Technical Systems, Organisation Forms and Social Implications: Statistical Analysis of the Firm Survey (Second Interim Report)

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Information Society, Work and
the Generation of New Forms of Social Exclusion

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Second Interim Report
(Statistical Analysis of the Firm Survey)

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1. INTRODUCTION

This is the second interim report of the research project "Information Society, Work and the Generation of New Forms of Social Exclusion" (SOWING). It is based on a firm survey conducted in the eight regions participating in the research project — Flanders (Belgium), Lazio (Italy), Niederösterreich (Austria), Portugal, the Republic of Ireland, the Stuttgart area (Germany), the Tampere region (Finland) and the West London area (U.K.). The aim of this report is to present a broad overview of the collected data. In general, only simple statistical methods have been applied. The report focuses on a regional comparison; however, the data have also been analysed by firm size, measured by quantity of staff, and industrial sector. It should be seen as a first step in the data analysis; it may also give some hints for a more strategic analysis of the survey data.

The aim of the next step is to produce a more comprehensive report. Therefore, the continuation of the data analysis will be based on more advanced statistical methods (factor analysis and cluster analysis) and new, more complex variables will thereby be created.

The results of the firm survey will be used to provide information about the case studies. One could argue that the survey analysis generates hypotheses of relationships between the key variables, which can be tested in the case studies. Together with the regional/national profile report, the firm survey can help in giving preliminary answers to the question of whether there is one European way into the information society or whether various regions follow their own path into it.

A major part of the report deals with the concept of technological practices. First, we will present the technological dimension. We will discuss and use different concepts of ICT applications in the report. Next, we will deal with the organisational dimension of technological practices and analyse how the technological and organisational dimensions are related. Finally, we will focus on the social consequences of technological practices, and pay particular attention to the exclusion aspect.

The aim of the firm survey was to focus on the opinions and perceptions of company managers in the eight regions. It was decided that the number of observations would be small (100 completed questionnaires per region) in order to have comprehensive data concerning all the aspects relevant in the research. Because of different research traditions, national research groups could independently decide whether to gather the data by mailing a questionnaire or by conducting interviews.

Since the sample was small, it was considered impossible to conduct a representative sectorial analysis by limiting the number of industrial sectors, as many sectors are very heterogeneous. The small numbers of cases in each sector do not allow to cover their diversity, so the samples in different regions may very well cover companies of a different nature.

For a sectorial analysis, one needs to know the sector-codes of the companies in advance, which may become an additional hurdle. Given our previous experiences in sectorial surveys, it is very difficult and takes a lot of effort to define such sectorial populations. Therefore, in view of the small numbers of observations, the idea of representative data was abandoned; it was seen as more appropriate to have data from companies across the economy instead of some specific sectors. This way, the study can give a general overview of the changes taking place in the whole economy.

This does not preclude an analysis on the sectorial level. As the sector-codes of the companies are known, it is possible to make a classification of the observations in the course of the analysis. Indeed, such classification in the analysis stage offers much more flexibility. Therefore, it was more realistic to have economy-wide samples in all regions involved in the project. Referring to the NACE codes, 'economy-wide' means from code '10' to '75', excluding public administration, education and health care, which would require an adapted questionnaire and approach to investigate. For similar reasons, only companies with twenty or more employees were included in the population.

Undoubtedly, the regional dimension of the survey created additional problems of establishing a good 'research population', since good and comprehensive regional enterprise databases were not always available. Two specific problems can be mentioned here:

1. The problem of 'employer' as opposed to 'location', 'plant' or 'establishment' as the level of observation. There are, of course, many more 'establishments' than there are 'employers' since many companies have several establishments. Quite often, administrative databases only account for the employers, while the establishments of each employer are not known. But also with regard to the content, there was little to be gained in asking about many separate but similar establishments in a company, several branch offices of a bank, for example. Only if the establishments of the same employer are heterogeneous, it makes sense to choose them as research units. As the first case was much more common, the 'employer' as the level of observation could be retained.

2. Related to the previous point is the problem of employers having their administrative location outside the investigated region but many establishments in the region. Large companies can be administratively located in a specific region, while their economic activities are mainly located in other regions. As the study does not claim to have representative samples, the population was limited to the employers that are administratively located in the region selected for investigation. Therefore, the population consists of all employers located in the investigated region and having 20 or more employees and a NACE code between 10 and 75.

While the sample does not claim to be representative for the whole economy, it was agreed that it should nevertheless cover the diversity of the companies in the economy. For example, large and small enterprises as well as companies from different industrial sectors were included.

The questionnaire was developed in close co-operation with all partners in the project. In view of the coding and analysis of the data, no open or optional questions were included in the standard questionnaire (Appendix 1). However, each partner was allowed to insert open questions to the questionnaire, but standardized answer categories were not be replaced by an open question. To ensure the comparability of different national data, it was decided that the coding and the data input be done centrally by the Work Research Centre in Finland.

2. DESCRIPTION OF THE SAMPLE

This report presents the results of the firm survey conducted within the project. It is based on the integrated data sets of the following regions: Flanders, Lazio, Niederösterreich, Portugal, the Republic of Ireland, the Stuttgart area, the Tampere region and the West London area. From the enumeration one can see that the term region is used for different types of territories. Actually, only Flanders, Lazio and the Tampere region can be characterised as typical regions. Portugal and the Republic of Ireland are countries, while the West London and Stuttgart areas are cities or form a part of a city.

Our procedure was influenced by strategic considerations. One can justify the inclusion of the Stuttgart and West London areas in the research project by the following argument: The analysis of the technological practices in the service sector can be studied in the cities, as here the service sector is by far the dominating sector. Furthermore, we can expect to find more advanced technological practices in big cities with a large number of globally oriented companies. Portugal and Ireland were also included, although they are countries, not regions, since they represent interesting cases concerning the use of ICTs.

In the following, we will first describe the sample. In the third chapter, we will focus on those variables that are related to the concept of technological practices, such as ICT applications and organisation forms. Our intention is to develop a typology of different technological practices. We will also analyse to what extent ICT applications and organisation forms are influenced by various factors, including region, company size, type of production, location of the company, and companies' market area.

In the fifth chapter, we will focus on the socio–economic consequences of different ICT applications and technological practices. Then, we will discuss to what extent ICT applications and organisation forms are related to the aspects of social exclusion. Finally, we will elaborate on how the questionnaire respondents view the Information Society.

2.1. Collection of data

The data were collected in the regions by using different methods (Table 2.1.). Postal surveys were conducted in Flanders, Portugal, the Republic of Ireland and the Tampere region. The respondents were interviewed face–to–face or by phone in Niederösterreich and the West London area. Both methods were applied in Lazio and the Stuttgart area. Some kind of direct contacts to the companies were made in all regions with the data collection. The response rate varied from 15% to 58%. In total, the rate was 28%, which is satisfactory in company surveys.

Table 2.1. Data collection methods and response rates

Region	Response rate	Data collection method
Flanders	58%	postal survey + mail, telephone and face–to–face contacts
Lazio	25%	face–to–face and telephone interviews, survey by fax
Niederösterreich	38%	face–to–face interviews
Portugal	24%	postal survey + mail, telephone, fax and e–mail contacts
Republic of Ireland	41%	postal survey + telephone contacts
Stuttgart	38%	postal survey and face–to–face interviews + mail and telephone contacts
Tampere	23%	postal survey + telephone contacts
West London	15%	telephone interviews
Whole data	28%	

The sample in each country, as already mentioned, was limited to 100 completed questionnaires. The aim was to have approximately the same number of cases in each of the selected industries[1] and to have equally spread cases by size in each industry. It was not fully reached, as the following Table 2.2. indicates.

[1] The following industries were included: light manufacturing (manufacture of food, textile, etc.), heavy manufacturing (manufacture of paper, chemicals, basic metals, etc.), other manufacturing (manufacture of equipment, etc.), construction (energy and construction), sales, hotel, etc. (wholesale, retail, hotels and restaurants), transport & finance (incl. data communications), and business services (real estate activities, renting machinery and equipment, computer and related activities). For details, see Appendix 2.

Table 2.2. Number of cases by region, size and sector

Region / Size / Sector	Flanders		Lazio		Nieder-österreich		Portugal		Republic of Ireland		Stuttgart area		Tampere region		West London area		Total		
	20–49	50+	20–49	50+	20–49	50+	20–49	50+	20–49	50+	20–49	50+	20–49	50+	20–49	50+	20–49	50+	Total
1. Light manufacturing	9	6	10	6	7	7	1	7	1	12	9	5	12	11		2	49	56	105
2. Heavy manufacturing	9	6	19	19	7	8	15	14	10	8	7	8	13	21	10	8	90	92	182
3. Other manufacturing	9	9	10	6	7	6	5	11	6	12	4	5	4	5	10	6	55	60	115
4. Construction	9	4	3	1	7	7			5	12	7	10	5	4	3	1	39	39	78
5. Sales, hotel, etc.	5	8	3	1	8	7	11	5	8	10	6	8	5	3	9	11	55	53	108
6. Transport & finance	6	5	5	11	7	7	1	13	3	8	6	8	5	5	9	11	42	68	110
7. Business services	9	6	1	5	7	8	12	5	2	3	9	8	6	1	13	7	59	43	102
Total 1.–7.	56	44	51	49	50	50	45	55	35	65	48	52	50	50	54	46	389	411	800

The sample was equally distributed by size and sector in the cases of Niederösterreich and Flanders. Manufacturing companies are over–represented in the samples of Lazio, Portugal, the Republic of Ireland and the Tampere region, and service companies in the West London data. By industrial sectors, the construction industry lacks more cases than others. Also, business service and light manufacturing companies are under–represented in the data. Most probably, these under– and over–representations reflect the varying industrial structures of the different regions.

2.2. Dimensions of sample companies

In the questionnaire (Appendix 1), we asked for background information about the companies, such as the company's type and location, type of its products, its most important achieving criteria, the market it operates on, its customers, and the characteristics of the company's labour force.

Company type

Concerning the company type, we differentiated between fully independent companies, parent companies, companies independent in a group, and branch establishments. Fully independent companies are the most common ones in all regions, but they can be found particularly in Niederösterreich (76%), the Stuttgart area (63%) and Lazio (57%). About 27% of all the companies are independent in a group and they are more typical in Flanders (36%), the West London area (32%), the Republic of Ireland (32%) and Lazio (30%) than elsewhere. There are only few parent companies in our sample (about 7%). Branch establishments (15% of all the companies) are more frequent in the Tampere region and in the West London area (28% and 24%).

The dominant company type varies according to the industrial sectors. Fully independent companies are the most common types in the construction industry (71%). Also, in light manufacturing industry, more than half of the companies (51%) are fully independent. The greatest share of independent companies in a group can be found in heavy manufacturing (36%), in the sales & hotel industry (35%), and in the group of other manufacturing industries (32%). Branch establishments are the most common in business services (19%) and in the transport & finance sector (18%). Parent companies are exceptional in all sectors. Most of the small companies are fully independent companies, while among the larger companies the share is much smaller (36%).

Company's location

In all regions, most of the companies are located in urban areas, particularly in the Tampere region (71%), in Lazio (70%) and, of course, in the West London area (100%). In Portugal and in Flanders, approximately one third of the companies are situated in mixed areas. The largest share of the companies located in rural area can be found in Niederösterreich (24%).

Companies in all service sectors are typically located in urban areas (more than 70%), which in the manufacturing sectors is less frequently the case. For example, in light manufacturing industry, only half of the companies are situated in urban areas. In general, manufacturing companies are more commonly located in mixed areas. In the light manufacturing sector, instead, companies are fairly commonly located in rural areas (30%). If we look at firm size, no significant differences concerning the location of companies can be found.

Years the company has been operating at current address

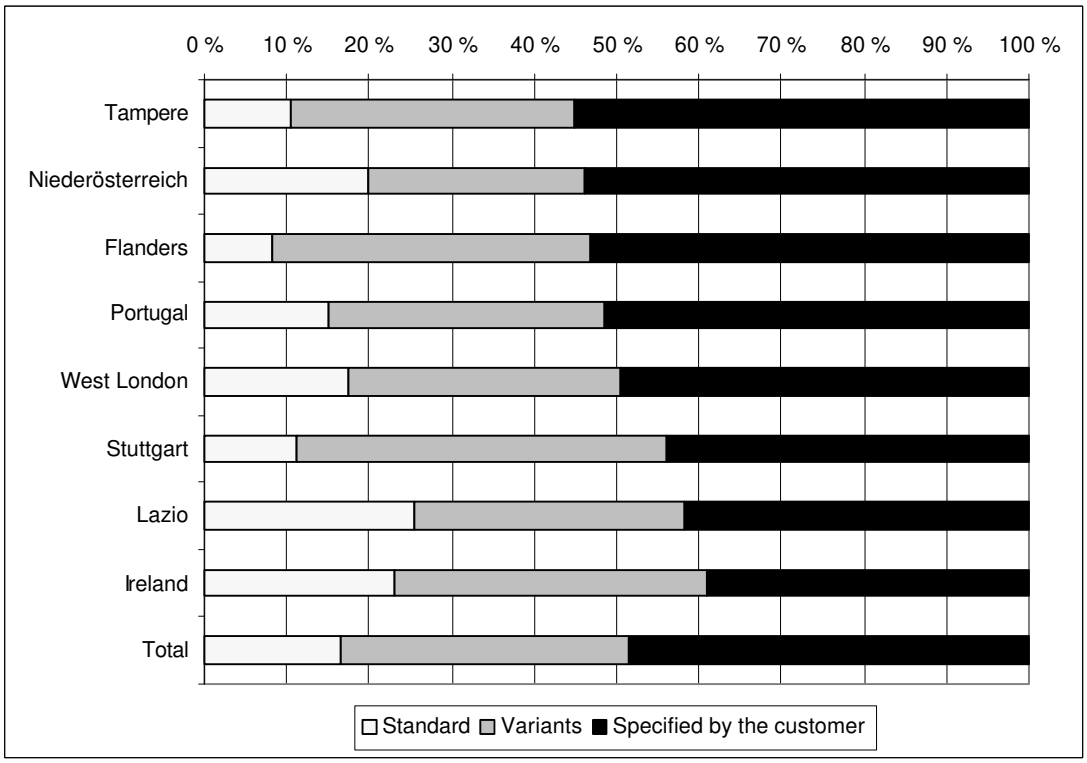
Most of the companies have been operating at their current addresses for quite a long time; half of the companies for over 20 years. Only the West London area is an exception; almost 60% of the companies have been operating at the same addresses for less than 10 years. In general, companies in the manufacturing sectors have been operating at their current addresses longer than companies in the service sectors. In the construction sector, as many as 66% of all companies have been operating at the same addresses for over 20 years. In the business services sector, their share is only 21%. In addition, more than half of these companies have been operating at the same location for less than 10 years. Large companies, as expected, have been operating at the same addresses slightly longer than small companies. Altogether 73% of large companies and 65% of small companies have been operating at their current addresses for over 10 years.

The type of products or services of the company

We differentiated between three types of products or services that the companies produce: standard products or services, variant products or services, and products or services specified by customers. Most typically, the products or services provided by the company are specified by customers (48%), whereas only few companies produce standard products or services. Figure 2.1. indicates

that in the Tampere region (55%), Niederösterreich (54%), Flanders (53%) and Portugal (52%), half of the companies produce products or services that are customer-specified. On the other hand, the share of companies producing variants (45%) is the greatest in the Stuttgart area. The greatest share of companies with standardised products or services can be found in Lazio (26%), the Republic of Ireland (23%) and Niederösterreich (20%), while in Flanders (8%), the Tampere region (10%) and the Stuttgart area (11%), only few companies provide this type of products or services.

Figure 2.1. Type of products or services of company by region



$\chi^2 = 27.6$ (df = 14) p= 0.016*

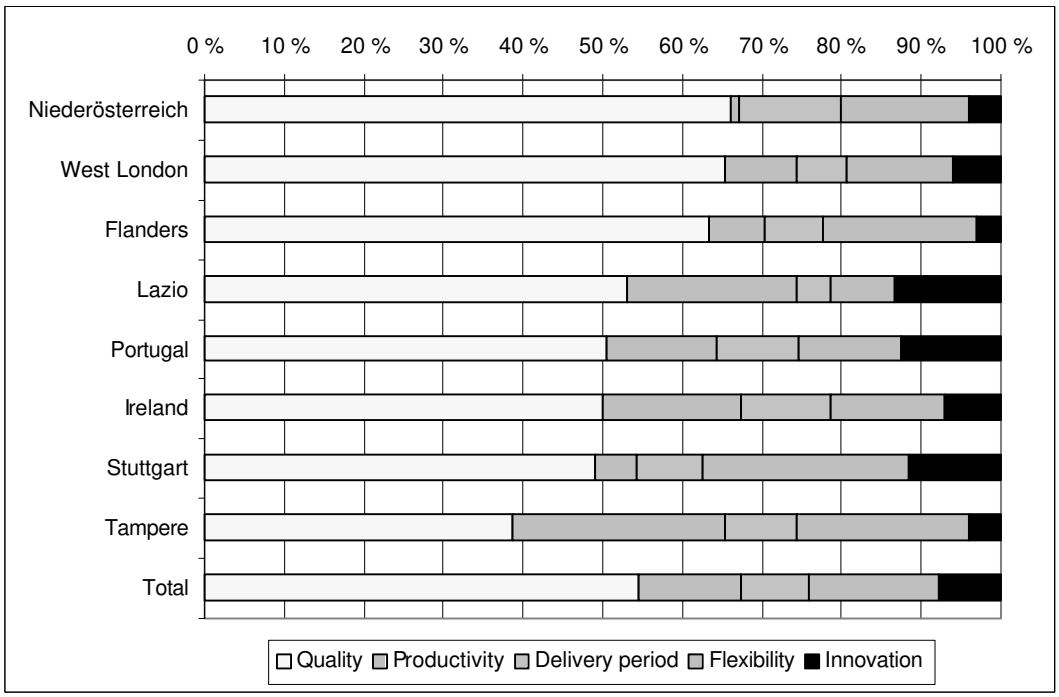
Business services (63%) and the construction industry (58%) represent the industries in which customer-specified products or services dominate. The opposite is true for the sales & hotel industry; in this sector, only 27% of all companies provide customer-specified services, while 28% of the companies offer standard services. Thus, variants are typical in the sales & hotel industry (45%) and light manufacturing (45%) as well as in the transport & finance industry (41%). In general, there are no big differences regarding the type of products or services between service and manufacturing industries, however. We can find only small differences in the type of products or services when we look at the size of the companies. More than half of the small companies (54%)

produce customer-specified products; this share is slightly smaller when we look at the larger companies (44%).

Company's most important achieving criteria

Quality, productivity, delivery period, flexibility, and innovation are the key criteria which companies aim at achieving (Figure 2.2.). In our sample, quality was most often regarded as the key competition criterion. It is especially important for companies in Niederösterreich (66%), the West London area (65%), and Flanders (63%), while for companies in the Tampere region it seems to be less important (38%). On the other hand, productivity is still defined as a relevant criterion for competitiveness by a larger share of companies in the Tampere region (27%), Lazio (21%) and the Republic of Ireland (17%). Quite a big number of companies in the Stuttgart area (26%) and the Tampere region (21%) also regard flexibility as a relevant achieving criterion. In all regions, the share of companies regarding the delivery period and innovation as a key competition criterion is rather small.

Figure 2.2. Company's most important achieving criterion by region



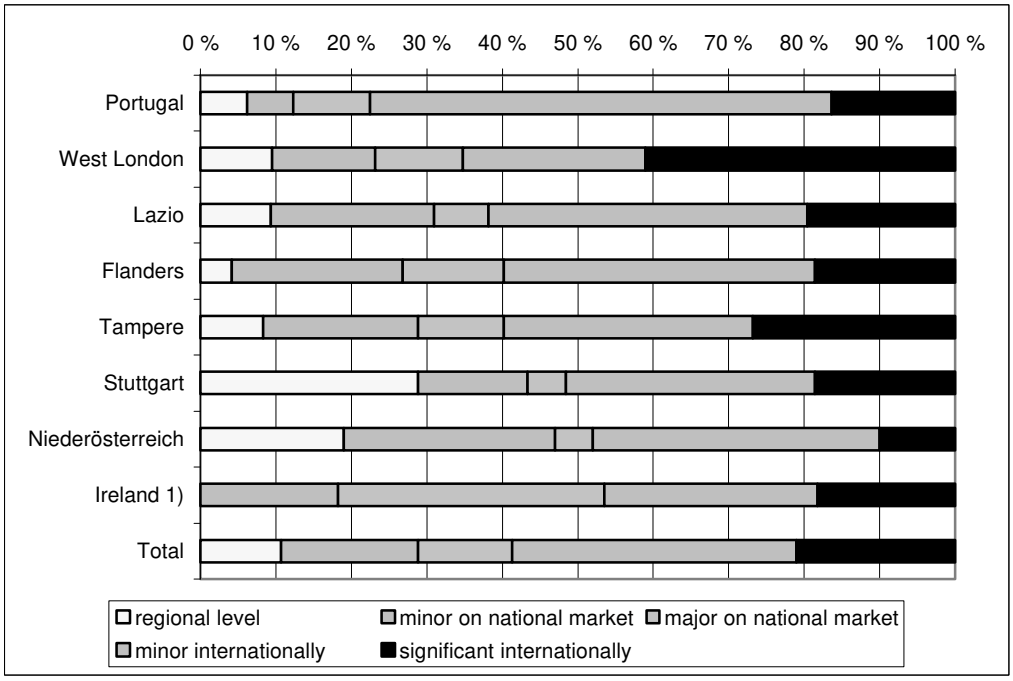
χ^2 = 87.6 (df = 28) p= 0.000***

Particularly for light manufacturing (71%), quality is the most important achieving criterion, while it is the least important for companies in business services (41%). On the other hand, flexibility (23%) and innovation (24%) are also important criteria for companies in the business services sector. Productivity is most often regarded as an important achieving criterion by companies in heavy manufacturing industries (18%). Concerning the dominating achieving criteria, companies of different size do not differ significantly.

