data. A total of 31,100 persons (16%) entered the sector in 1999, with one third coming from other branches. At the same time the number of those coming direct from educational institutions had risen to 36 per cent. The proportion of newcomers who had been unemployed was 18 per cent. The numbers leaving the sector had risen to 23,500 (13%), more than one third of whom moved on to work in other branches, one fifth were made redundant and a further one fifth continued their studies. Staff turnover in a rapidly expanding sector tends to be high.

Figure 2 Changes in employment (%) in the broadly defined information sector 1998–1999*.



Source: Statistics Finland, Regional Employment Statistics.

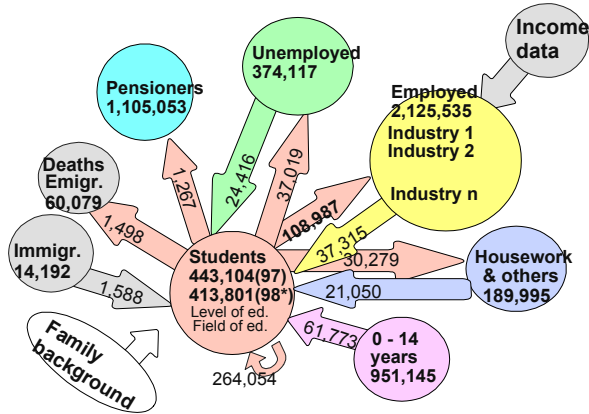
Staff turnover in the manufacturing industry is markedly lower. In 1999, only 44,500 employees (10%) left the industry, at the same time as 48,900 new employees were recruited, representing 11 per cent of the total labour force at year-end 1999.

2.5 School leavers

Job information is produced for school leavers with a view to helping them to decide whether they can find a job that corresponds with their qualifications. The efficiency of different vocational institutions and universities can be measured by studying how well and fast their graduates can find jobs. Comparisons of data from consecutive years

will provide information on people's movement between different activity groups. The figure below aims to illustrate the kind and number of flows that can be specified during one year.

Figure 3. Flows between different activity groups: STUDENTS 1997-1998*.



Source: Statistics Finland, Regional Employment Statistics.

At year-end 1997 there were a total of 443,104 persons attending post-comprehensive education in Finland. During 1998, 108,987 of them entered the labour market, at the same time as 37,315 exited the labour market in order to begin or continue studies. Out of those who were students in 1997, 264,054 continued their studies.

2.6 Employment upon completion of qualifications in information technology and media studies

We go on to look at how attainers of qualifications in information technology and media studies succeed in finding employment on the labour market. The main activity of the persons concerned is extracted from employment statistics describing the situation during the last week of 1999.

Over four fifths, or 81 per cent, of the attainers of tertiary qualifications in 1998 had found a job by the end of the following year. The figure for graduates from information technology and media studies was 91 per cent.

Among graduates from both upper secondary and tertiary levels, the number who had found employment increased as more time elapsed since graduation. The one exception to this pattern were information technology and media students, for whom employment rates ranged between 88 and 91 per cent regardless of the time since graduation. It seems that for persons with upper secondary qualifications from information technology and media studies, the employment rate declines to some extent after five years since graduation.

Table 2 Attainers of tertiary qualifications in 1990, 1993, 1995, 1997 and 1998 by main activity at year-end 1999*.

	Field of education	Degree completed in	Total	Main activity at the end of year 1999*		
				Employed	Student	Unemployed
				%	%	%
Persons with qualification, total						
		1990	28 667	86	3	5
		1993	37 278	83	4	6
		1995	37 407	82	5	7
		1997	39 408	81	7	7
		1998	37 675	81	8	7
IT and media studies						
		1990	2 158	89	2	5
		1993	2 696	88	3	4
		1995	2 231	89	4	4
		1997	2 469	88	7	3
		1998	2 184	91	3	3

Source: Statistics Finland, Education Statistics.

Among attainers of tertiary qualifications in 1998, seven per cent were unemployed one year on. Unemployment was slightly lower level among persons graduating from information technology and media studies, but in contrast to the situation for persons completing degrees in other fields of study, tended to increase to some extent as more time elapsed.

Table 3 Employment among attainers of post-compulsory qualifications in 1998 by age at year-end 1999*.