Position on the widest operated market

As Figure 2.3. shows, more than half of all the companies operate on the international market (59%). However, the majority of them are only minor players on the international level. Still, 21% of all companies have a rather strong position on the international market by being among the five largest either on the European or on the global market. Approximately a tenth of the companies operates only on the regional market and 30% only on the national market where the majority of companies (18% of all the companies) seem to be minor players.

Figure 2.3. Company's market position by region



1) In the Irish questionnaire, the whole Republic of Ireland was considered a region.
$\chi^2 = 175.0$ (df = 28) p = 0.000***

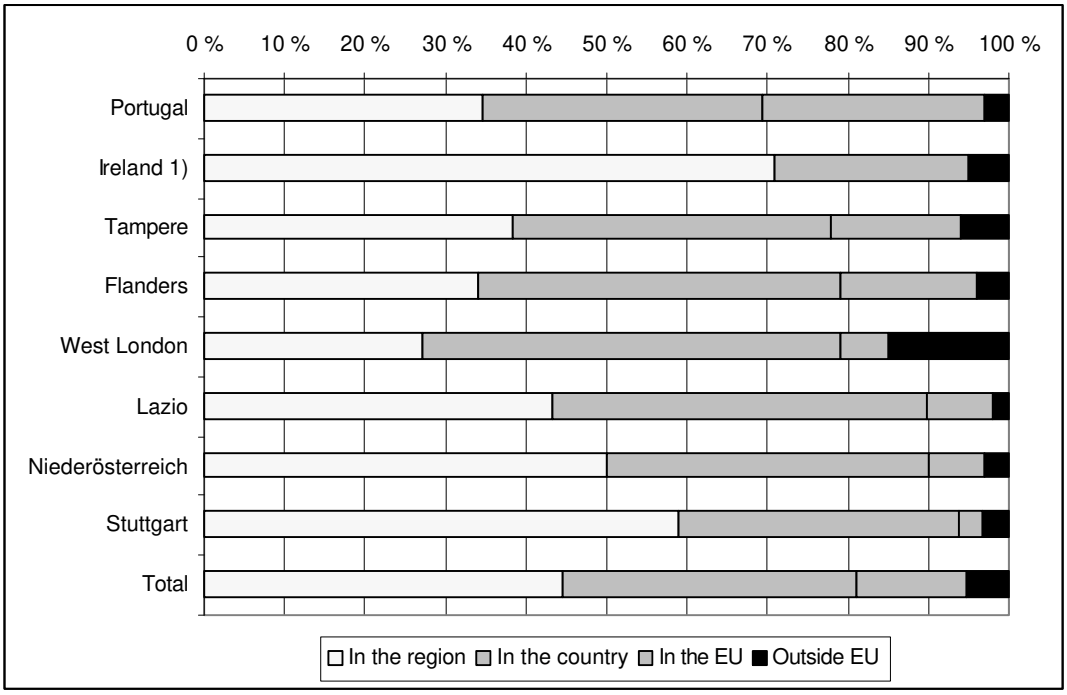
Nearly 80% of the Portuguese companies (78%) and about two thirds of the firms in the West London area (65%) operate on the international market. As many as 41% of companies in the West London area have a significant role on the international level, whereas over half of the companies in the Republic of Ireland (54%) and Niederösterreich (52%) operate only on the national market. The Central European firms' market areas also equal to their own region (in Niederösterreich 19% and especially in the Stuttgart area 29%) more commonly than those of the other firms.

In general, companies from manufacturing sectors are very often present on the international market (61%–81%), while companies in the construction industry are in the weakest position on international markets (24%). Most typically, construction companies play a minor role on the national market (37%). Larger companies, as expected, are more active on international market than smaller ones.

Location of customers

Above we discussed the companies' widest market areas. Next, we will deal with the location of the majority of their customers (Figure 2.4). In the Stuttgart area (59%) and Niederösterreich (50%), the share of companies with customers predominantly in the region is quite large. On the contrary, only about one fourth of all companies in the West London area mostly co–operate with regional customers; here the most relevant area is the national economy. The majority of customers of as many as 15% of all companies in West London is located outside the EU. Customers in the EU countries are quite important for companies in Portugal (28%), the Republic of Ireland (24%), Flanders (17%), and the Tampere region (16%).

Figure 2.4. Location of customers by region



[1)] Ireland in the region = in the Republic of Ireland
in the EU = in Northern Ireland, in the U.K. or in the other parts of EU
χ^2 = 145.0 (df = 21) p = 0.000***

Customers of companies in various services sectors are most typically located in the region. This also holds true for companies in the construction sector. For other sectors, such as light manufacturing (48%) and heavy manufacturing (41%), the national territory is where most of their customers are located. Also, in the business services sector, companies' customers can mostly be found in their own countries (41%). In general, the customers of the companies in the industrial sectors are located in the EU and, even on the global market, more often than those of the companies in the service sectors.

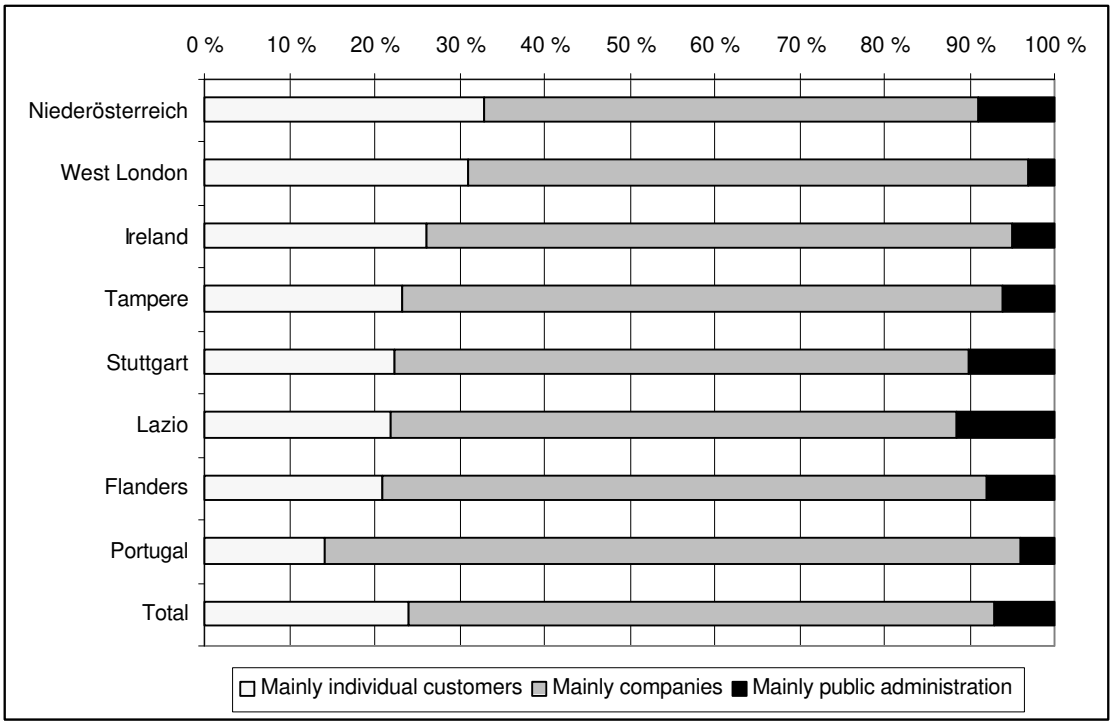
Customers of small companies, as expected, are more frequently located in the region than those of larger companies. However, more than one third of all companies in both size categories have the majority of its customers in their own country. And one fifth of larger companies have their biggest shares of customers in the EU.

The type of customers

As can be seen in Figure 2.5., customers mainly consist of other companies in each region. This is particularly true for Portugal (82%), Flanders (71%) and the Tampere region (70%). One third

of the companies in Niederösterreich have mainly individual customers, who are quite important for companies in the West London area (31%) and in the Republic of Ireland (26%) as well. Public administration is not very significant as a customer for any region.

Figure 2.5. Type of customers by region



$\chi^2 = 23.7$ (df = 14), p = 0.050*

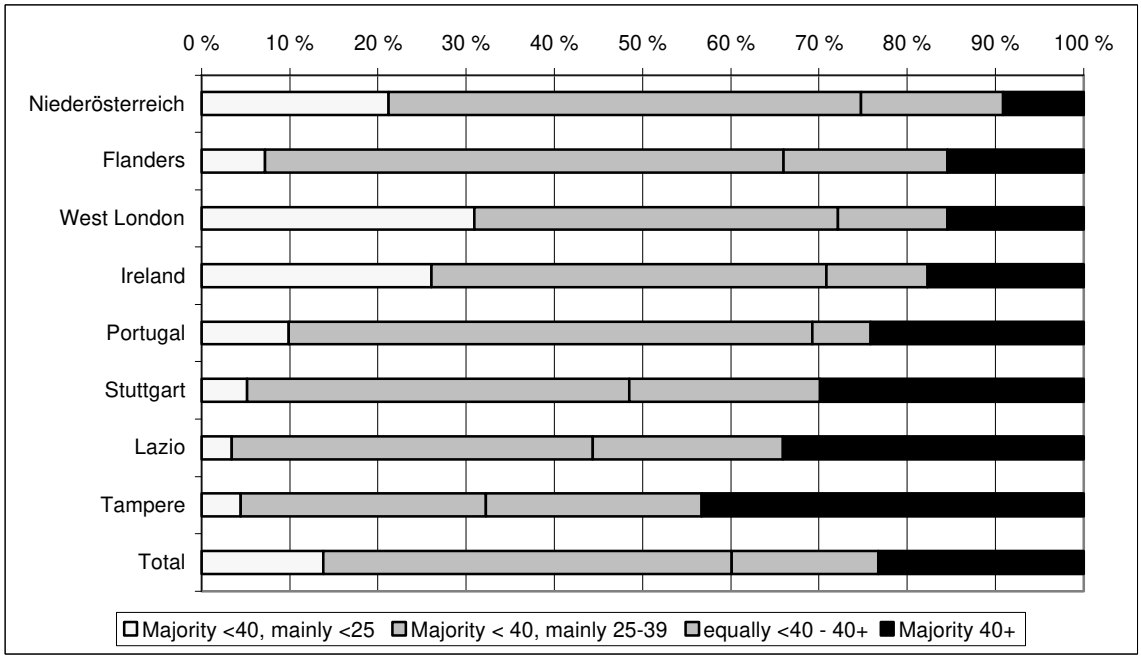
In all sectors, with the exception of the sales & hotel industry in which individual customers dominate, customers are mainly companies. However, in the transport & finance sector as well as in the construction industry, more than 30% of all companies have predominantly individual customers. In general, however, industry and services do not differ very much concerning the dominant type of their customers. Differences in size of company concerning the dominant type of companies' customers are not statistically significant.

Age of the companies' workforce

The regions differ from each other quite considerably regarding the age of the workforce (Figure 2.6.). Typically, the majority of the workers within companies are under 40; this is particularly true for companies in Niederösterreich (75%), the West London area (72%) and the Republic of Ireland (71%). In addition to this, the companies in West London area and the Republic of Ireland have remarkably often a lot of young employees. On the other hand, only one third of all the

companies in the Tampere region and 44% in Lazio belong to the group with a majority of workers under 40. The share of companies with a workforce beyond 40 is the greatest (43%) in the Tampere region.

Figure 2.6. Workforce age by region



χ^2 = 123.9 (df = 21) p= 0.000***

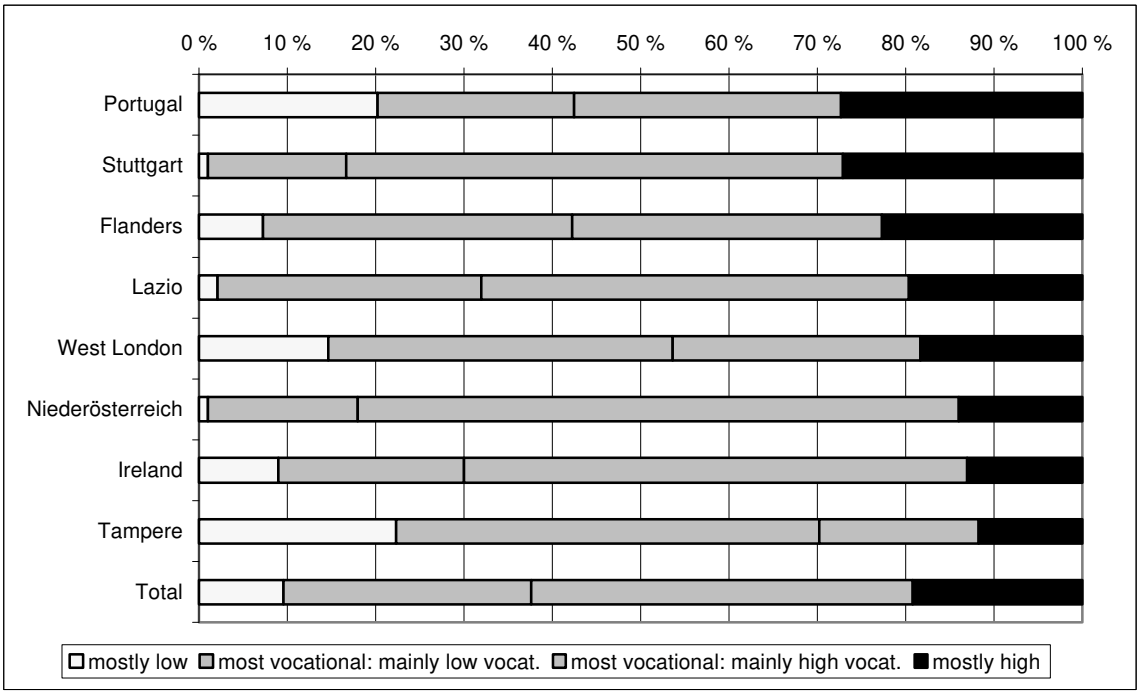
Especially in business services (79%), the sales & hotel industry (68%), and in other manufacturing (65%), we can find a predominantly younger workforce. On the other hand, employees beyond 40 are particularly common in companies in light manufacturing (42%), transport & finance (28%), construction (25%), and heavy manufacturing (24%). Considering the age of the workforce, small and large companies differ only slightly. A total of 27% of the larger companies have an aged workforce within which the majority of employees is over 40, whereas the share is only 19% among smaller companies.

Education level of the companies' workforce

There are quite notable differences in the education level of the companies' workforces by regions (Figure 2.7.), although in all regions the majority of companies have a workforce with a predominantly vocational education, which education level is particularly representative of companies in Niederösterreich (85%), the Republic of Ireland (77%), and Lazio (77%). In

Portugal, on the other hand, the share is reduced to 52%. A low education level of the workforce is fairly common for companies in the Tampere region (23%), Portugal (20%), and the West London area (14%). And a workforce with a predominantly higher education level is fairly frequent in companies in Portugal (28%), the Stuttgart area (27%), Flanders (23%), and Lazio (21%).

Figure 2.7. Education level of workforce by region



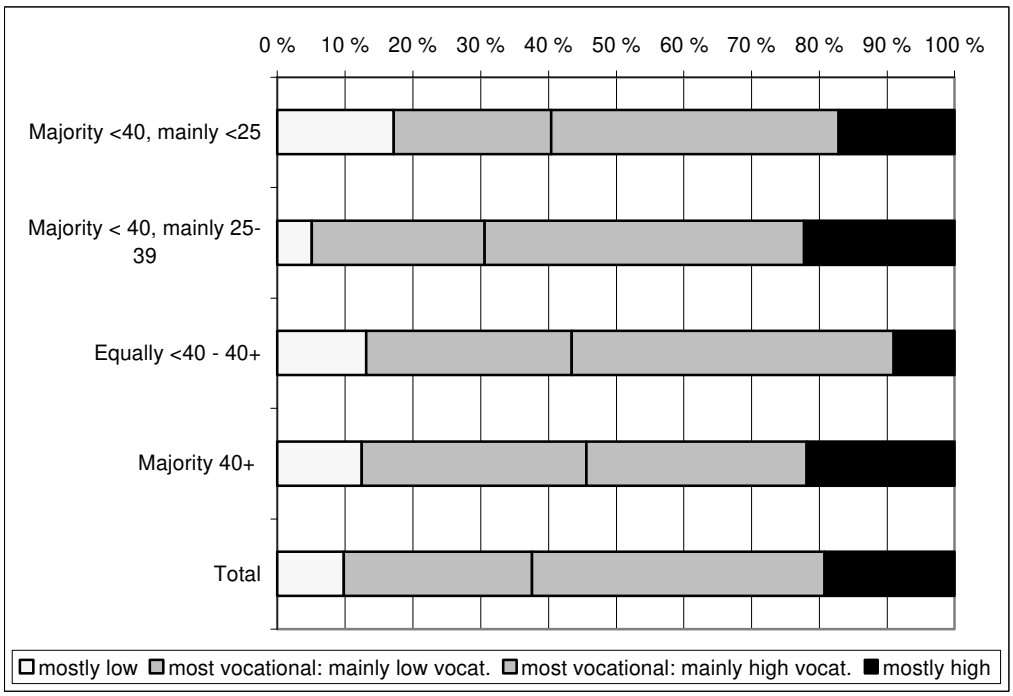
$\chi^2 = 142.2$ (df = 21) p= 0.000***

Vocational education is the most common educational level in all industrial sectors (over 70%) with the exception of business services, in which only 35% of all companies predominantly have a workforce with vocational education. Thus, in this sector, 59% of the companies have a workforce predominantly consisting of people with higher education. A low education level is quite common in companies in light manufacturing (20%). Company size does not make a difference concerning the education level.

Workforce age and educational level

It was assumed that the younger the workforce was, the higher the educational level would have been. This, however, was not the case (Figure 2.8.). The highest educational level could be found in the companies with the majority of the workforce between 25 and 39. In companies that had a lot of younger than 25-year-old employees, the educational level was the lowest of all.

Figure 2.8. Workforce age and educational level by region

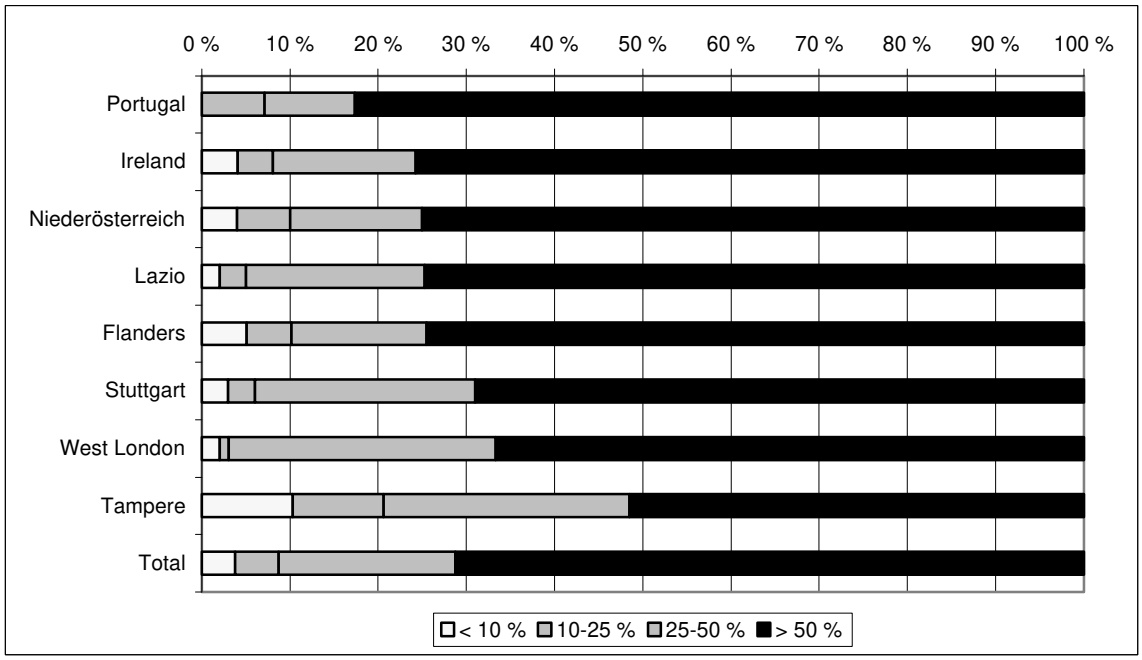


$\chi^2 = 34.5$ (df = 9) p= 0.000***

Share of male employees

In all regions, men constitute the majority of the workforce in more than 50% of the companies (Figure 2.9.). Still, there are regional differences, as in Portugal, for example, in as many as 83% of the companies more than half of the workers are men. On the other hand, in the Tampere region, only 52% of the companies predominantly have a male-dominated workforce. In quite a small number of companies, men constitute 25–50% of the employees, particularly in the West London area (30%), the Tampere region (28%), and the Stuttgart area (25%).

Figure 2.9. Share of male employees by region



χ^2 = 53.9 (df = 21), p 0.000***

By industrial sectors, construction and heavy manufacturing are very male–dominated sectors; in construction 92% and in heavy manufacturing 84% of the companies reported having employed more than 50% male workers. On the other hand, in only 52% of the companies in light manufacturing and in 56% of the companies in the sales & hotel sector, men represent the majority in the personnel. Regarding the predominant gender of the workforce, company size does not matter very much. In 70% of the companies, small and large firms alike, the share of male employees amounts to more than a half of the workers.

Summary of the influencing variables

The following tables give an overview of what has been discussed so far. Table 2.3. shows how the regions differ according to each variable considered above. It was constructed by using the mean of each variable by regions. Deviations of 10% or more from the mean (+ /–) are presented.