Age	Persons employed as a proportion (%) of those completing qualifications	
	Total	Information technology and media studies
	%	%
Total	58	74
-24	44	50
25-34	80	89
35-44	83	85
45-	82	83
Men	56	72
-24	39	48
25-34	84	90
35-44	85	88
45-	80	80
Women	60	81
-24	48	68
25-34	76	86
35-44	81	79
45-	83	86

Source: Statistics Finland, Education Statistics.

Looking at employment by age, we find that in the age group 25 and over some 80 per cent were in gainful employment regardless of the field of study. By contrast, in the age group of those under 25 less than half, or 32 per cent, were still pursuing their studies and 10 per cent were out of work. Among persons with qualifications in information technology and media studies, employment rate was the highest in the age group 25–44, and the lowest among those under 25 and over 45. In all the fields of study included in this analysis women aged under 25 had been more successful than men of the same age in finding employment; this was particularly true of young women graduating from information technology and media studies. However, the highest employment rate was recorded for men aged 25–34, among whom 90 per cent were working one year after completing their studies.

Looking at how people with different qualifications in information technology and media studies have found employment, we observe that virtually all of those with tertiary qualifications were in gainful employment, whereas some of those with upper secondary qualifications were out of work.

The higher the individual's level of education, the less that individual will ever have to suffer from unemployment. The variations between different branches and levels of education are quite substantial. When the economy is slow, up to half of those with a high level of education may find themselves out of work. The longer the period of unemployment, the harder it is to find work. Employment among those having graduated during the recession may remain at a permanently lower level than among those graduating during a booming economy.

2.7 New entrants in different industries

The example below looks at what kind of labour was recruited by different industries: the focus is on the proportion of students, unemployed and other groups in the flow of new recruits. The analysis was done for 1995 and 1998. Overall it can be concluded that the fastest growing industries recruited larger proportions of their labour force from educational institutions than from amongst the unemployed and other population groups.

In manufacturing and construction, the demand for labour started to fall off in 1989; in trade and finance, and in transport and communications, the turning point came one year later. Hiring within the public services sector continued up to 1991, largely from educational institutions. The public services sector now employs almost half of all school leavers who manage to get a job. Now that the recession has abated, the hiring of students in the processing industries and in the services sector as a whole accounts for over 80% of jobs. Before the recession, construction and manufacturing hired the largest proportion of jobless people. Only 40% of all new jobs now go to the unemployed.

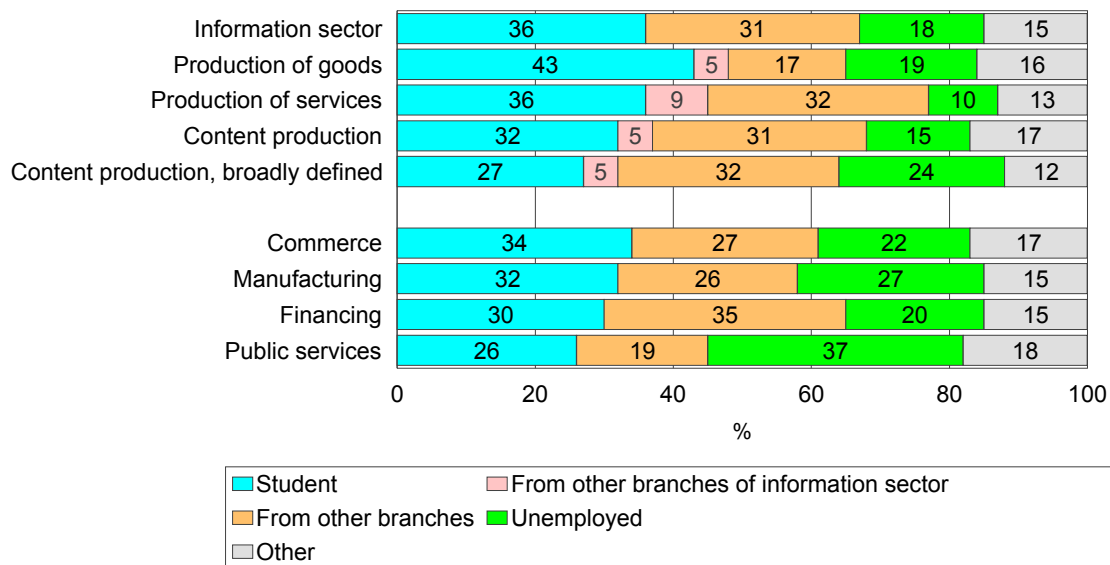
Today there is demand in Finland for new labour in manufacturing industries, trade and commerce, business services, and in health and welfare services. The proportion of students in the new recruited workforce is high and has increased since 1995. The hotel and catering sector is the most active in recruiting young students. In this business students often take on jobs while they are still studying, which means that staff cannot always be recruited on a permanent basis. The situation is very similar in trade and commerce as well as in cleaning jobs.