Table 2.3. Background information on companies

Region		Flanders	Lazio	Niederösterreich	Portugal	Ireland	Stuttgart	Tampere	West London
Variables	Mean								
Type of products /services of the company	49% 35% 16%		 Standard +			Specified –	 Variants +		
Company's most important achieving criterion	55% 13% 16%			Quality + Productivity –			 Flexibility +	Quality – Productivity +	Quality +
Market position	11% 18% 12% 38% 21%			 Minor on nat. level + Significant internationally –	 Minor on nat. level – Minor internationally +	 Major on nat. level + Minor internationally –	Regional level +		 Minor internationally – Significant internationally +
Years company has been operating at current address	48% 15%			More than 20 + Less than 5 –	More than 20 –		More than 20 + Less than 5 –		More than 20 years – Less than 5 +
Company type	47% 30% 13% 9%		Fully independent company +	Fully independent company + Independent company in a group –	Fully independent company – Independent company in a group + Branch establishment – Parent company +		Fully independent company +	 Branch establishment +	 Branch establishment +
Location of company	64% 22% 14%	Urban – Mixed +		Urban – Rural +	 Mixed +				Urban + Mixed – Rural –
Location of customers	45% 37% 14% 5%	In the region –			In the region – In the EU +	In the region + In the EU +	In the region + In the EU –		In the region – In the country + Outside EU +
Type of customers	69% 23%			Mainly companies –	Mainly companies + Mainly individual customers –				
Age of workforce	60% 23% 17%		< 40 – 40+ +	< 40 + 40+ –	 Even –	< 40 +	< 40 –	< 40 – 40+ +	< 40 +
Education level of workforce	71% 10%			Mostly vocational +	Mostly vocational – Mostly low +			 Mostly low +	
Share of male employees	71% 20%				> 50 % + 25–50% –			> 50 % –	 25–50% +

Half of the companies offer customer specified products/services and around one third offers variants (in Niederösterreich only 26%). In the Republic of Ireland, the share of specified products/services is considerably smaller (23%). In addition, the Stuttgart area is exceptional, because companies producing variants are most typical (45%) there. Furthermore, standard products are fairly common in Lazio (26%).

Quality is clearly the most important achieving criterion, even though there are major differences between regions. Niederösterreich and the West London area differ somewhat, since in these regions as many as about two thirds of the companies regard quality as the uppermost criterion. In the Tampere region, the same share is only 39%. Compared to other regions, productivity is quite a common criterion in Tampere (26%); at the same time, only 1% of the companies in Niederösterreich is of the same opinion. The importance of delivery period differs only little between regions. In the Stuttgart area and the Tampere region, companies consider flexibility fairly often as the most important achieving criterion (26% and 21%).

In almost every region a bigger part of the companies are minor players on the international market by their market positions. Portugal is exceptional because there the share is as great as 61%. The regional market is very important to the companies in the Stuttgart area(29%). Being a minor player on the national market is fairly common to the companies in Niederösterreich (28%). Companies in the Republic of Ireland are most typically major players on their national market (35%). There are many companies in the West London area that play a significant role on the international market (41%).

On average, half of the companies have been operating at their current addresses for more than 20 years. The share is exceptionally large in Niederösterreich (74%) and in the Stuttgart area (66%) and, at the same time, relatively small in Portugal (31%) and in the West London area (19%). Fewer companies than on average in Niederösterreich (4%) and in the Stuttgart area (4%) have been operating at their current addresses for less than 5 years. The West London area is remarkably different because the same share is as great as 34% there.

Most companies are fully independent companies (47%), but their share is substantially greater in Niederösterreich (76%) and in the Stuttgart area (63%). In Portugal, companies are mainly independent in a group (56%). Branch establishments are the most common in the Tampere region

(28%) and in West London area (24%) but extremely infrequent in Portugal (3%). In general, parent companies are exceptional but in Portugal as many as 40% of the companies belong to this category. Thus, as a whole, Portugal seems to be very different from the other regions.

Companies in every region are mainly located in urban areas (64%). The West London area, however, is exceptional because there all companies are situated in the urban area. On the other hand, in Flanders and Niederösterreich the share of companies in an urban location is clearly small (46% and 49%). One fifth of the companies is situated in mixed areas, which is particularly common in Portugal (36%) and in Flanders (33%). The share of companies located in rural areas is noteworthy only in Niederösterreich (24%).

The majority of customers are located in the region, especially in the Republic of Ireland (71%) and the Stuttgart area (59%) but less than on average in the West London area (28%), Flanders (34%), and Portugal (35%). The country as the location of customers is significant only in the West London area (52%). In Portugal (28%) and in Ireland (24%) many customers are situated within the EU. In Stuttgart, instead, the percentage is clearly lower (3%) than the average. The location of customers outside the EU is also quite significant in the West London area (15%).

Customers are mainly companies, in Portugal as many as 82%. Thus, there are only few individual customers. In Niederösterreich, instead, companies as customers constitute less than the average (58%).

In many firms, the majority of workers are younger than 40 (60%). This age group is predominant in three fourths of the companies in Niederösterreich, the West London area, and the Republic of Ireland. The share of companies with older workforces is the greatest in the Tampere region and in Lazio (43% and 34).

Vocational education is a typical educational level among the workforce in most companies. This is especially the case in companies in Niederösterreich (85%). On the other hand, in barely half of the companies in Portugal, workers predominantly have vocational education. Thus, low education levels are common, in companies in the Tampere region (23%) and in Portugal (20%).

Male employees dominate the workforce in most companies in every region. There are some variations, however. In as many as 83% of the companies in Portugal, men are the majority. In Tampere, instead, in barely half of the companies (52%) men constitute the majority of workers; the situation is extraordinary compared to that of the other regions. Still, companies having a male workforce of 25-50% are fairly common in the West London area (30%).

All in all, compared to the others; Portugal seems to be a very extraordinary region. Companies seem to be quite active internationally there, they have been situated at their current addresses for a somewhat shorter period of time than companies in other regions, company types are different from those of the others, customers in Portugal are located more often in the EU than customers in other regions, a notably large share of customers are companies, companies with workers mostly having a low educational level dominate, and the workforce in most companies is clearly male-dominated. No other region differs from the average as much as Portugal.

Another extreme is Flanders, which is a very average region. In addition, Lazio is quite like Flanders; the only noteworthy thing is that companies with older workforces can be found more often in Lazio. Tampere does not differ from the average much either. Compared to the other regions, there are differences in company's most achieving criterion, as productivity is highly important. Also, in companies' in the Tampere region, employees are a bit older and have a mostly low educational level, and there are quite many companies with a significant share of female workers. In the Stuttgart area, companies have been situated at their current addresses longer than on average, companies are significantly often fully independent, their market position is regional, and their customers are situated more in their own region than in other regions. Also, the number of companies with an older workforce is a bit greater than the average.

The West London area and Niederösterreich are both quite extreme regions, in a way opposed to each other. In the West London area, companies operate significantly more internationally, they have been operating at their same addresses only for a short time, branch establishments are more common than in other regions, companies are located in the urban area, a lot of customers are located outside the EU, and a significant share of companies has a young workforce.

In Niederösterreich, companies operate mainly on the national level, the addresses of the companies have been the same for a long time, companies are usually fully independent, quite a

large share of the companies are located in rural areas, companies constitute a smaller portion of the customers than in other regions, as many as 84% of the companies employ workers with predominantly vocational education, and, as in West London, quite many companies have a younger workforce. The Republic of Ireland is somewhat similar to Niederösterreich. In Ireland, companies' market position is distinctly often regional, customers are often located in the region and in the EU as well, and in most companies the workers are also fairly young.

3. TECHNOLOGICAL PRACTICES

The key concept in the research project is technological practices[2]. They consist of three dimensions: technological, organisational, and cultural. Here we will first deal with the technological dimension and discuss the various forms of ICT applications. We will then focus on the organisational dimension separately before analysing the relationships between ICT applications and organisation forms. The cultural dimension was not included in the questionnaire.

3.1. ICT applications

ICT systems include two dimensions: computer technology as an information processing device and communication technology as a connecting device. First, we will discuss the computer technology applied within companies. Both hardware and software components are dealt with. In the second part, we will analyse the communication technology applied within companies. Characteristically, the ICT systems which we will then discuss integrate both of the two technology strands, computer technology and communication technology. Our technology-related research also includes an analysis of the dominant functions for which ICT systems are installed. A third typology regarding ICT systems is based on the intensity and modernity of ICT applications.

3.1.1 The computer hardware technology

Concerning the computer technology, we differentiated between the following systems: stand-alone PCs, mainframes with terminals, and local area networks (LANs). The stand-alone PC was considered to be the simplest computer system. It has a limited operational capacity and it is basically a separate working unit, although it can be connected, for example, through telephone lines to the Internet. The mainframe can be characterised as a centralised computer system. Through terminals, users are connected to the main computer, its software and databases. The main computer outlines the tasks that can be conducted. Users cannot freely adjust the system to suit best to their needs at work. They are connected to the main computer but not directly to other users. We can characterise the use of mainframes as a "master/slave type of computing", as each "host" mainframe has slave terminals attached to it.

Local area networks represent a totally different and more decentralised type of computing. They can be described as client/server architecture. LANs and similar technologies connect the users to a network, shared software, databases and other users, but it also leaves space for more autonomy at work. Being integrated into a local area network, users do not have to rely only on the capacity of their own computer or the mainframe. The software is not limited to one machine but it can be processed co-operatively on various computers in the network. The computer, as Tapscott (1996: 100) argues, becomes the network and the network becomes the computer.

Nearly half of the companies (45%) in our sample apply only one of the three computer systems described above. In most cases, this is the local area network technology. This means, on the other hand, that the majority of companies still use at least two different computer technologies. In total, 78% of the companies apply LANs either alone or together with another technology, 61% apply stand-alone PCs and 35% the mainframe with terminals.

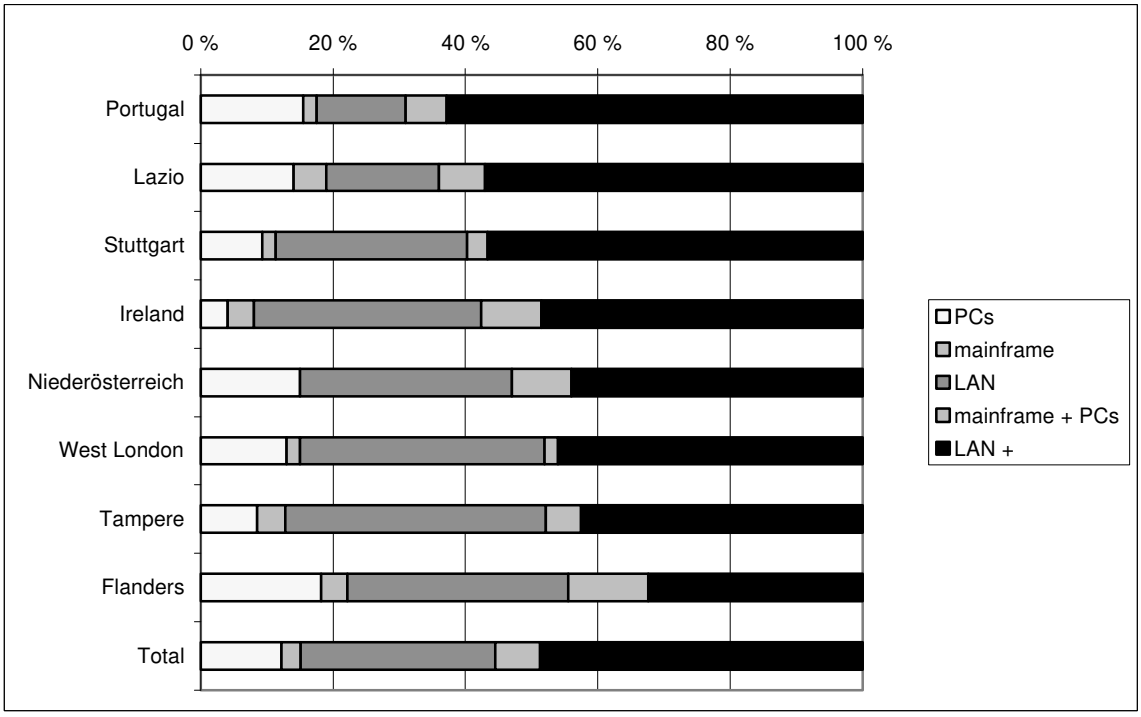
We categorised the different applied computer systems into five types. Companies applying only one system — stand-alone PCs, the mainframe with terminals, or LANs — and multi-systems — the mainframe and PCs together or LANs with either one or both of the other systems.

The number of the applied computer systems varies significantly according to the region of the company (Figure 3.1.). Over half of the companies in Flanders, the Tampere region and the West London area use only one system. Parallel use of two and more computer systems is the most common among firms in Portugal (70%) and in Lazio (64%).

Companies applying only stand-alone PCs are the most common in Flanders (18%), Portugal and Niederösterreich (15% in both regions). Instead, LANs as the single applied computer system is most widely used in the Tampere region (39%) and in the West London area (37%). In general, over 80% of companies in the Stuttgart area, the Republic of Ireland, the West London area and the Tampere region include LANs in their computer system, while only 66% of the companies in Flanders apply LANs.

[2] See for an extensive discussion of the concept the first interim report.

Figure 3.1. Applied computer system by region

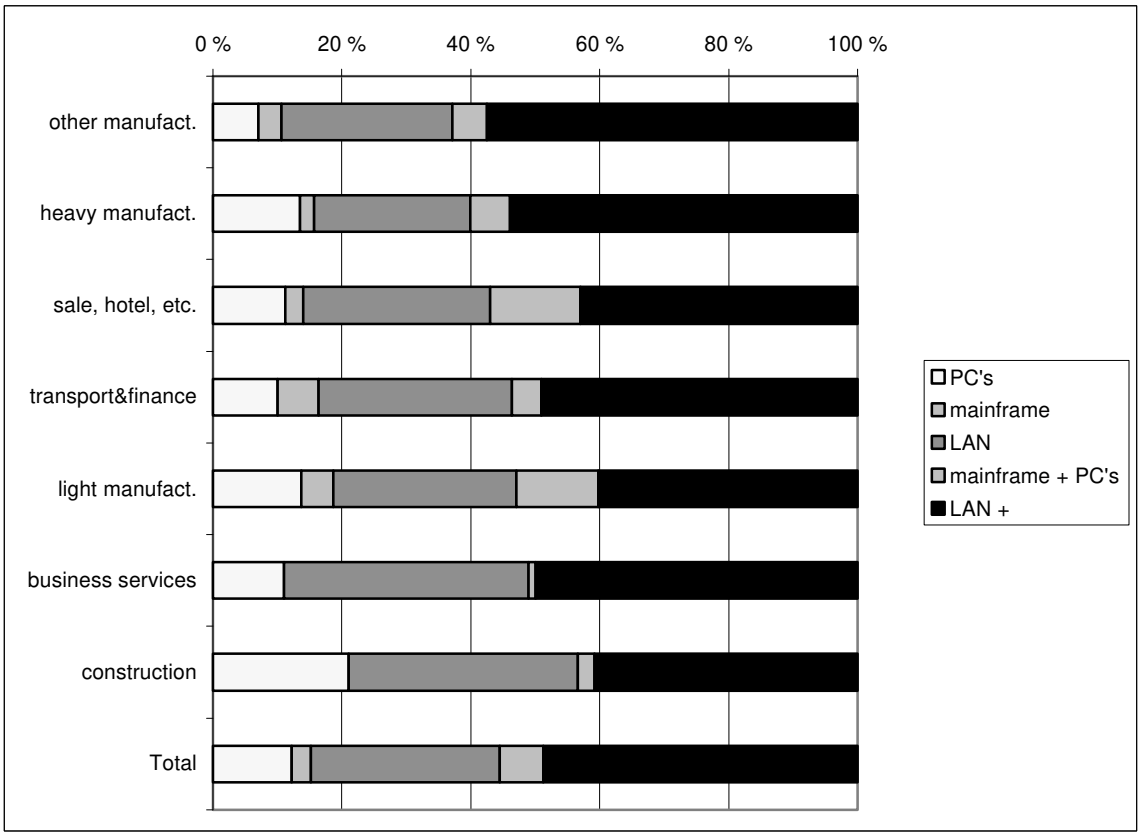


$\chi 2 = 63.7$ (df= 28) p= 0.000***

As can been seen in Figure 3.2., a single computer system is most commonly used in construction industry (57%), and multi-systems in other manufacturing (63%) and heavy manufacturing (60%). Companies in construction industry rely only on stand-alone PCs most often (21%). The PC system is frequently applied in light (14%) and heavy manufacturing (13%) as well. The mainframe with terminals possibly added with stand-alone PCs is most widely used in light manufacturing (18%), in the sales, hotel & restaurant sector (17%), and in transport & finance (11%). LANs, instead, are most common in business services and other manufacturing. They can be found in over 80% of the companies in these sectors.

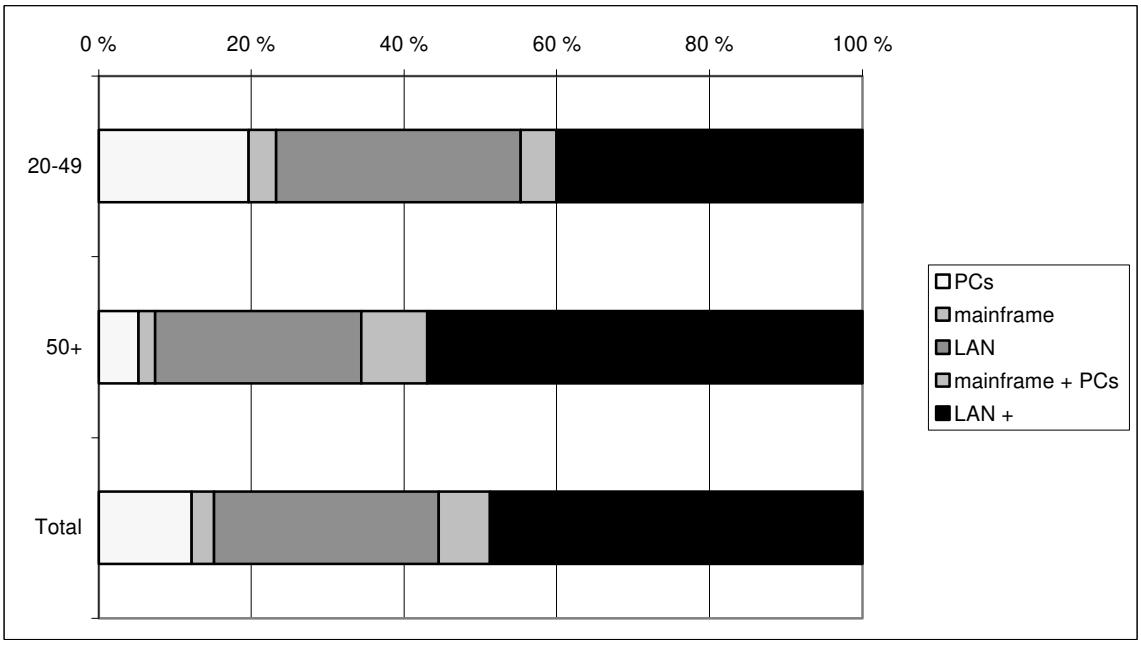
Company size also affects the type of ICT systems applied (Figure 3.3.). Over half of the small firms (53%) use only one computer system, while two-thirds of the larger companies apply a multi-system, which is most commonly LANs added with other system(s) (57%). The isolated stand-alone PC system is applied in 20% of the small firms and only in 5% of large companies.

Figure 3.2. Applied computer systems by industrial sector



$\chi 2 = 53.2$ (df= 24) p= 0.001***

Figure 3.3. Applied computer systems by company size

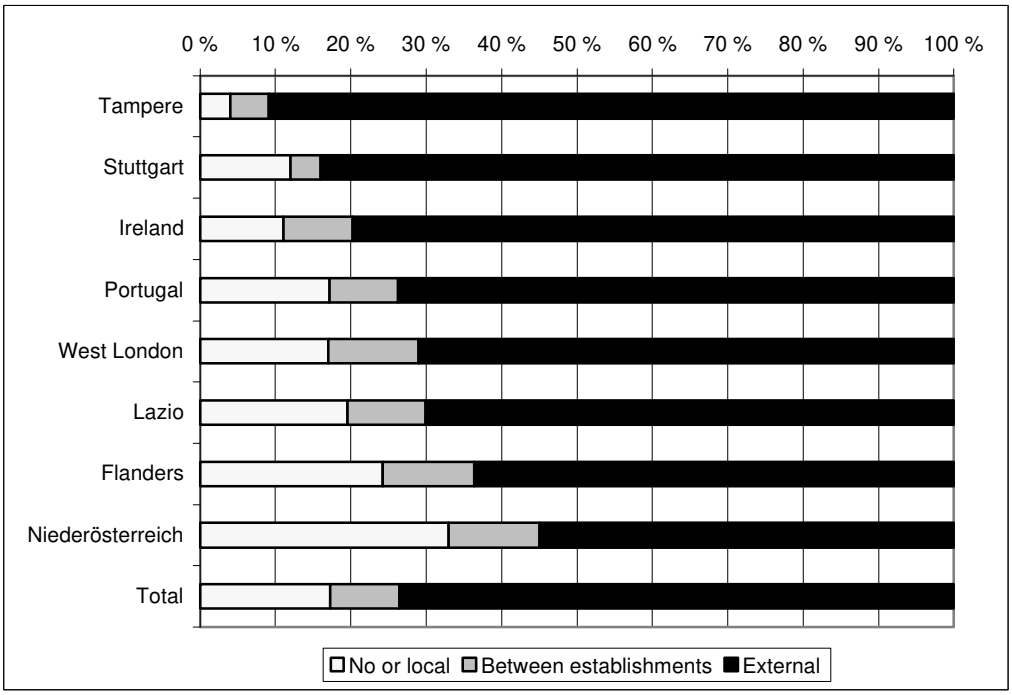


$\chi 2 = 52.6$ (df= 4) p= 0.000***

We further analysed whether the applied computer technology is connected only locally in a company establishment if at all, whether connectivity exists between separate establishments of a company, or whether the company is connected to the outside world. Overall, 9% of the companies lack any connection outside the particular establishment, 17% have inter-establishment links and 73% have external connections.

Figure 3.4. indicates that the establishments that are technically isolated can most often be found in companies in Niederösterreich (33%), while the share is only 4% among companies in the Tampere region. Also, a great majority of the firms in this region have data communication links with external third parties (91%).