In contrast, recruitment from the ranks of the unemployed is more common in transport and communication, building and construction as well as in public administration. Transport, as well as building and construction are sectors that are affected by seasonal fluctuations so that some of the labour force is more or less "regularly" unemployed during the winter, returning to work in the spring. The public sector seems to recruit large numbers from the ranks of the unemployed, but this is partly explained by government relief work programmes.

The fastest-growing sectors are found in the information industry. A distinctive feature in these sectors is that graduates take precedence in recruitment over unemployed and skilled workers from other industries. Apparently the thinking is that the educational and skills qualifications of the long-term unemployed are not up to the standards required in hi-tech companies.

In the information sector newly employed persons come direct from school more often than do those in commerce, manufacturing, financing and the public sector. Expanding ICT companies are particularly active in recruiting students and graduates. People newly employed in the public sector have typically been unemployed previously and obtained employment through various job creation measures. The numbers moving into service production in the information sector are particularly small among those out of work.

Figure 4 People newly employed in 1999 by previous activity (%).



Source: Statistics Finland, Regional Employment Statistics.

The fastest-growing industries prefer to recruit direct from educational institutions rather than from amongst the ranks of the unemployed. Hi-tech industries in particular are reluctant to take on unemployed people. The public sector has a greater responsibility than others when it comes to providing relief work for the unemployed.

2.8 Impact of place of study on entry into the labour market

In Finland one of the methods used to try and measure the efficiency of the educational system is to monitor the recruitment into and the exclusion from the labour market of people graduating from different types of institutions in different regions. There are marked differences in employment between different lines of education and different levels of education.

There are clear differences between university towns in terms of the employment of graduates as well as in terms of where they are employed. The table below illustrates the labour market status of people graduating from different university towns in 1988-1995 two years after graduation. At the same time, it provides details on whether the graduates are working in their home town, in neighbouring municipalities or elsewhere. Somewhat surprisingly, the highest employment figures are recorded for the smallest universities, i.e. those in Rovaniemi and Lappeenranta. The employment figures for the biggest university towns of Helsinki, Turku and Tampere are up to 7-8 percentage points lower. However, those outside the active labour force are not unemployed but have either moved out of the country, continued their studies or stayed at home to work as housewives or fathers. Bigger cities apparently have the best opportunities for further studies as well, so that the proportions in post-graduate studies are highest there. The numbers moving abroad are the highest in Espoo, Turku and Vaasa. Turku and Vaasa also provide university education in the Swedish language, improving prospects of employment on the Nordic labour market.

Table 4. Labour market status of people graduating from university towns in 1988-1995 two years after graduation.

City	Number of graduations in 1988-1995	%	Labour market status two years after graduation					Unemployed	Not in the labour force	Emigrated (died)
			Employed in the same town	Employed in the same city area	Employed in other municipalities	All employed				
Espoo	5 125	100	30	39	17	86	4	7	3	
Helsinki	19 495	100	43	17	22	82	6	10	2	
Turku	9 167	100	23	5	51	79	7	10	4	
Tampere	7 681	100	27	3	53	82	8	9	2	
Lappeenranta	1 480	100	13	0	75	89	5	6	1	
Kuopio	1 945	100	21	1	64	86	5	8	1	
Joensuu	2 384	100	16	5	62	82	8	9	1	
Jyväskylä	5 615	100	16	4	66	86	5	7	1	
Vaasa	2 944	100	15	3	67	86	5	7	3	
Oulu	5 631	100	28	5	52	84	6	8	2	
Rovaniemi	1 438	100	15	5	69	88	7	4	1	

Source: Statistics Finland, Regional Employment Statistics.