Figure 3.4. External data communication by region

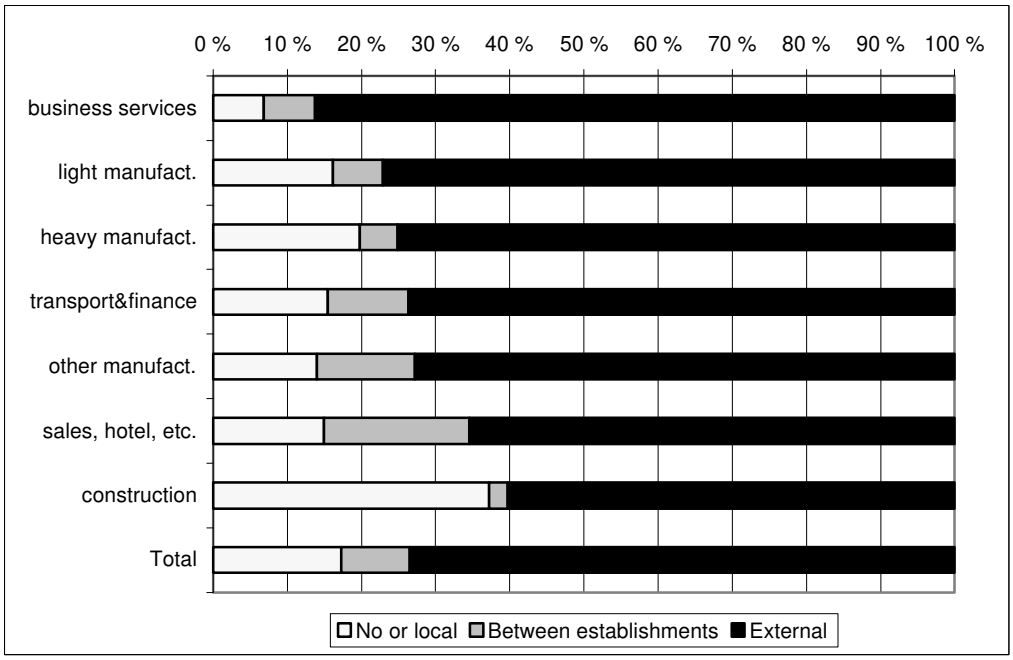


$\chi 2 = 51.1$, df= 14, p= 0.000***

Data communication among company establishments is most common in companies in the business service sector (93%). As many as 86% of these companies have data communication linkages with external parties outside the company (Figure 3.5.). On the other hand, in only 60% of the companies in the energy & construction sector and 65% of the firms in the sales & hotel sector establishments are externally connected. In nearly a quarter of the small companies and a tenth of the large companies, single establishments lack any external data communication link (Figure 3.6.).

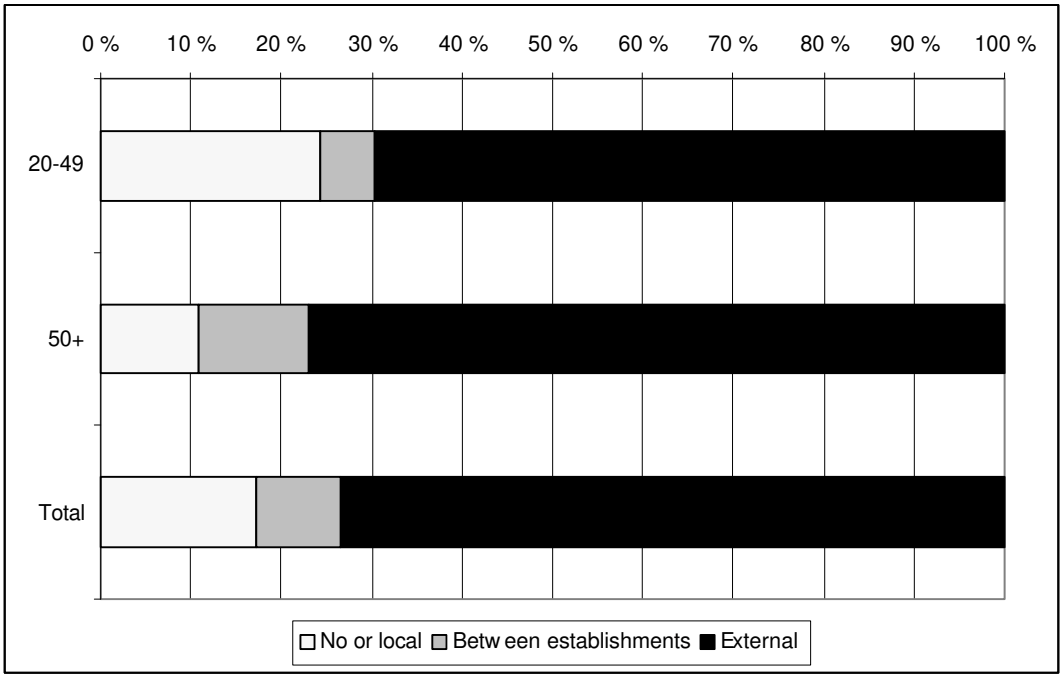
Compared to the 69% of the small firms, a total of 77% of the large companies have the link outside the other establishment of the company.

Figure 3.5. External datacommunication by sector



$\chi 2 = 54.8$, df= 12, p= 0.000***

Figure 3.6. External data communication by company size



$\chi 2 = 30.7$, df= 2, p= 0.000***

Based on what has been discussed so far, we can distinguish between the following ICT systems (Table 3.1.). More than 93% of all companies use network technologies, which in 73% of the cases include external connectivity, and in 9% of the cases links between the establishments of the company. More than half of the companies (55%) applying stand-alone PCs only do not have any electronic data connection at all.

Table 3.1. Technical systems

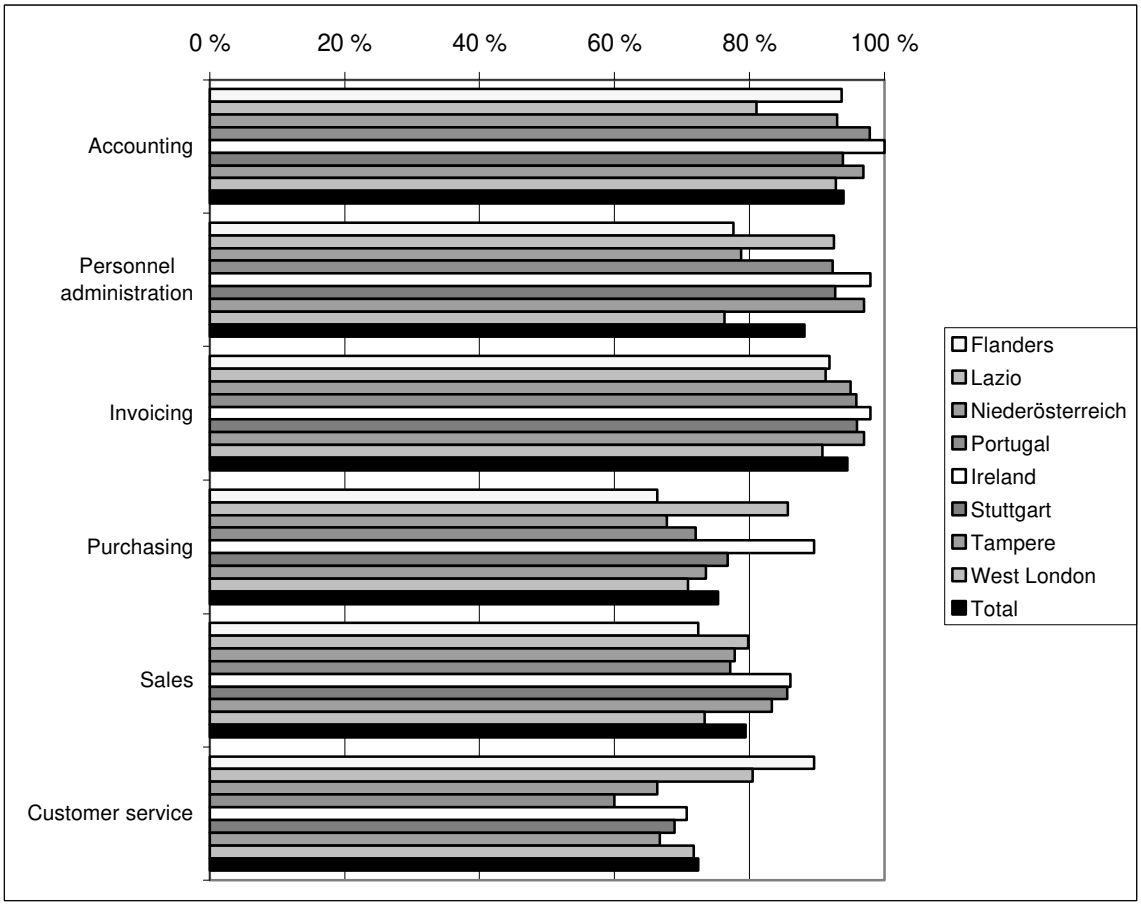
Technical system	Frequency	Percentage	Cumulative percentage
— Only PC with no connection	53	7	7
— Mainframe and terminals (+ PC) with only local connection	14	2	9
— LAN with only local connections	70	9	18
Subtotal A: **ICT system with only local connections (no connection between other establishment of the company or externally)**	137	18	
— Only PC between establishments connected	3	0	18
— Mainframe (+ PC) between establishments connected	11	1	19
— LAN between establishments connected	59	8	27
Subtotal B: **ICT systems with connection to other establishments of the company**	73	9	
Subtotal A+ B: **ICT systems with no external connectivity**	210	27	
— Only PC with external connectivity	40	5	32
— Mainframe (+ PC) with external connectivity	51	7	39
— LAN with external connectivity	479	61	100
Subtotal C: **ICT systems with external connectivity**	570	73	
Total	780	100	100

3.1.2 Software applications for office tasks

Companies can use office software for a variety of different tasks. In our survey, we included the following tasks: accounting, personnel administration, invoicing, purchasing, sales and marketing, and customer services. It is only rarely that all of these tasks are not applicable, that is, the tasks do not exist in the company. A total of 12% of the companies do not have customer service and 5% do not have sales.

Companies' application of software in various functions differs according to region, sector, and size. Concerning the regional aspect (see Figure 3.7.), the Irish companies are the leading users of office software in all tasks, except in customer service. The firms in Flanders and Lazio are distinctively ahead, as far as the application of software in customer service is concerned. In Lazio, software is also widely used in purchasing.

Figure 3.7. Office tasks carried out using software applications by region

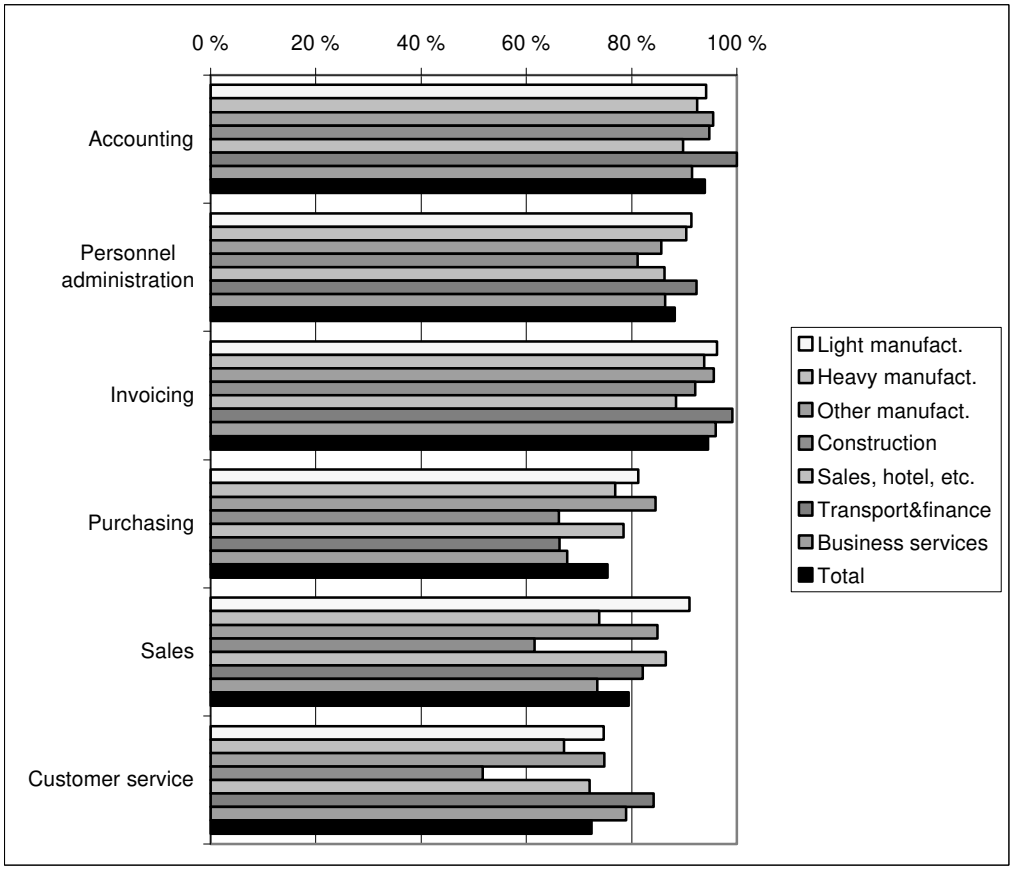


$\chi 2$ counted on frequencies of using/not using companies by region:

Accounting, $\chi 2 = 33.6$, df= 7, p= 0.000***
Personnel administration, $\chi 2 = 52.3$, df= 7, p= 0.000***
Invoicing, $\chi 2 = 9.8$, df= 7, p= 0.199
Purchasing, $\chi 2 = 24.5$, df= 7, p= 0.001***
Sales & marketing, $\chi 2 = 10.3$, df= 7, p= 0.171
Customer service, $\chi 2 = 26.3$, df= 7, p= 0.000***

In general, large companies, as expected, use office software more often than small companies, but differences are less remarkable as far as invoicing or customer service is concerned. As Figure 3.8. displays, companies in the manufacturing sectors are more frequent users of software support regarding purchasing. Software support in selling and marketing is most often used in light manufacturing, other manufacturing and the sales, hotel & restaurant sector. Customer service is naturally more common in the service sectors than in manufacturing.

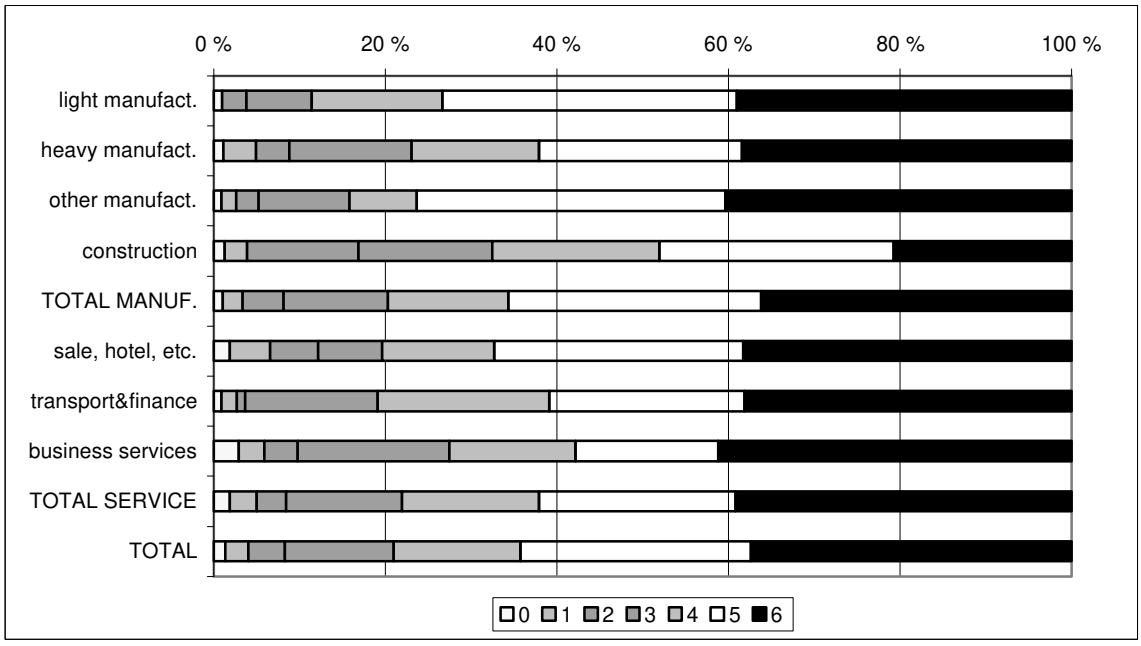
Figure 3.8. Office tasks carried out using software applications by sector



$\chi 2$ counted on frequencies of using/not using companies by sector
Accounting, $\chi 2 = 12.0$, df= 6, p= 0.063
Personnel administration, $\chi 2 = 8.3$, df= 6, p= 0.214
Invoicing, $\chi 2 = 13.7$, df= 6, p= 0.033*
Purchasing, $\chi 2 = 17.6$, df= 6, p= 0.007**
Sales & marketing, $\chi 2 = 31.3$, df= 6, p= 0.000***
Customer service, $\chi 2 = 22.9$, df= 6, p= 0.001**

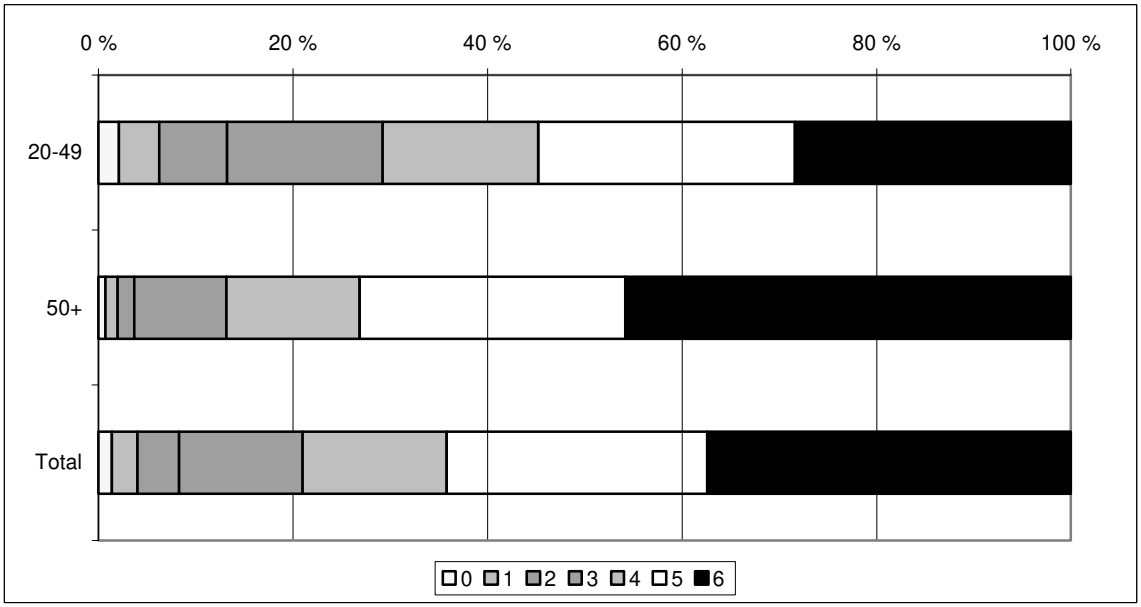
Figure 3.9. shows that multifunctional use of software support is more common in light manufacturing, other manufacturing, and the sales, hotel & restaurant sector, while in the construction sector, isolated software support is used more often only for few tasks. As expected, companies with fewer than 50 employees in general apply software in fewer tasks than larger companies (Figure 3.10.).

Figure 3.9. Number of tasks carried out using software applications by sector



$\chi 2 = 60.3$, df= 36, p= 0.007**

Figure 3.10. Number of tasks carried out using software applications by company size



$\chi 2 = 45.6$, df= 6, p= 0.000***

Table 3.2. indicates that software support is used the most in companies in invoicing (94%), accounting (94%), and personnel administration (88%), and the least for customer services (72%). Companies differ in the extent to which they use software support. Some 37% use software support for all tasks mentioned above. In addition, 27% of all companies use software support for five of the above-mentioned tasks. Isolated use of software support for only one (3%) or two tasks (4%) is very rare.

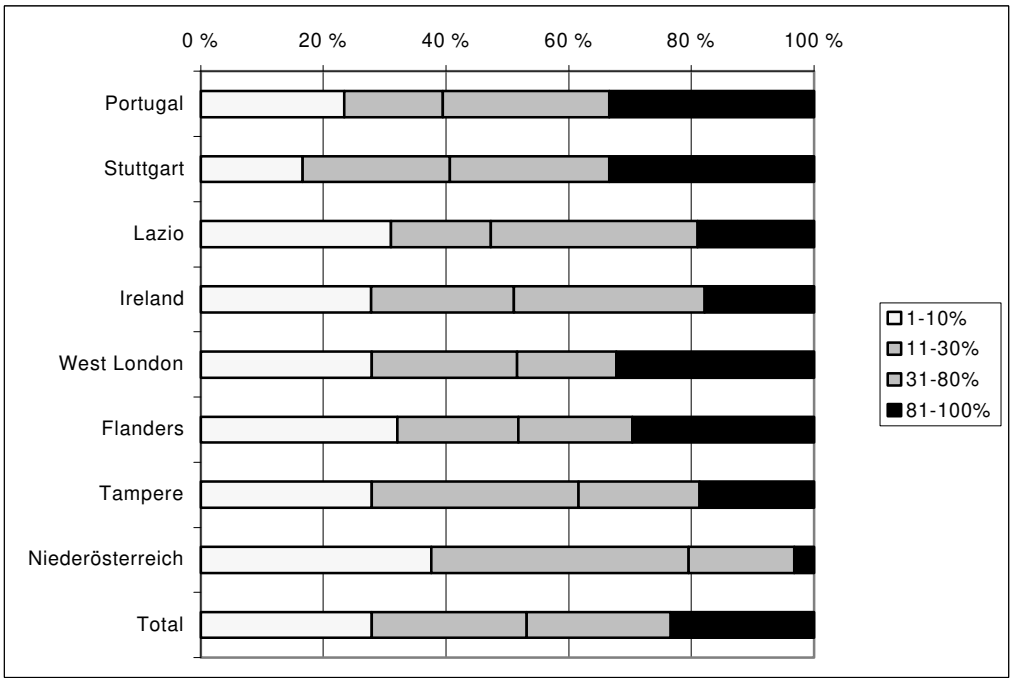
Table 3.2. Tasks carried out regularly by using software applications by number of tasks

	Applicable tasks			Not applicable	N
	Yes	No	Total		
Accounting	94%	6%	100%	3%	776
Personnel administration	88%	12%	100%	3%	786
Invoicing	94%	6%	100%	2%	792
Purchasing	75%	25%	100%	4%	766
Sales	79%	21%	100%	5%	765
Customer service	72%	28%	100%	12%	748

The share of employees[3] using software in specific administrative tasks within companies is the greatest in Portugal and in the Stuttgart area (Figure 3.11.). In 60% of these companies over 30% of the company workforce apply office automation. In larger companies, the share is only a little bigger than in small companies. Instead, the share of users varies remarkably when we look at the sector variable (Figure 3.12.). Business services and transport & finance are the sectors where the share of users of office automation in companies is the greatest.

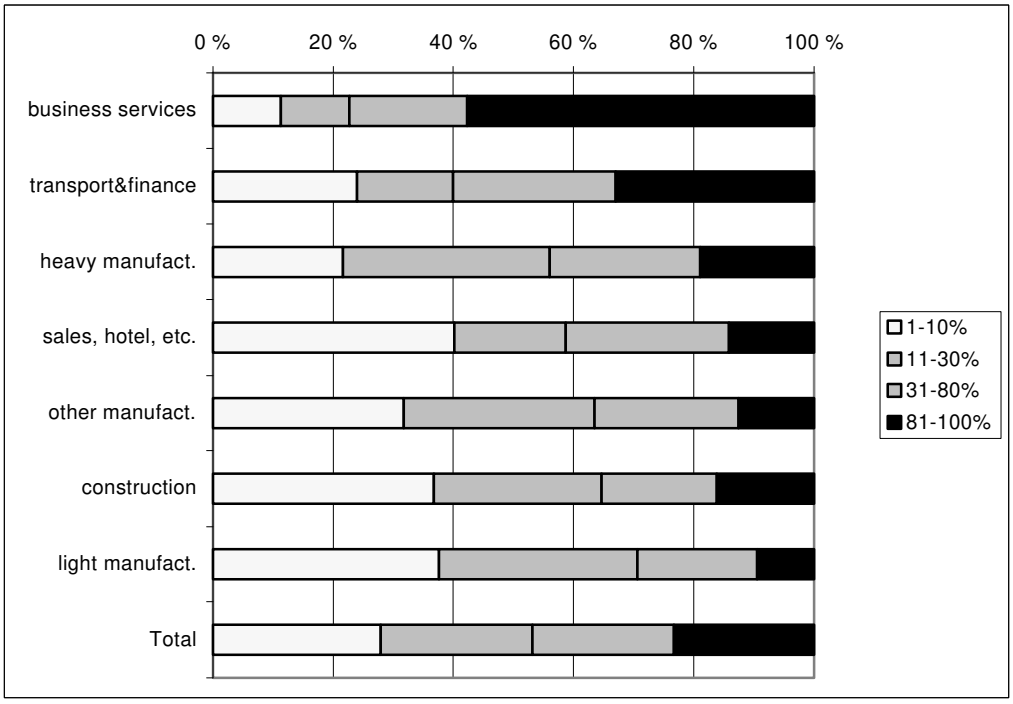
[3] The distribution of values in this variable significantly deviates from the normal curve, and the share of users in the companies was classified in quartiles.

Figure 3.11. Share of workforce applying office automation by region



$\chi 2 = 70.2$, df= 21, p= 0.000***

Figure 3.12. Share of workforce applying office automation by sector



$\chi 2 = 118.3$, df= 18, p= 0.000***

3.1.3 Software applications at production stages

Computer support and automation in production concerns companies in manufacturing sectors in the first place; only few production stages can be used in the service companies as well. Therefore, the share of companies having answered to the related question is smaller than the average. In general, the lack of automation use in production and the isolated use are more common in service sectors. About half of them have not answered to this question at all, and over half of the service companies that answered use automation only at one or two stages of the production.

Table 3.3. provides information about the stages in the production process which companies find suitable for automation and about the actual application of automated systems in various stages of the production process. Computer systems[4] are used the most in the planning and preparation stage (61%), and in the design stage (58%) of the production.

Table 3.3. Computer-supported stages of production process

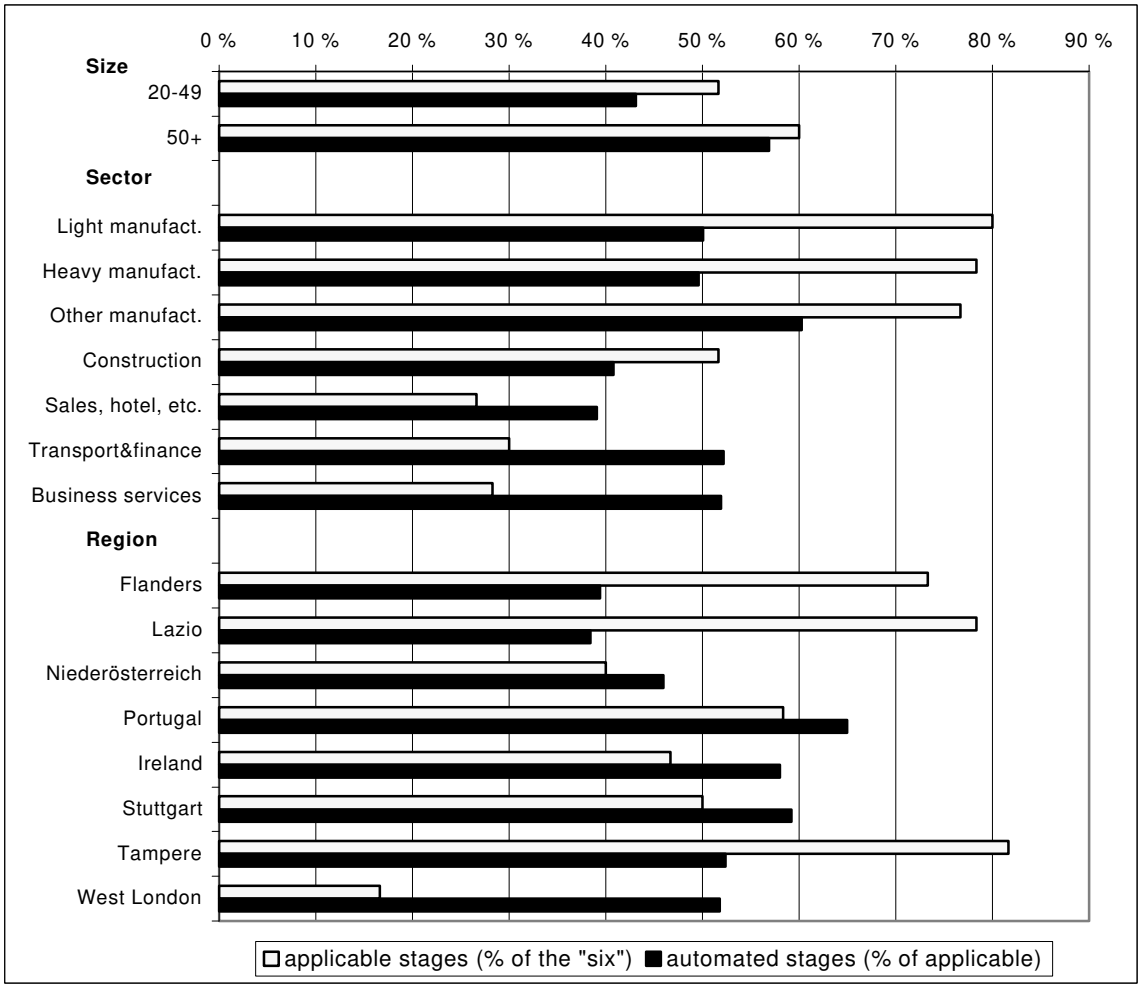
	Applicable stages				Not applicable	N
	In use	Planned	Not in use	Total		
Design of products	58%	2%	40%	100%	24%	583
Planning and preparation	61%	8%	31%	100%	18%	584
Treatment of products	43%	2%	56%	100%	29%	578
Process control	42%	4%	55%	100%	25%	583
Transport or warehouse management	30%	5%	65%	100%	26%	581
Maintenance planning or quality management	49%	9%	43%	100%	19%	584

[4] Some examples of the different computer systems were given for the respondents in the questionnaire. CAD (Computer-Aided Design) and CAE (Computer-Aided Engineering) are computer systems for the *design of products*. Likewise, MRP (Manufacturing Resource Planning) and technical production- and work preparation for systems for *planning and preparation of the production process*. In the *treatment of products*, CNC, DNC or industrial robots, for example, can be used. PLCs (Programmable Logic Controllers), DCS (Distributed Control System) and PCs with adequate software can be used in *process control*. The example systems for *transport of products or stock & warehouse management* were automatic transport systems, pick-and-place robots and automatic storage systems. For computer support in *maintenance planning and/or quality management*, no specific example was given.

In Figure 3.13., we can see the average applicable and automated production stages by firm size, industrial sector, and region. Large companies of course are able to apply automation in more stages of the production process than small companies, and they actually also automate production stages more often. And, for companies in manufacturing sectors, the range of stages suitable for automation is naturally wider (on average nearly 80% of the six stages) than for companies in the service sectors (less than 30%). However, the transport & finance sector and the business service sector both automate as much as light and heavy manufacturing. Automation is applied the most in the dispersed sector of other manufacturing.

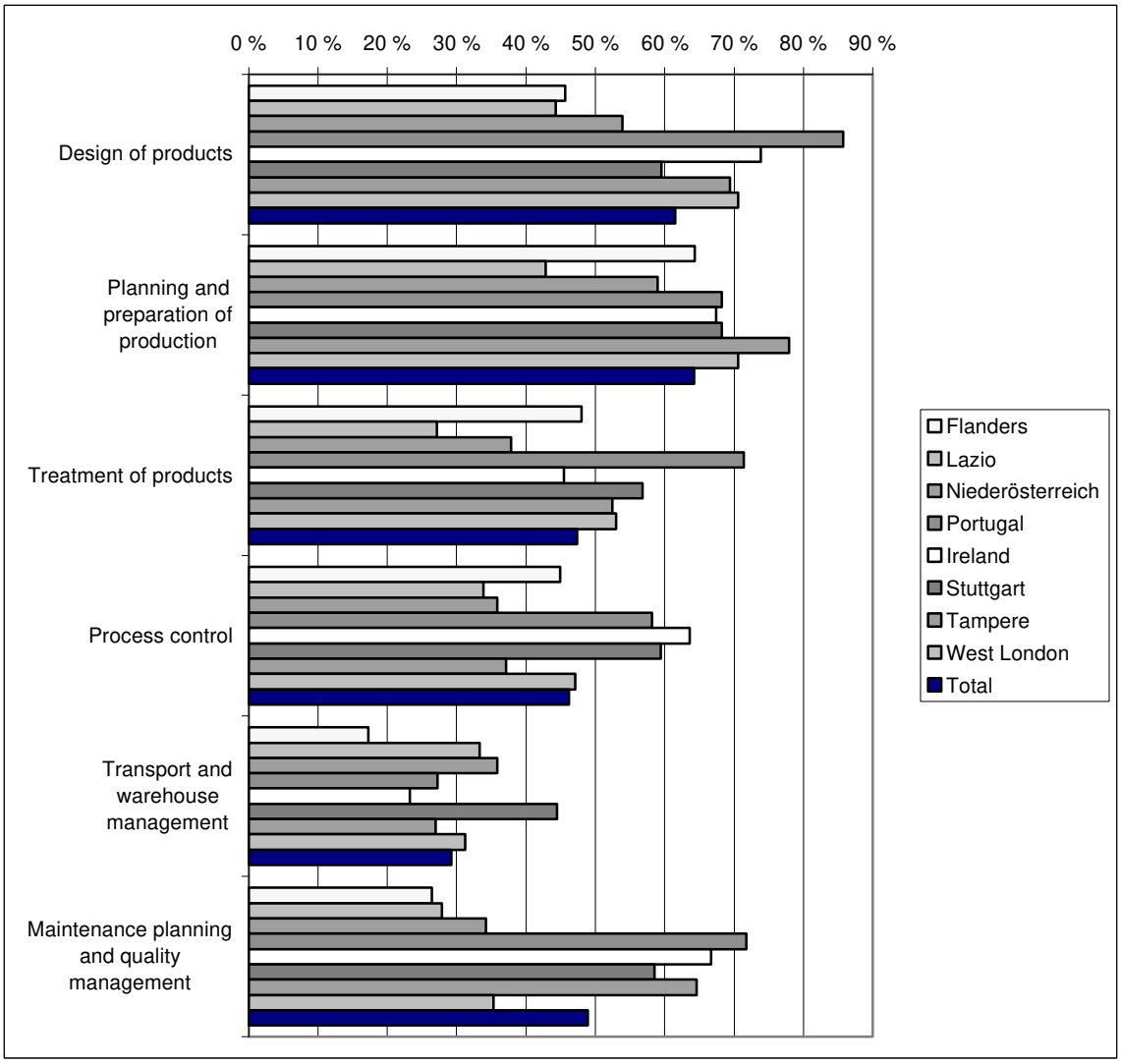
Production automation is the most widespread in companies in Portugal, the Stuttgart area and the Republic of Ireland (about 60% of the applicable production stages). In Lazio and Flanders, the firms automate only up to 40% of the applicable production stages on average.

Figure 3.13. Average applicable and automated production stages by firm size, industrial sector and region



The following figures include only manufacturing companies. Automation of the production process in manufacturing is the most advanced in Portugal and in the Stuttgart area (Figure 3.14.). Companies in Lazio and Niederösterreich are clearly lagging behind in the overall application of automation; in transport and warehouse management they are among the top users.

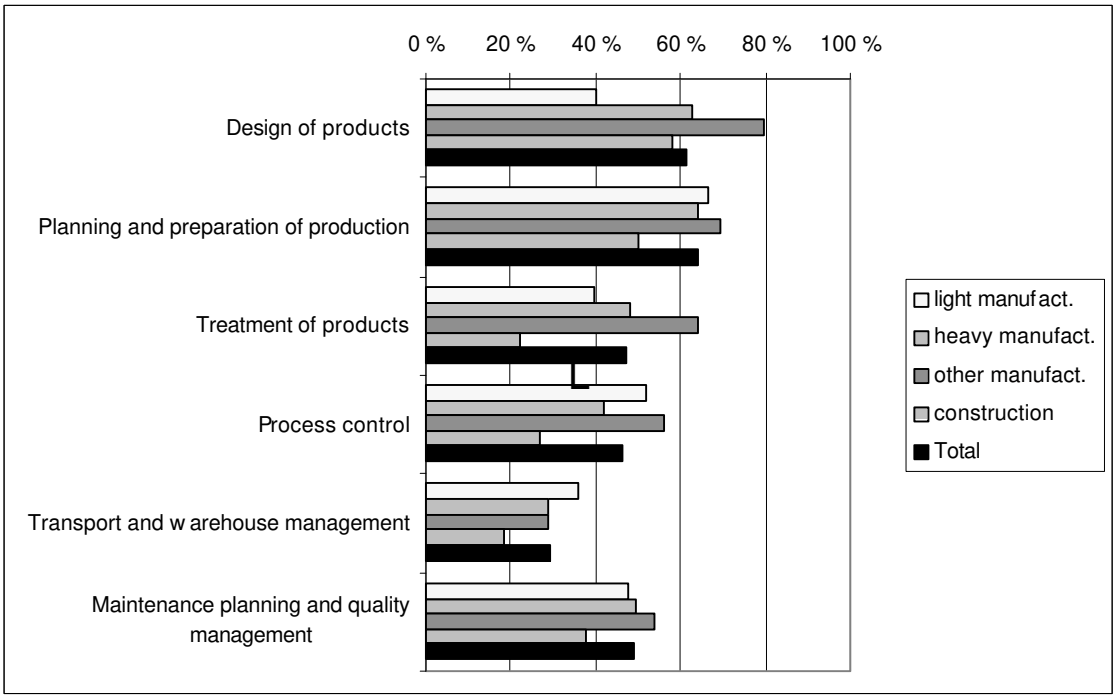
Figure 3.14. Automation of applicable production stages by region



$\chi 2$ counted on frequencies of applying/not applying companies by region:
Design of products, $\chi 2 = 28.9$, df= 7, p= 0.000***
Planning and preparation, $\chi 2 = 19.6$, df= 7 , p= 0.006**
Treatment of products, $\chi 2 = 21.4$, df= 7 , p= 0.003**
Process control, $\chi 2 = 18.0$, df= 7 , p= 0.012*
Transport or warehouse management, $\chi 2 = 9.9$, df= 7, p= 0.0193
Maintenance planning or quality management, $\chi 2 = 49.3$, df= 7, p= 0.000***

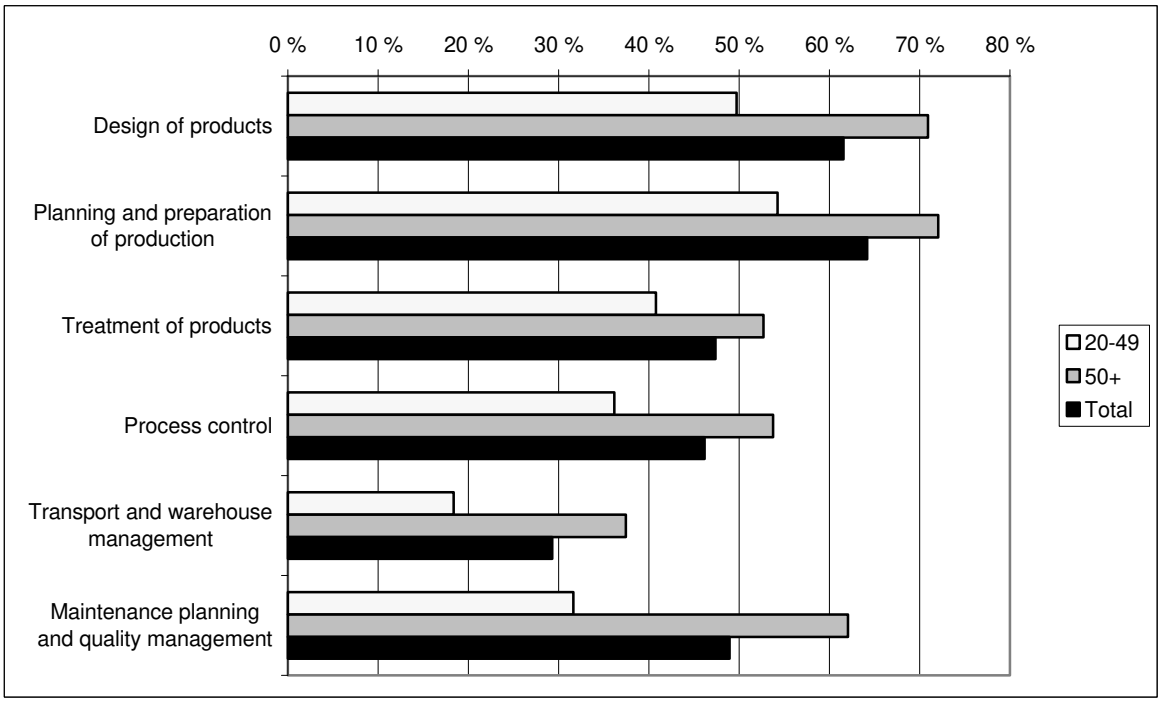
According to the industrial sectors (Figure 3.15.), automation varies significantly only in the design and treatment stages of products and in the process control stage. Automation is applied the most comprehensively in the other manufacturing sector. It is the least advanced in companies in the energy & construction industry. Large companies automate more of the applicable production stages than small companies (Figure 3.16.).