In the Helsinki region the labour markets for graduates are very good: up to 60% of all those graduating get a job in or around the city. The labour markets in the Oulu region are also showing strong growth, but even so 50% of those graduating have to move to find a job. Rovaniemi is the northernmost and one of the smallest university towns in the country, and not surprisingly the majority, or 70%, of its graduates are employed elsewhere.

There is clearly less mobility among vocational school graduates than among university graduates: they are often employed in their home town or its immediate vicinity, or they remain outside the labour market. They travel farther away in search of a job less often in all three cities in this example, i.e. in Helsinki, Oulu and Rovaniemi.

In Finland educational opportunities are evenly spread out across the whole country: the purpose of this policy is to ensure the availability of qualified labour force in all regions. The employment of those graduating depends on the size of the local labour markets and of course on the field of education. Only the metropolitan Helsinki region can provide job opportunities to the majority of those who have studied in the same region. In the fast-growing region of Oulu, for instance, over half of those graduating have to move to find work. In the smallest universities, the majority of students are eventually employed elsewhere. The line of study also has an impact on where the graduate is employed: the labour markets for doctors, teachers, priests, nurses, police and civil servants extend across all 452 local municipalities in the country, so large numbers graduating in a university town will have to move to find work.

3 Mobility research

3.1 Introduction

Statistics Finland participated in a joint Nordic research project headed "Competence Flows in Nordic Countries", one of the aims of which was to study how closely the mobility of highly educated personnel, job changes of employees and other personnel mobility follow economic fluctuations and which personnel characteristics (industry of workplace, education, age, gender) associate with the rate of mobility.¹

When a person changes jobs, he or she brings along to the new workplace both his or her educational qualifications and the knowledge acquired through work experience. The development, stagnation or decline of areas of society depend largely on whether they are recipients of losers of knowledge from the perspective of the mobility of trained personnel.

¹ M. Virtaharju: Korkeasti koulutetun väestön liikkuvuus. Tiede, teknologia ja tutkimus 2002:1. Tilastokeskus

3.2 Definition of mobility

The research studied labour force mobility with its so-called rates. These rates can be measured with either inflow (= numbers having changed jobs since the year before) or outflow (= numbers having changed jobs in the next year) of personnel. Furthermore, the rates can also be calculated using a broad definition by also including persons outside the labour force during the comparison year, or a narrow definition by only including persons having been employed during two studied years.

Whether the inflow or outflow definition is used depends on what each specific study aims to explore, for there is no conceptual difference between the two. This study focuses on the inflow of employees. The chosen perspective represents that of the employer for whom it is more important to know where an employee has previously been than where he or she will be going when he or she leaves the employ of the enterprise. If, on the other hand, the intention is to study the activity or efficiency of educational institutes, for example, it would be more appropriate to know what happens to students after the conclusion of their studies, e.g. whether they find employment or end up being unemployed, in other words examine the outflow of students.

Change of jobs is defined as moving from one establishment to another between the observation years. The information of the study concerning establishments was largely used as such. A transformation was performed on the data on enterprise sector establishments for the purpose of minimising the effect of “non-genuine” structural enterprise changes on the calculated mobility rates. The information on central and, especially local, government establishments is less accurate than that on enterprise sector establishments and often depicts administrative practices that may vary between different government units.

3.3 The data

Personal data produced by the different statistical topic units of Statistics Finland constituted the study data. The annual data files of employment statistics for the 1987 to 1998 period were used as primary data. These were supplemented with data from Statistics Finland’s Register of Completed Education and Degrees. Data on emigrants and immigrants were drawn from the migration files of Population Statistics.

3.4 Used classifications

Classification of Education

For international comparability reasons, the data on the population’s education produced according to the 1997 Finnish Classification of Education (=highest degree or qualification attained in each year) were converted to correspond with the new International Standard Classification of Education (ISCED 97). Persons aged between 20 and 74 with at least a lowest level tertiary degree or qualification were included in the highly educated population. This population was divided into four groups according to the ISCED 97 levels and durations of education.