Figure 3.15. Automation of applicable production stages by sector



$\chi 2$ counted on frequencies of applying/not applying companies by sector:
Design of products, $\chi 2 = 27.1$, df= 3, p= 0.000***
Planning and preparation, $\chi 2 = 5.0$, df= 3, p= 0.169
Treatment of products, $\chi 2 = 20.6$, df= 3, p= 0.000***
Process control, $\chi 2 = 10.7$, df= 3, p= 0.013*
Transport or warehouse management, $\chi 2 = 3.9$, df= 3, p= 0.276
Maintenance planning or quality management, $\chi 2 = 3.0$, df= 3, p= 0.385

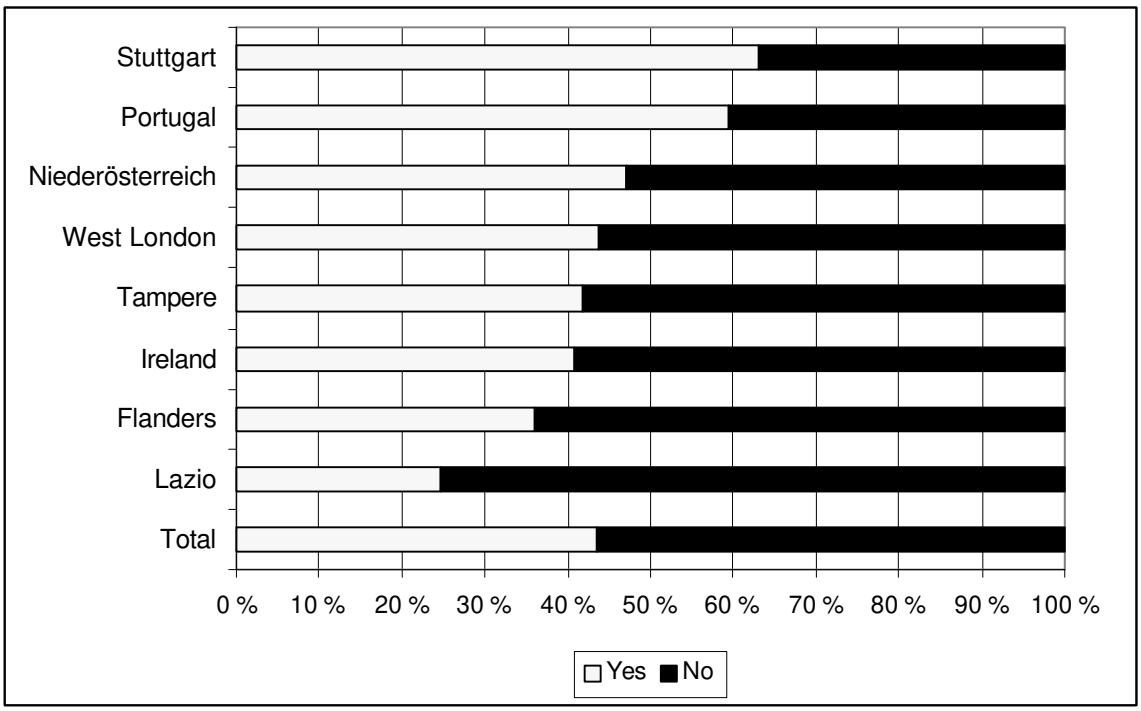
Figure 3.16. Automation of production stages by company size



$\chi 2$ counted on frequencies of applying/not applying companies by company size:
Design of products, $\chi 2 = 16.5$, df= 1, p= 0.000***
Planning and preparation, $\chi 2 = 12.8$, df= 1, p= 0.000***
Treatment of products, $\chi 2 = 4.8$, df= 1, p= 0.029*
Process-control, $\chi 2 = 10.7$, df= 1, p= 0.001***
Transport or warehouse management, $\chi 2 = 14.7$, df= 1, p= 0.000***
Maintenance planning or quality management, $\chi 2 = 33.2$, df= 1, p= 0.000***

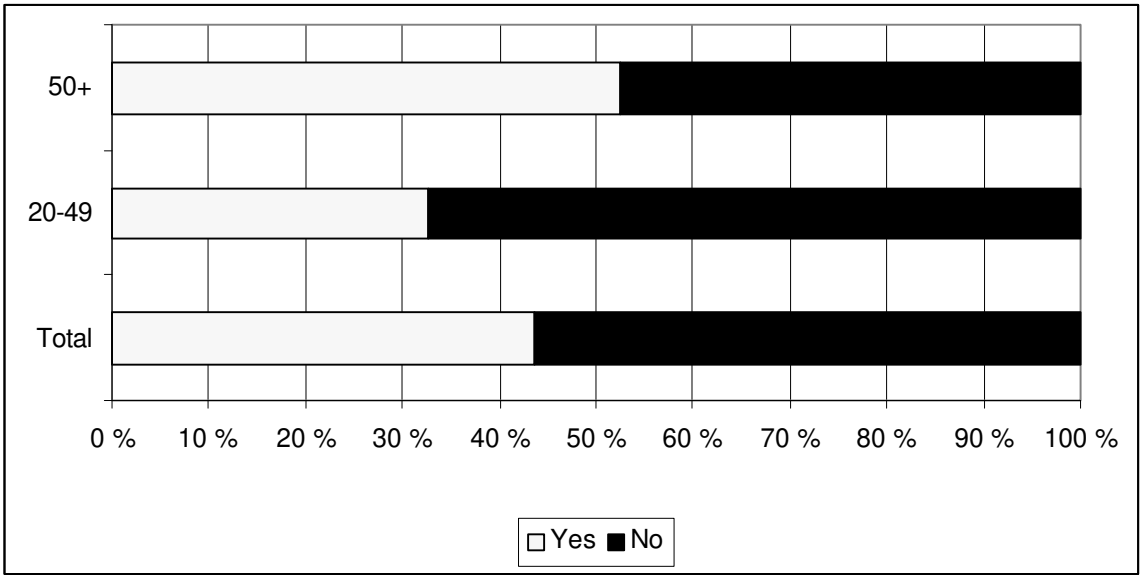
Over 60% of the companies in Portugal and the Stuttgart area have technical integration between the different production stages (Figure 3.17.). Integration is quite rare in Lazio (only in 25% of the companies). According to different manufacturing sectors, there is practically no variation in the application of technical integration in production. Expectedly, larger companies use more technical integration between the production stages than small firms (Figures 3.18. and 3.19.)

Figure 3.17. Technical integration between computer-supported production stages by region



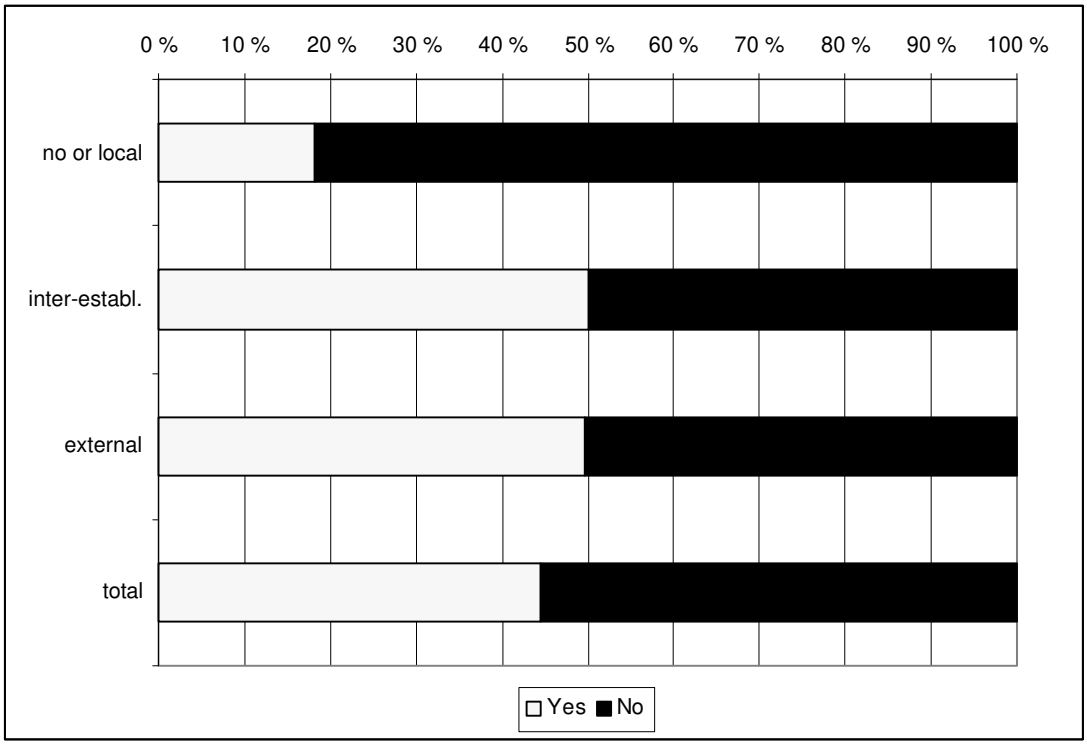
$\chi 2 = 27.9$, df= 7, p= 0.000***

Figure 3.18. Technical integration between computer-supported production stages by company size



$\chi 2 = 17.4$, df= 1, p= 0.000***

Figure 3.19. Technical integration between computer-supported production stages by computer infrastructure



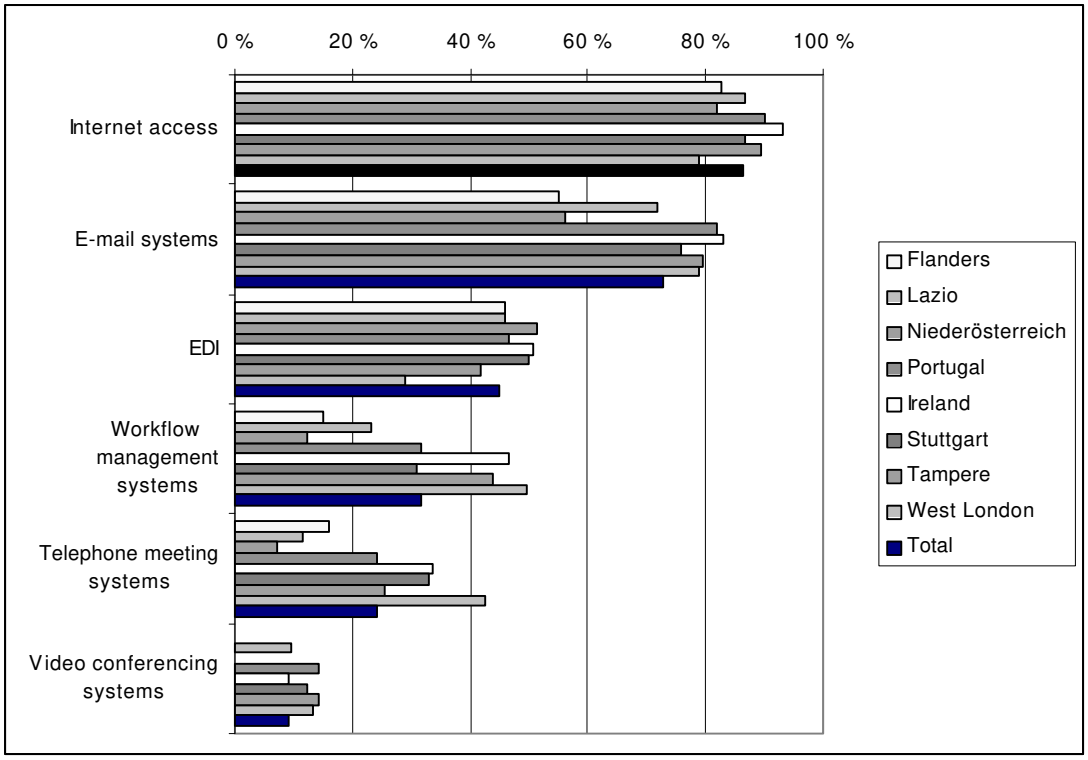
$\chi 2 = 17.1$, df= 2, p= 0.000***

3.1.4 Communication technology

We have so far discussed the hardware and software aspects of information managing technologies. Now we will pay attention to the technologies in charge of the connecting function. A clear majority of all companies in our sample have access to the Internet (87%), and 73% of them use the e-mail. Less applied are the electronic data interchange, EDI, (45%), workflow management systems (32%), and telephone meeting systems (24%). Only 9% of all companies participating in the questionnaire have video conferencing systems.

The use of communication technology, however, differs significantly if we look at each region separately (Figure 3.20.). The Irish and Portuguese companies seem to be the most advanced in having access to the Internet and e-mail systems. Data transmission (EDI) is more widely used in Niederösterreich, the Republic of Ireland, and the Stuttgart area than in other regions. The companies in the West London area are the most advanced users of workflow management and telephone meeting systems.

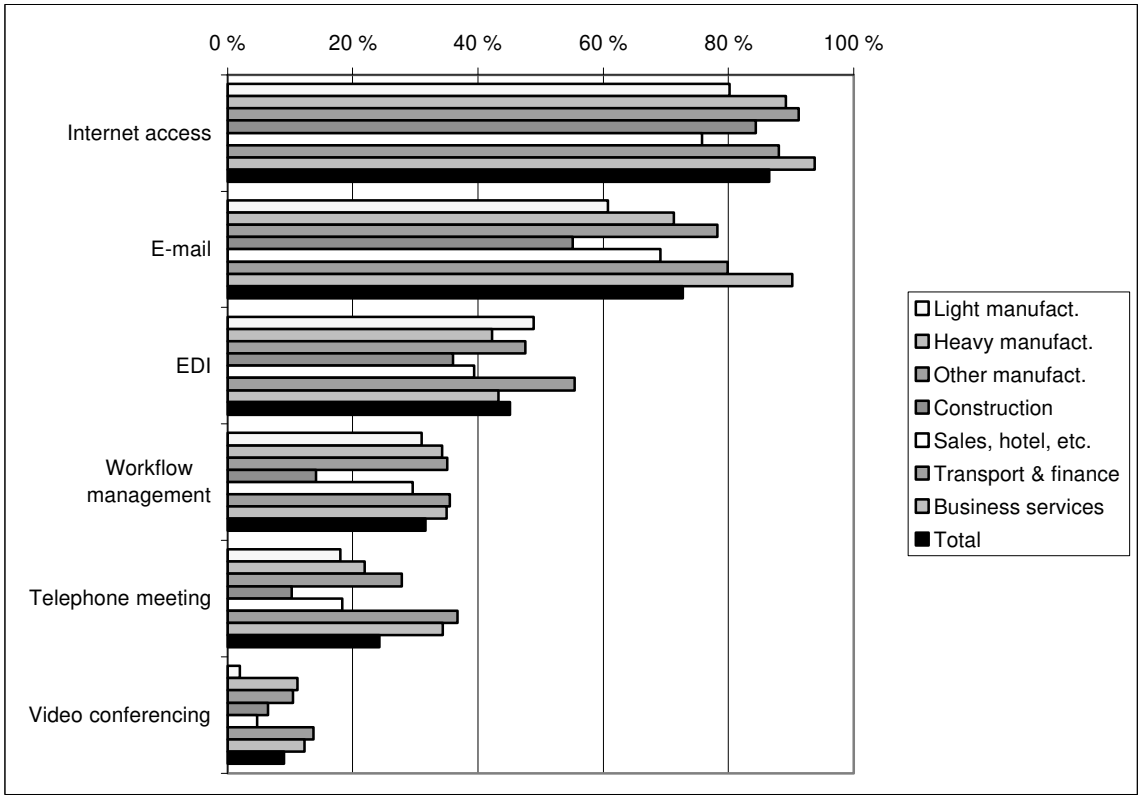
Figure 3.20. Application of communication technology by region



$\chi 2$ counted on frequencies of applying /not applying companies by region:
Internet access, $\chi 2 = 10.2$, df= 7, p= 0.175
Electronic mail systems, $\chi 2 = 40.9$, df= 7, p= 0.000***
EDI, $\chi 2 = 12.8$, df= 7, p= 0.076
Workflow management systems, $\chi 2 = 65.3$, df= 7, p= 0.000***
Telephone meeting systems, $\chi 2 = 53.9$, df= 7, p= 0.000***
Video conferencing systems, $\chi 2 = 30.9$, df= 7, p= 0.000***

As we can see in Figure 3.21., industries differ considerably in their adoption of communication technology. In general, communication technologies, especially the e-mail and telephone meeting systems, are used more often in the service sectors than in the manufacturing sectors. Business services and other manufacturing sectors seem to be the most advanced sectors in applying communication technology. It is also used relatively often in transport & finance and in heavy manufacturing.

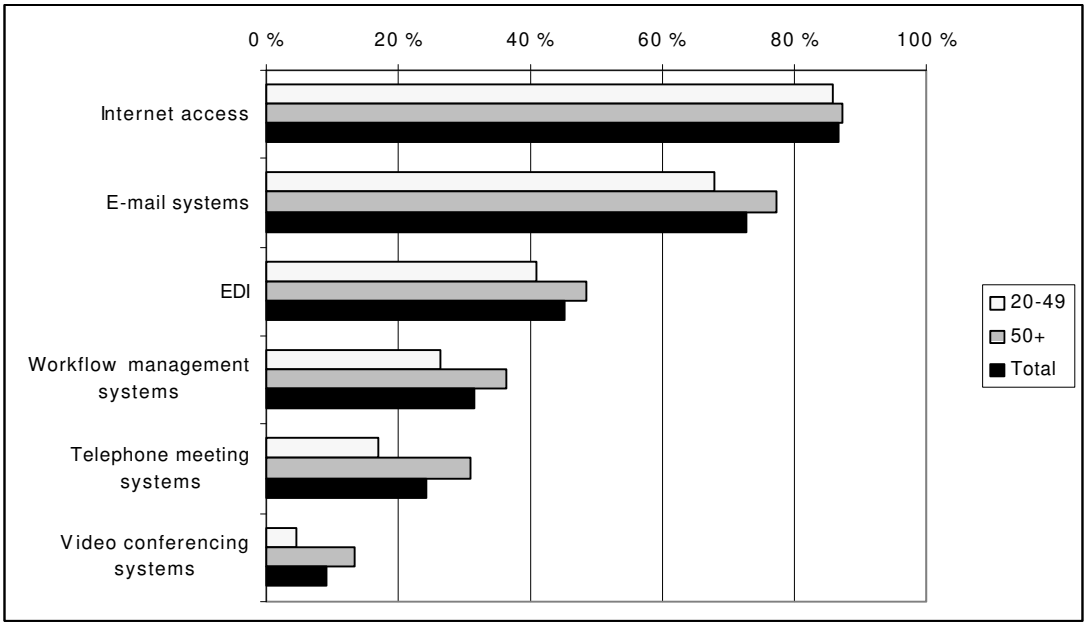
Figure 3.21. Application of communication technology by sector



$\chi 2$ counted on frequencies of applying/not applying companies by sector:
Internet access, $\chi 2 = 23.7$, df= 6, p= 0.001***
Electronic mail systems $\chi 2 = 38.2$, df= 6, p= 0.000***
EDI, $\chi 2 = 8.1$, df= 6, p= 0.232
Workflow management systems, $\chi 2 = 14.7$, df= 6, p= 0.022*
Telephone meeting systems, $\chi 2 = 30.5$, df= 6, p= 0.000***
Video conferencing systems, $\chi 2 = 14.9$, df= 6, p= 0.021*

Large companies apply all the above-mentioned communication technologies more frequently (Figure 3.22.). However, significant differences can only be found in the use of telephone meeting technology, video conference systems, workflow management systems, and e-mail systems.

Figure 3.22. Application of communication technology by company size



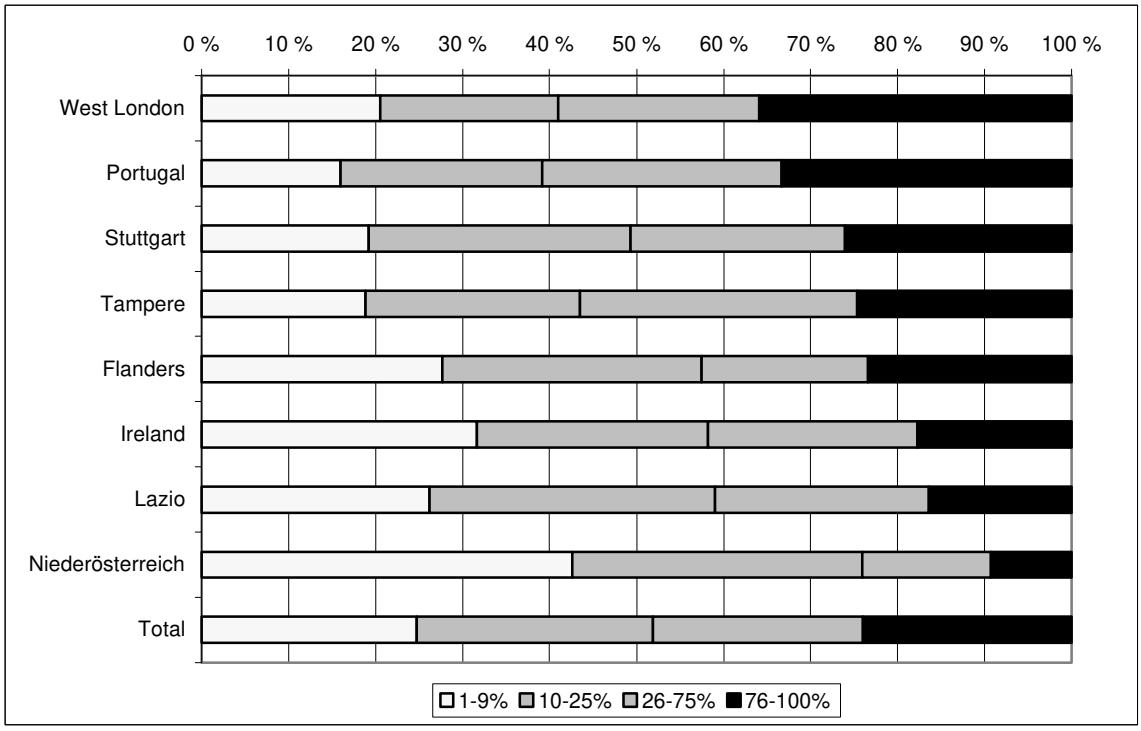
$\chi 2$ counted on frequencies of applying/not applying companies by company size:
Internet access, $\chi 2 = 0.7$, df= 1, p= 0.399
Electronic mail systems, $\chi 2 = 9.1$, df= 1, p= 0.003**
EDI, $\chi 2 = 2.9$, df= 1, p= 0.090
Workflow management systems, $\chi 2 = 7.4$, df= 1, p= 0.006**
Telephone meeting systems, $\chi 2 = 19.3$, df= 1, p= 0.000***
Video conferencing systems, $\chi 2 = 15.0$, df= 1, p= 0.000***

In most of the companies, only a minority of employees actually uses communication technologies. If the company applies the communication system, 42% of the workforce on average use workflow management systems, 39% the electronic mail systems, 11% telephone meeting systems and 3% video conferencing systems. There are, however, great differences. In every fourth company, less than 10% of all employees in the company use the e-mail, workflow management technology, and telephone conference systems. On the other hand, the number of companies in which all employees use the three technologies is also relatively big. This is the case with the e-mail in 17% of the companies, with workflow management systems in 12% and with telephone conference systems in 7%.

Figure 3.23. shows that the most extensive use of the electronic mailing systems among employees can be found in the West London area and Portugal[5]. On the other hand, companies in Niederösterreich seem to reduce the use of the e-mail to a small number of employees only. Regional differences concerning the application of workflow management systems were not

significant. It is still worth mentioning that, in the West London area, where the use of data transmission is the most widespread, the share of employees within a company making use of it is the largest as well, as we can see in Figure 3.24.