Industrial Classification

The results of the study by industry represent data calculated at the enterprise establishment level, and central government agencies and institutes as well as municipalities were deemed comparable to enterprises. An exception to this were universities and central government research institutes, whose establishments were all moved under their respective main industries in order to obtain a clearer picture of mobility between the different parts of the innovation system. Industries were classified according to the 1995 Standard Industrial Classification of Statistics Finland. Information technology industries were separated into their own group because of their higher assumed mobility rate compared to other industries.

IT Industries	SIC95
Manufacture of computers and communication equipment	30, 32
Telecommunications	642
Computer and related activities	72

3.5 Mobility at establishment level

The most accurate register information on workplaces is data on establishments, the benefit of which is that establishments represent more permanent units than enterprises. Diverse business re-organisations, such as incorporations, acquisitions, mergers and wind-ups do not necessarily affect the establishment level at all and operations continue unchanged. Nevertheless, changes also take place at the establishment level but they may not represent genuine changes in the sense that the activity of the establishment continues within the same industry and with the same personnel. Some of the mobility between establishments may be internal mobility within an enterprise, making it difficult to ascertain whether any transfer of knowledge has taken place. At all events, the character of internal mobility within an enterprise is different from that of mobility between enterprises. In certain countries data on enterprise sector employees are more readily available than data on enterprises, so performing calculations at the establishment level is easier and the obtained results are also more reliable than would be those at the enterprise level. On the other hand, in the case of Finland, for example, the establishment registers are not as well developed in the public sector as they are in the enterprise sector, and this in turn makes public sector figures somewhat unreliable. The establishment level was selected in this study largely because of the above described practical reasons.

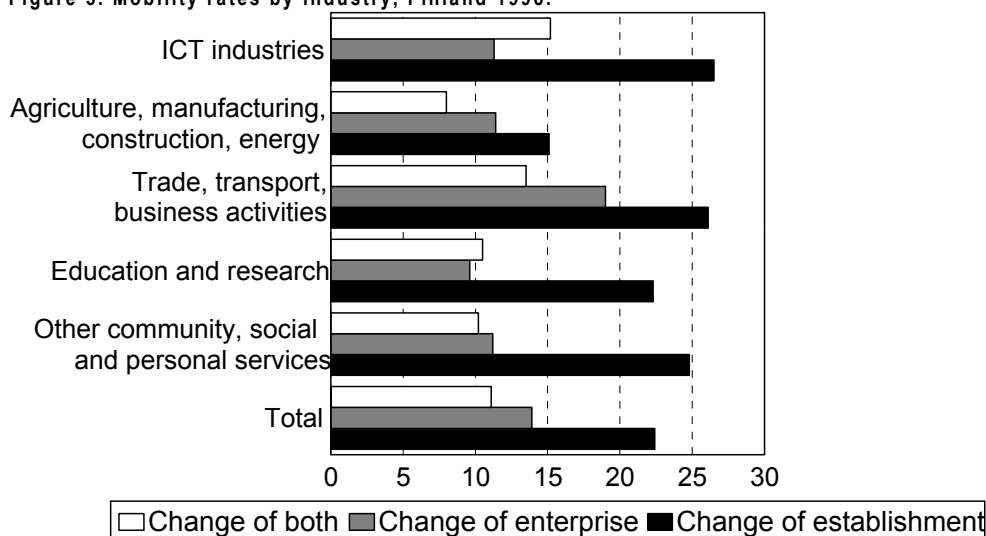
3.6 Mobility at enterprise level

Selection of the enterprise level as the basis for examining the mobility of employees is firstly supported by the fact that employees themselves perceive the enterprise as their employer, rather than its individual establishment, the changing of which is not even necessarily viewed as a change of job. Furthermore, decisions about economic activity are made at the enterprise (enterprise, institute, agency, university) level. Examinations are hampered by the already mentioned effects of structural changes of enterprises on mobility assessments. The enterprise may change without causing any changes at the establishment level. Naturally, even such changes have significance in terms of changes in and management of knowledge capital, but assessing the extent of the significance is difficult. Whichever level is chosen to study personnel mobility, the impact of such enterprise demographic changes must be taken into account.