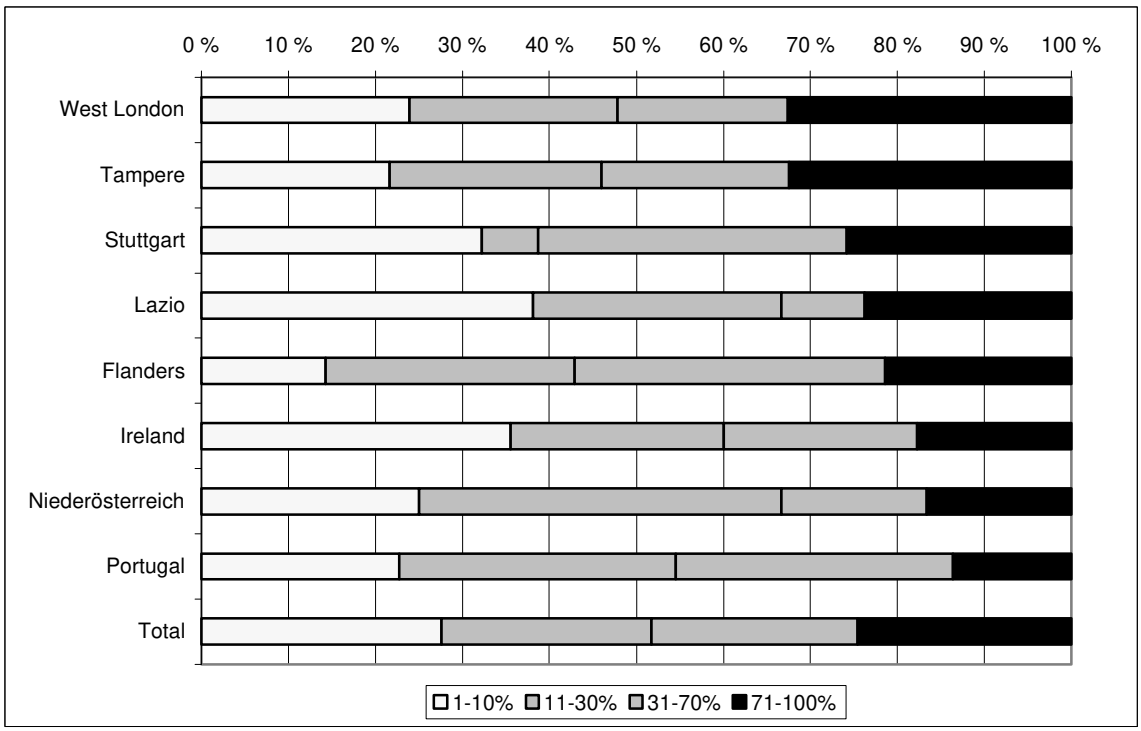
Figure 3.23. Share of users of e-mailing systems in companies by region



$\chi 2 = 41.5$, df= 21, p= 0.005**

[5] The distribution of values in these variables significantly deviates from the normal curve, and the share of users in the companies was classified in quartiles.

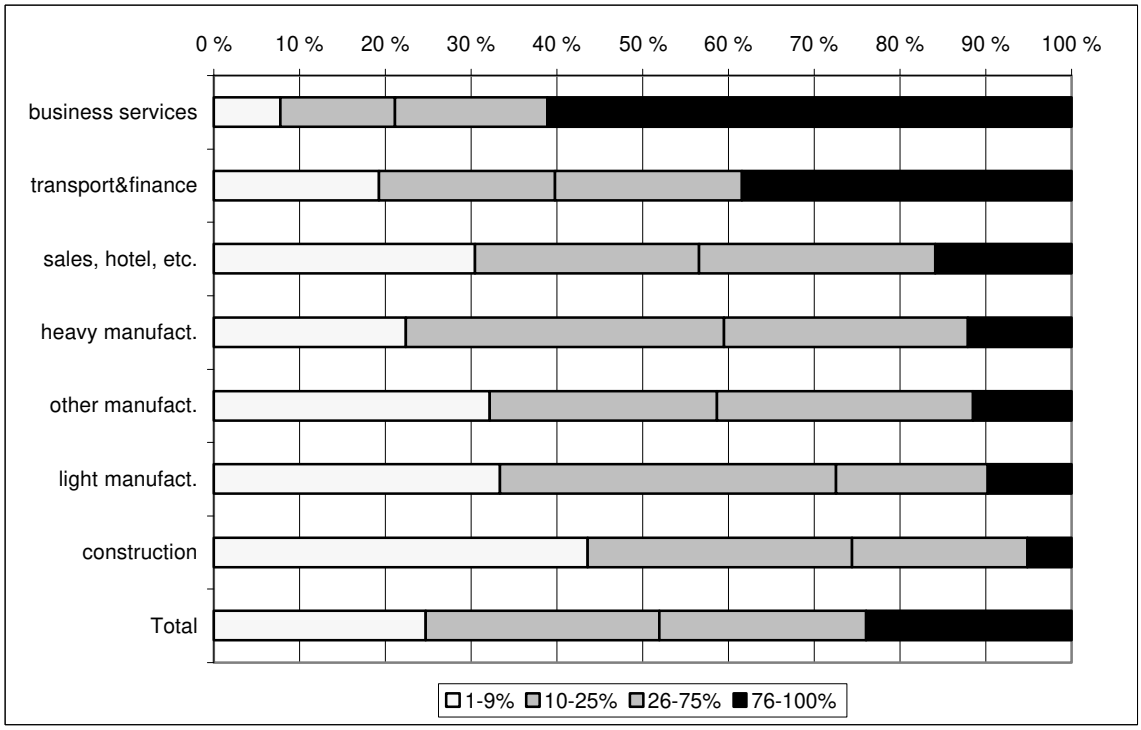
Figure 3.24. Users of workflow management systems in companies by region



$\chi 2 = 20.5$, df= 21, p= 0.489

The application of the e-mail systems is the most widespread in business services (Figure 3.25.). More than three quarters of the employees use the e-mail in over 60% of these companies. In small companies the use of the e-mail is less widespread than in large companies. Somewhat surprisingly, the share of the workforce using workflow management systems in small companies is bigger than in larger companies.

Figure 3.25. Users of e-mailing systems in companies by sector

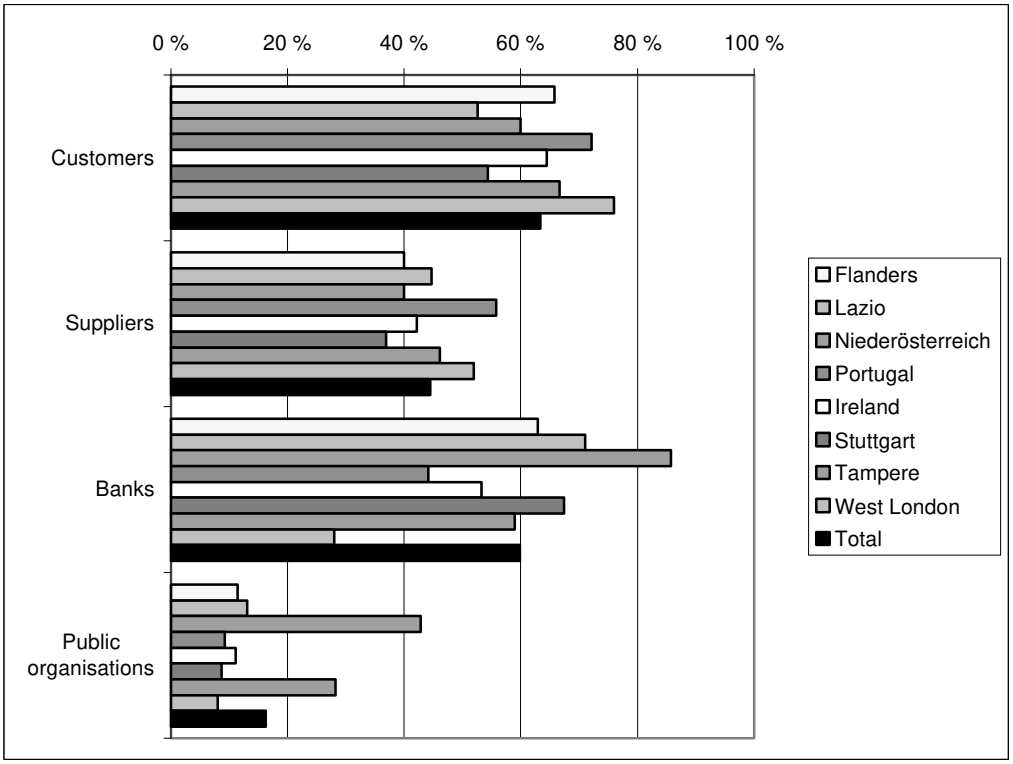


$\chi 2 = 124.7$, df= 18, p= 0.000***

Which are the most important partners for companies in the electronic data interchange EDI? Most often companies interchange data with customers (63%) and banks (60%). The EDI is less used with suppliers (44%) or public organisations (16%).

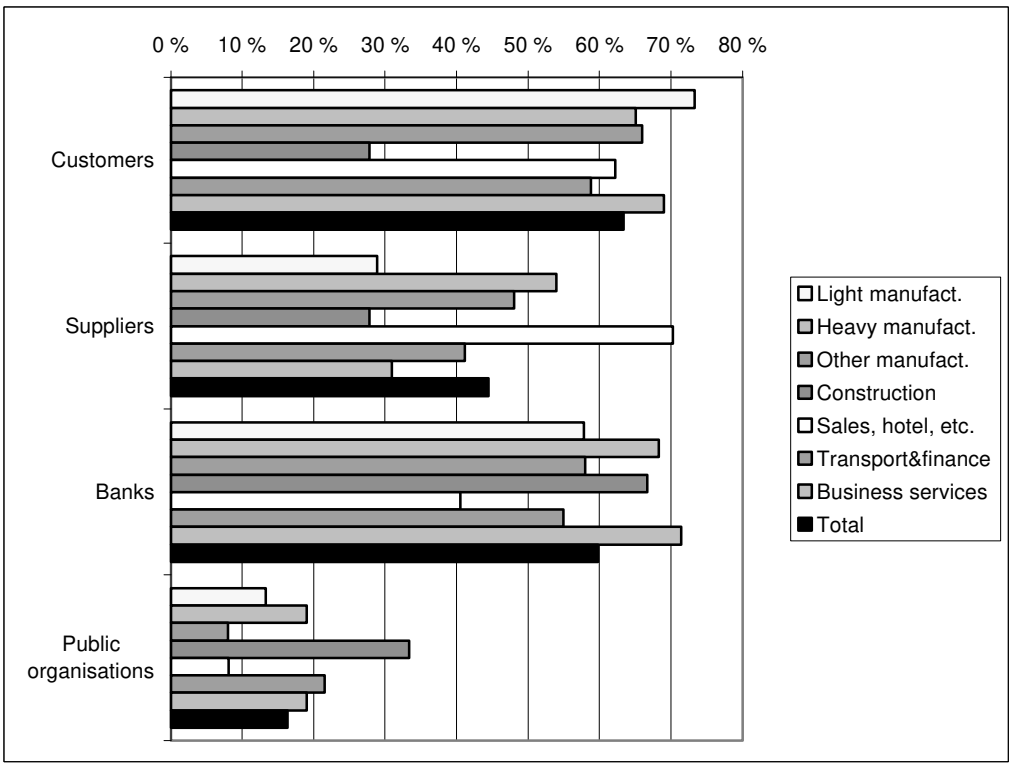
Regions differ particularly in the extent to which the companies exchange data with banks and public organisations (Figure 3.26.). Over half of the companies in Niederösterreich, Lazio, the Stuttgart area and Flanders apply EDI with banks. The firms in Niederösterreich also exchange data with public organisations extensively as do the companies in the Tampere region. Company size does not seem to have any effect on with whom companies have data transmission. Looking at industry (Figure 3.27.), however, we can find remarkable differences in data transmission with suppliers. The sales, hotel & restaurant sector and heavy manufacturing use EDI more than other sectors. Construction industry, light manufacturing and business services, instead, apply it the least.

Figure 3.26. EDI partners of companies by region



Customers, $\chi 2 = 7.1$, df= 7, p= 0.420
Suppliers, $\chi 2 = 4.6$, df= 7, p= 0.712
Banks, $\chi 2 = 28.7$, df= 7, p= 0.000***
Public organisations, $\chi 2 = 28.6$, df= 7, p= 0.000***

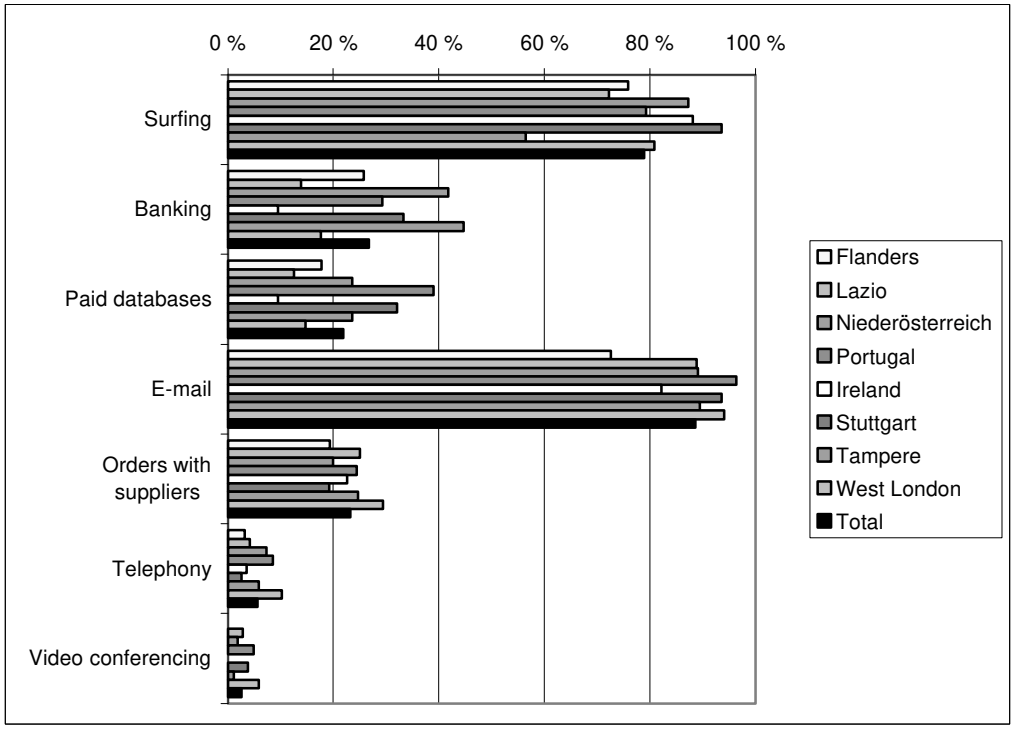
Figure 3.27. EDI partners of companies by sector



Customers, $\chi 2 = 13.0$, df= 6, p= 0.042*
Suppliers, $\chi 2 = 22.3$, df= 6, p= 0.001***
Banks, $\chi 2 = 11.0$, df= 6, p= 0.090
Public organisations, $\chi 2 = 10.1$, df= 6, p= 0.122

Companies use the Internet most often for electronic mailing (89%) and surfing (79%). About a quarter of all companies use the Internet for banking, giving orders to suppliers or accessing aid databases. The use of the Internet does not differ significantly by company size or sector, but there are regional differences (see Figure 3.28.). Surfing on the Internet is more common in the companies in the Stuttgart area, the Republic of Ireland and Niederösterreich. Net banking is most applied in the Tampere region and Niederösterreich. Instead, companies in Portugal and in the Stuttgart area use paid databases on the web, and the Internet e-mail is very often applied in the firms in Portugal, the West London and Stuttgart areas.

Figure 3.28. Internet use of companies by region



Surfing, $\chi 2 = 44.7$, df= 7, p= 0.000***
Banking, $\chi 2 = 44.0$, df= 7, p= 0.000***
Paid databases, $\chi 2 = 33.0$, df= 7, p= 0.000***
E-mail, $\chi 2 = 28.1$, df= 7, p= 0.000***
Order with suppliers, $\chi 2 = 3.3$, df= 7, p= 0.855
Telephony, $\chi 2 = 7.4$, df= 7, p= 0.389
Video conferencing, $\chi 2 = 9.9$, df= 7, p= 0.193

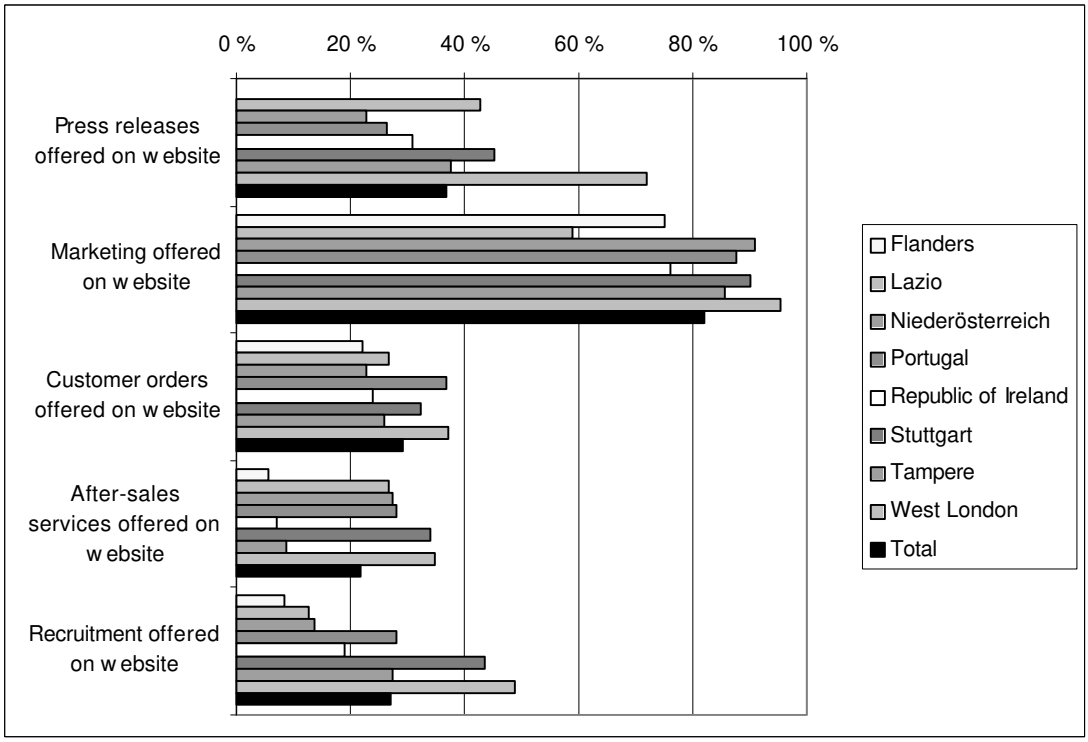
A total of 57% of all firms provide an Internet website. Company websites are quite rare in Niederösterreich, where only a third of the companies have one. Instead, about half of the firms in the West London area, the Republic of Ireland and Flanders, about two thirds of the companies in the Stuttgart area, Lazio and Portugal, and 73% of companies in the Tampere region have their own websites.

Companies mainly provide their websites for marketing (82%) and press release purposes (37%). It is used less for customer orders (29%), recruitment announcements (27%), or after-sales services (22%). The purpose of the website varies significantly by industrial sector and region of company.

As we can see in Figure 3.29., companies in the West London area are the most intensive providers of websites for every purpose mentioned in the questionnaire. Also, the companies in the Stuttgart

area provide more versatile information on their websites than companies in other regions. Press releases are also more often placed on the webpages in Flanders and marketing announcements in Niederösterreich and Portugal. The websites are provided the least in Flanders and the Republic of Ireland.

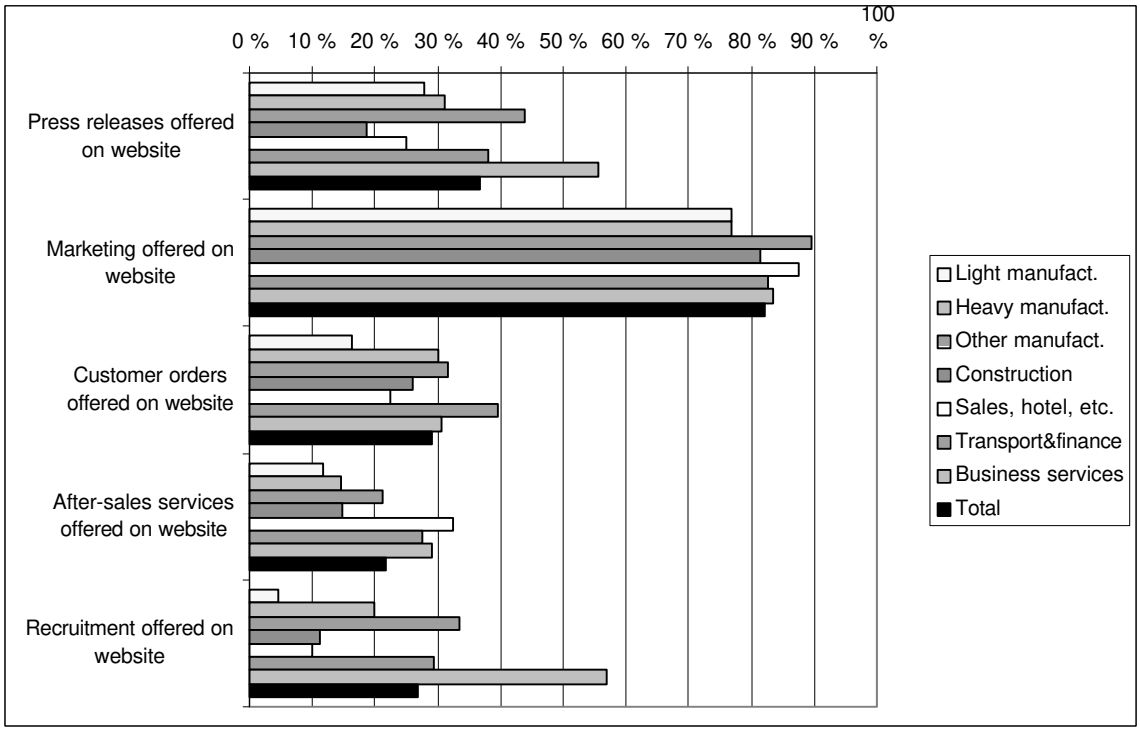
Figure 3.29. Purposes of companies' websites by region



Press releases, $\chi 2 = 59.8$, df= 7, p= 0.000***
Marketing, $\chi 2 = 40.9$, df= 7, p= 0.000***
Customer orders, $\chi 2 = 13.5$, df= 7, p= 0.062
After-sale services, $\chi 2 = 36.0$, df= 7, p= 0.000***
Recruitment, $\chi 2 = 44.5$, df= 7, p= 0.000***

By industrial sectors (Figure 3.30.), press releases are more often offered on the Internet by business services and light manufacturing companies. Marketing is the most common reason for having a website in other manufacturing companies and in the sales, hotel & restaurants sector. The transport & finance sector is the leading provider of customer orders on the Internet, and all the service sectors provide after-sales services on the Internet more than the manufacturing sectors. Companies in the business service sector recruit new employees through the Internet twice as often as companies in other sectors.