3.7 Findings produced with alternative definitions

Figure 4 depicts mobility rates by industry in Finland. In all industries, the rate is the highest at the establishment level. Contrary to previously presented findings, in the ICT industries the mobility rates based on change of establishment and change of enterprise are higher at both levels than the mobility rate at the enterprise level. This is explained by multiple establishment and multiple industry enterprises, where the industry of an employee also changes when the examination level is changed.

Figure 5. Mobility rates by industry, Finland 1998.



3.8 Enterprise demography changes and mobility

Many of the structural changes of enterprises are purely organisational ones where no real change takes place as far as the studied phenomenon of personnel mobility is concerned. A factor which also influences mobility rate calculations is the maintenance and updating of the registers from which data on employees' workplaces are drawn. The exit of some enterprises from the data in a given year and their reappearance in subsequent years produces artificial changes to time series. The problem is how to allow for these non-genuine changes in calculations of mobility rates from enterprise and establishment codes.

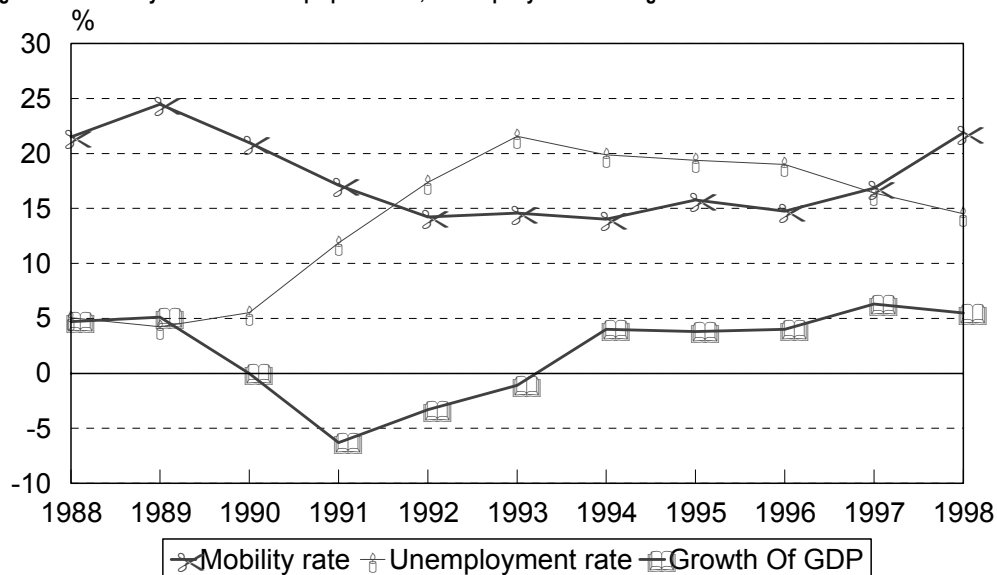
The selection between the enterprise or establishment level (or both) is crucial for achieving the primary aim of the study, i.e. analysing how the knowledge capital associated with personnel is transferred. Applying the enterprise level, which reduces mobility rates, or the enterprise and establishment level together would appear to produce better results. In all eventualities, if the establishment level criterion is chosen, the internal mobility within an enterprise must be taken into account as an important component of mobility at the establishment level.

A study conducted using register data will, naturally, also be influenced considerably by the original purpose for which the source data were intended. A register initially designed for another purpose and serving it well does not necessarily suit a statistical study as such.

4 Mobility of highly educated population

During an economic boom enterprises recruit more human resources, in other words more jobs are created and the number of vacancies increases because employees are keen to change jobs for, e.g. better pay. Correspondingly, during a downturn jobs disappear and employees prefer to stick to their jobs because new ones are hard to get. Accordingly, mobility rates can be assumed to follow economic trends, growing during economic upswings and falling during downswings.

Figure 6 Mobility of educated population, unemployment and growth of GDP.



It is easier to study the connections between mobility and economic fluctuations in Finland than in other countries because Finland experienced exceptionally clear cyclical changes in the 1990s. The Finnish economy plunged from the economic boom and a five per cent GDP growth rate that prevailed at the beginning of the examination period to a deep recession and an equally rapid contraction rate of GDP. Towards the end of the period, GDP was growing by an even higher rate than it had done during the peak of the late 1980s. The rate of unemployment (the Figure below shows the unemployment rate of the highly educated population calculated from the data used in the study) reveals an equally strong fluctuation of the economy. The rate of unemployment among the highly educated population rose from the barely two per cent figure in 1988 to around 12 per cent in 1993, from where it fell back to eight or so per cent by 1998. Over this period, the mobility of the employed highly educated population followed economic fluctu-

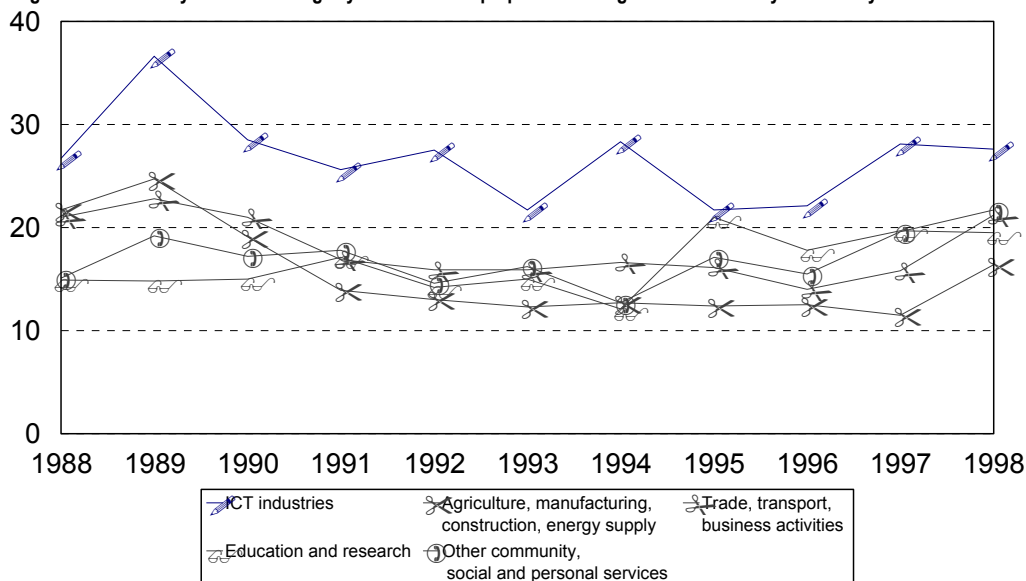
tuations as expected, and was at its lowest when the unemployment rate peaked and grew again to the pre-recession level after the economic recovery.

4.1 Mobility by industry, sector and size of establishment

Change of workplace has been defined as change of the establishment of an employee, in other words mobility rates are data derived from the numbers of employees at the establishments of enterprises or central/local government organisations.

The influence of age on mobility is also evident in mobility rates by industry. The proportion of persons aged under 35 among those in employment contracted by over eight per cent from 1988 to 1998, when their respective share was 31 per cent. The proportion of older age groups was the highest, nearly 75 per cent, among those employed in education and public administration. The mobility rates of employees of the ICT industries (computers, telecommunications, ADP activities) were the highest in the age groups of young and old alike.

Figure 7 Mobility rates of highly education population aged 35 to 74 by industry.



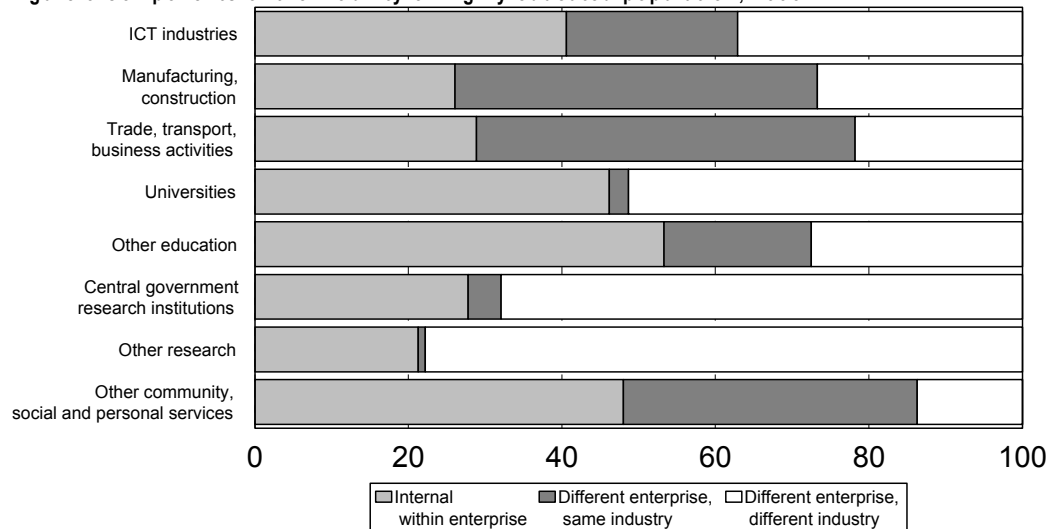
This development is naturally also influenced by the strong growth of the ICT sector in the 1990s. The sector's share of employed persons increased with respect to both age groups but more, or approximately five percentage points, among those aged 20 to 34. In agriculture and manufacturing, mobility rates are lower - and have also remained more stable even after the recession - than in other industries, and only show slight growth towards the end of the 1990s.

Examined by a more detailed classification, the rate of mobility within the ICT sector was the highest in the manufacture of computers and communication equipment. The level of the mobility rate is also influenced by structural changes within the enterprises of an industry, and these have been especially plentiful in ICT enterprises in the 1990s due to the rapid growth that has taken place in this field.

4.2 Characteristics of mobility

Most of the mobility was internal mobility within enterprises which, on average, accounted for just over 40 per cent. During the recession, the proportion of internal mobility grew at the same time as mobility on the whole decreased. Jobs were changed "safely" within the same enterprise. The proportion of mobility between enterprises within the same industry has been showing some growth since the recession. The average proportion of this kind of mobility was around one third. In contrast, mobility between enterprises and industries diminished somewhat in the late 1990s.

Figure 8 Components of the mobility of highly educated population, 1998.



5 Summary and conclusions

Annual statistics on the whole population can, thus, be produced in Finland and by combining the annual data for individual persons we can gain information about the changes that have taken place in the situations of these persons in the course of a year. These flow statistics provide additional tools for understanding labour market mechanisms, in other words how and from where employees are recruited, exits from the employed labour force and reasons for them. If, for example, the desire is to reduce unemployment, there is constant information available about the components that make up the unemployed population at any given time (those having lost their jobs, completed their education, and others), and about how unemployment could be lowered through training organised by employment authorities and subsidised employment measures and on what kinds of jobless persons are in danger of becoming unemployed long-term.

Similarly, important information is available for educational planners about what demand there is on the labour market for different educational groups, in other words what kind of labour growing industries recruit and how the demand varies across the country.

Flow statistics can be produced in all the Nordic Countries where questionnaire-placed population censuses have been replaced by register-based data collection systems. Sample-based labour force surveys cannot usually produce this kind of information because their samples are generally small and the follow-up period of events is not long enough.

APPENDIX: THE INFORMATION SECTOR*Production of goods*

- 3001 Manufacture of office machinery
- 3002 Manufacture of computers and other information processing equipment
- 3130 Manufacture of insulated wire and cable
- 3210 Manufacture of electronic valves and tubes and other electronics components
- 3220 Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
- 3230 Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods
- 3320 Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment
- 3330 Manufacture of industrial process control equipment

Production of services

- 51432 Wholesale of radio and television goods
- 51641 Wholesale of computer hardware
- 51652 Wholesale of telecommunications equipment and electronic components
- 642 Telecommunications
- 7133 Renting of office machinery and equipment including computers
- 72 Computer and related activities

Content production

- 221 Publishing
- 7413 Market research and public opinion polling
- 7414 Business and management consultancy activities
- 744 Advertising
- 921 Motion picture and video activities
- 922 Radio and television activities
- 924 News agency activities.

In addition, the broadly defined information sector contains the following content production branches:

- 222 Printing and service activities related to printing
- 223 Reproduction of recorded media
- 73 Research and development
- 71401 Renting of videotapes
- 7483 Secretarial and translation activities
- (923 Other entertainment activities)*
- (925) Library, archives, museums and other cultural activities)*