Figure 3.30. Purposes of companies' websites by sector



Press releases, $\chi 2 = 30.1$, df= 6, p= 0.000***
Marketing, $\chi 2 = 9.5$, df= 6, p= 0.146
Customer orders, $\chi 2 = 12.6$, df= 6, p= 0.049*
After-sale services, $\chi 2 = 15.0$, df= 6, p= 0.020*
Recruitment, $\chi 2 = 71.0$, df= 6, p= 0.000***

3.1.5 Information and communication systems

So far, we have dealt with the two technology strands of ICT separately. Next, we will analyse ICT systems, integrating both strands. Brousseau and Rallet (1998: 247) have developed a typology of modern ICTs focusing on the co-ordination dimension of organisations. Taking up the distinction between core technologies and integrating technologies, the authors differentiate between computers as information management tools that are in use in companies, and the type of transmission and switching capacities that are used to link these tools. They further divide information management tools, as we did earlier, into terminals and computing systems. The function of the terminals is to code and decode information, they represent interfaces between users and a system (the mainframe) that transmits or processes information. Computing systems, on the other hand, automatically process information.

Concerning the transmission and switching capacities, Brousseau and Rallet distinguish between physical and electronic systems. Characteristic of physical communication is that information has to be materialised on a physical support or embodied in a human being in order to be communicated between two information processing devices. In the case of electronic communication, information is de-materialised, transmitted and managed by a telecommunication system. Based on this differentiation, the authors distinguish between the following three systems: isolated computer systems, telecommunication systems and telematic systems. The following Table 3.4. shows the main characteristics of these three systems.

Table 3.4. ICT typology based on organisational functionalities (Brousseau and Rallet 1998: 247)

Isolated computer system	
information management tools	computing system to automate or support local decision processes
transmission and switching capacities	automated information management tools are not linked by automated and de-materialised communication capacities
consequences	these systems are not used in synergy to support, automate, or integrate decisions on the collective level
Telecommunication systems	
information management tools	only terminals, no computing systems that automatically process information
transmission and switching capacities	communication is automated
consequences	interactions are not bound and structured, content of the message is managed by human beings; the system supports both natural language communication and formal communication; the aim is to accelerate information flows and decrease information costs
Telematic systems	
information management tools	automated information management systems in all parts of an organisation
transmission and switching capacities	integration of information management tools through a telecommunication system that enables automated exchange of information and to process it in synergy, support and automation of co-ordination
consequences	automation of decision-making; process integration at the organisational level; results are communicated to human beings

Telephones, faxes and e-mail systems typically belong to the category of telecommunications systems. As one can assume that all companies have at least telephones, we only asked whether they use e-mails. We therefore differentiated between telecommunication systems using e-mails and those that do not use e-mails. EDI systems are typically telematic systems that are sets of message standards enabling the exchange of commercial transaction data between autonomous application systems without human intervention. In Table 3.5., we can see the communication systems applied in the companies.

Table 3.5. Communication technology

	Frequency	Percentage	Cumulative percentage
telecommunication without e-mail	182	23	23
telecommunication including e-mail	312	39	62
telematics (EDI)*	306	38	100

* This does not exclude the use of telecommunication systems. In fact, only 12% of the companies applying a telematic system in the data do not have an e-mail system.

We can now bring the two dimensions of ICT systems together. Table 3.6. presents the distribution of different ICT systems.

Table 3.6. ICT systems

Computer technology	Telecommunication without e-mail	Telecommunication including e-mail	Telematics (EDI)	Total
PC with no connection	50	(3)		53 (7%)
Mainframe with terminals - local	13	1		14 (2%)
LAN - local	56	11	3	70 (9%)
Subtotal A: Computer technology with no connectivity	119	15	3	137 (18%)
PC connected between establishment	1	2		3 (0%)
Mainframe with terminals Connected between establishment	3	5	3	11 (1%)
LAN connected between establishment	10	31	18	59 (8%)
Subtotal B: Computer technology with internal connectivity only	14	38	21	73 (9%)
Subtotal A + B: Computer technology with no external connectivity	133	53	24	210 (27%)
PC with external connectivity	3	23	14	40 (5%)
Mainframe with terminals externally connected	13	14	24	51 (7%)
LAN with external connectivity	28	215	236	479 (61%)
Subtotal C: Computer technology with external connectivity	44	252	274	570 (73%)
Total	177	305	298	780 (100%)

About three out of four companies are externally connected. Nearly half of them have an EDI system, which means that information exchange takes place without human interference. The other companies have telecommunications systems in which people are still involved in the interpretation of messages. A total of 27% of all ICT systems can be characterised as isolated systems if the

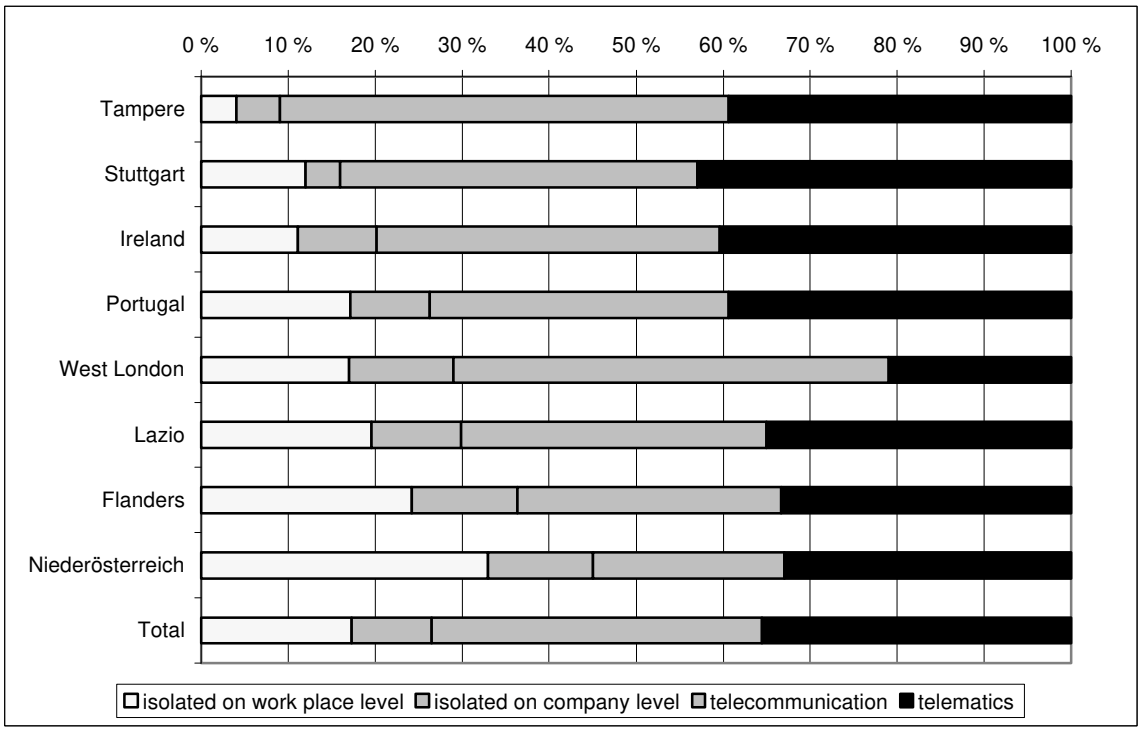
company as a whole is chosen as a reference point. If we go down to the individual workplace, only 18% of all ICT systems can be characterised as isolated computer systems (Table 3.7.).

Table 3.7. Type of ICT system

	Percentage
Isolated ICT system on the work place level	18%
Isolated ICT system on the company level	9%
Telecommunication system	32%
Telematic system	35%

Do regions differ concerning the type of ICT system applied in companies? Figure 3.31. gives an overview:

Figure 3.31. ICT systems by region



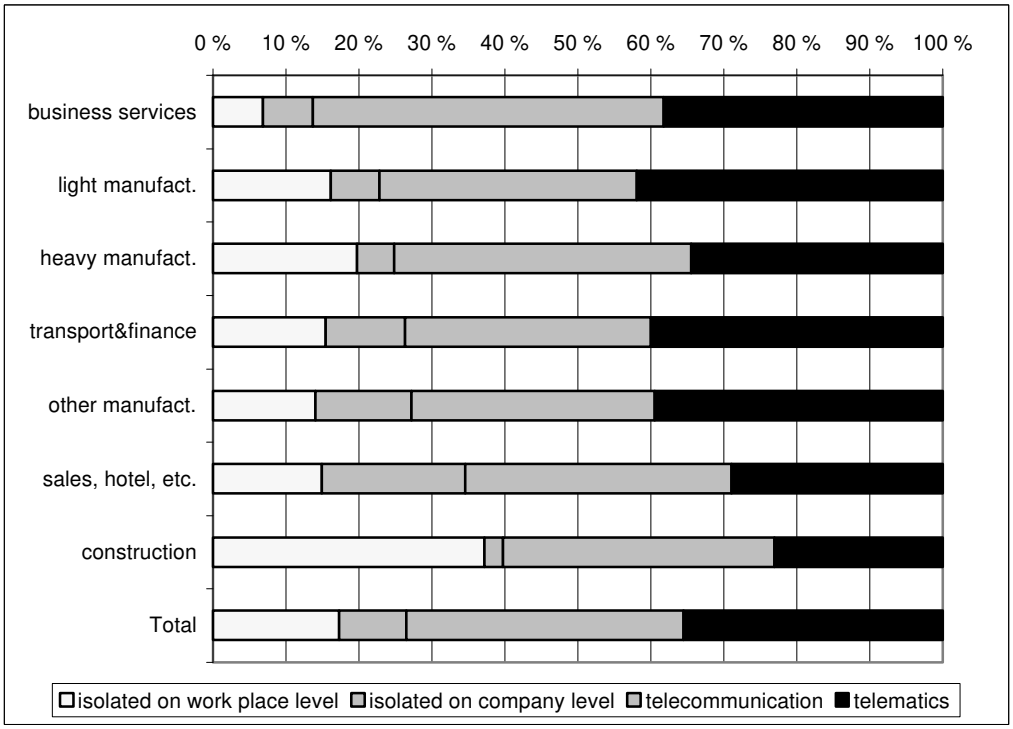
$\chi 2 = 65.8$, df= 21, p= 0.000***

As we can see in Figure 3.32., there are only few companies in the Tampere region (4%) and in the Stuttgart area (12%) that have applied only isolated computer systems with no technical connection either within the company or with the outside world. In Niederösterreich, on the other hand, we can find the biggest share of companies with no technical connection to the outside world

(33%). Telecommunication systems are the most often applied ones in the Tampere region (52%) and in the West London area (50%), and telematic systems are widespread in the Stuttgart area (44%) and in the Republic of Ireland (40%).

Isolated ICT systems are the most common in construction industry (40%) as well as in the sales, hotel & restaurant sector (35%). The technology can hardly be found in the business service sector. Instead, nearly half of the business service companies apply telecommunication systems. They are also often used in heavy manufacturing (41%). Telematic systems are the most common in light manufacturing (42%) and in transport & finance sector (40%).

Figure 3.32. ICT systems by sectors



$\chi 2 = 61.3$, df= 3, p= 0.000***

Looking at firm size, the results are the expected. Small companies have applied more isolated systems (30%) and telecommunication systems (39%), whereas in larger companies telematic systems are more widespread (40%). Concerning the location of the company, the most striking but also expected result is that telecommunication can be found less often in rural areas (30%) than in urban (38%) and mixed areas (41%). Also, hardly surprising is that the ICT systems of fully independent companies are more often isolated on the workplace level. Telecommunication

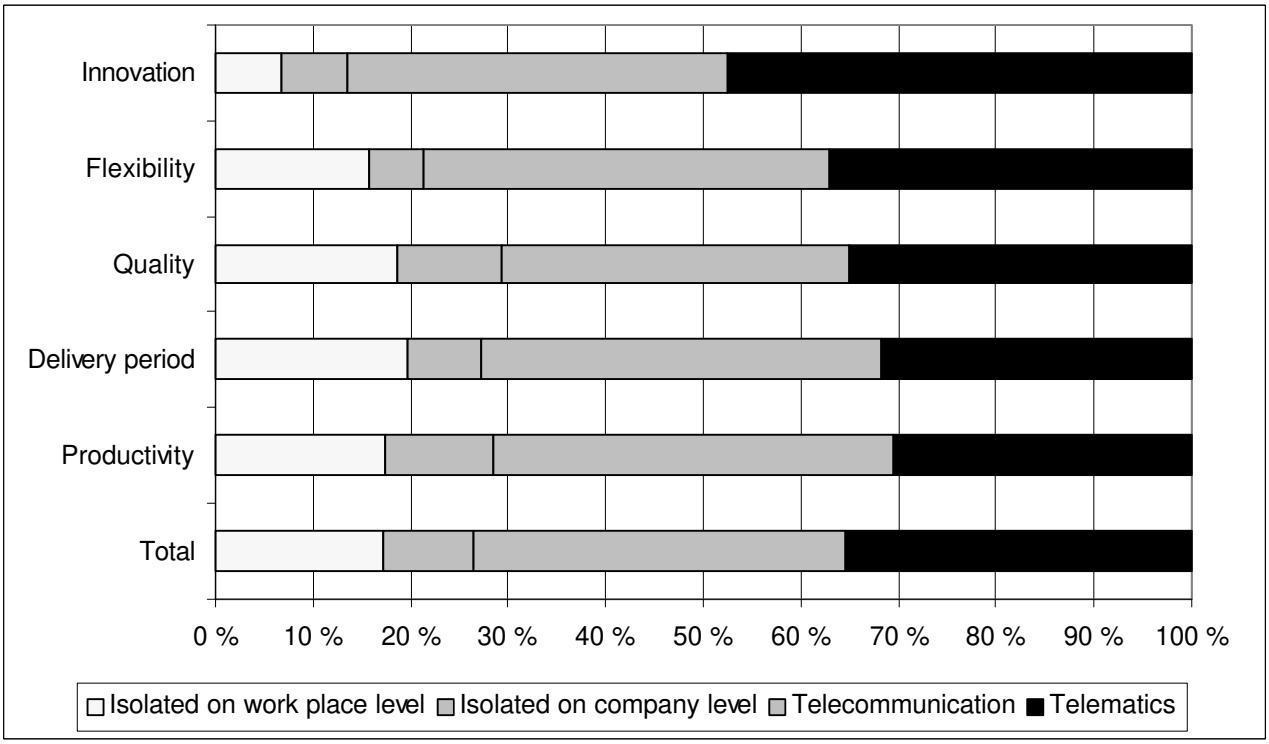
systems, on the other hand, are applied most often in parent companies (51%) and branch establishments (44%), whereas telematic systems are the most common in independent companies in a group (43%).

The results concerning the type of products or services are more or less expected. Telecommunication is the most widespread ICT system in companies producing products specified by the customer (41%). Somewhat surprising is that telecommunication is also dominating in companies with standardised products (41%) but, still, in a third of these companies, the ICT system is isolated either on the workplace or on the company level. In the companies producing variants, telematic systems are the most often applied ICT systems (46%).

Results concerning the market position are in line with our expectations. The isolated ICT system on the workplace level is the most common in companies that operate only on the regional market (51%), while in the companies operating on the international market these systems can hardly be found (11%). The telecommunication systems (41%) and telematic systems (39%) are applied extensively in the nationally (35% and 34%) and especially in the internationally operating companies (41% and 39%).

Figure 3.33. gives an overview of the relationships between companies' most important achieving criteria and the type of ICT system applied. The most striking result here is that companies striving for innovation hardly have isolated ICT systems in use. In general, they are connected with the outside world mainly through telematic systems (48%).

Figure 3.33. ICT systems according to company's most important achieving criterion



$\chi 2 = 13.2$, df= 12, p= 0.353

3.1.6 Intensity and modernity of ICT use

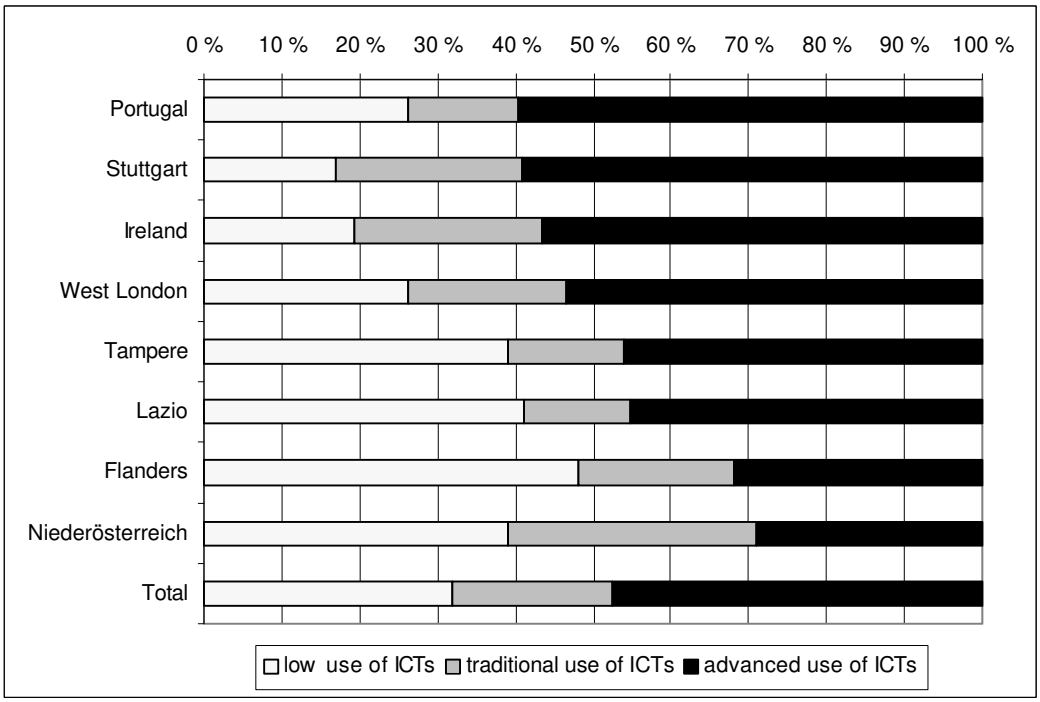
We also analysed the intensity and modernity of ICT use. Based on a cluster analysis[6], we differentiated between the following dimensions: "low use of ICTs", "traditional use of ICTs" and "advanced use of ICTs". Traditional use of ICTs is characterised by high office automation and high production automation, while automation of communication is low. Advanced use of ICTs includes also high automation of communication.

About a third of all companies in the overall sample make little use of ICTs. Approximately 50% of companies use modern ICTs in an advanced way, while 1/5 of all companies uses ICTs mainly for office, and if applicable, for production automation.

[6] The first cluster had a negative score on the three ICT variables used in the analysis, namely the usage of ICTs in office tasks, production, and communication. This cluster is called 'low use of ICTs'. The second cluster had a negative score in communication, but a positive one in office tasks and in production ('traditional use of ICTs'). The third cluster had high scores on all the three ICT variables ('advanced use of ICTs').

As Figure 3.34. points out, about 50% of all companies make little use of modern ICTs in Flanders. Also, in Lazio, Niederösterreich, and in the Tampere region the share of companies that do not use ICTs extensively is fairly large (about 40%). Advanced use of modern ICTs is dominating among companies in Portugal, the Stuttgart area, the Republic of Ireland, and the West London area. Here more than 50% of all companies use not only automated office and production tasks but also communication tasks extensively. Advanced use of modern ICTs ranks lowest among companies in Flanders and Niederösterreich. At the same time, however, traditional use of ICTs is ranks highest in Niederösterreich.

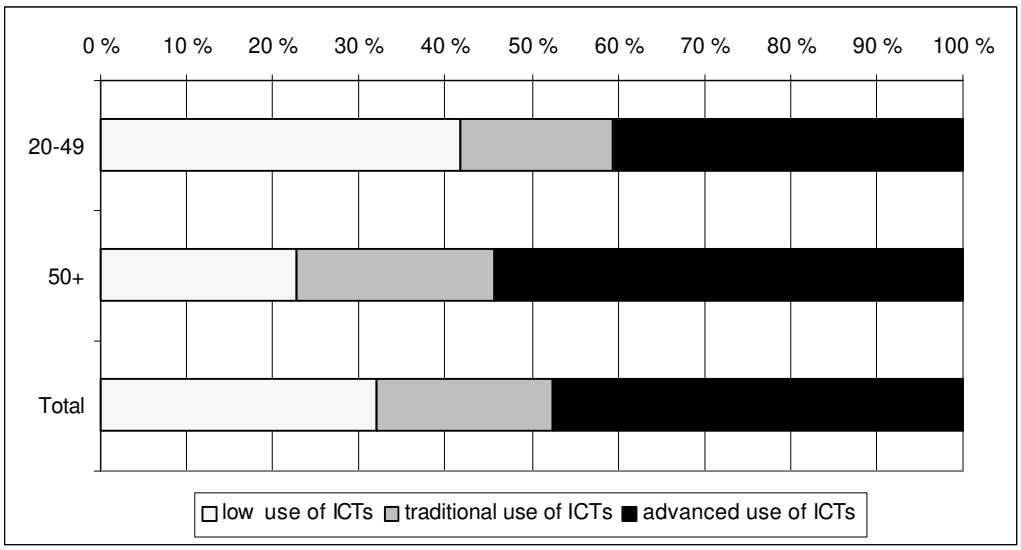
Figure 3.34. Intensity and modernity of ICT use by region



$\chi 2 = 62.1$, df= 14, p= 0.000***

Concerning firm size, the results are as expected (Figure 3.35.). The share of small companies making only little use of modern ICTs is nearly twice as great as that of larger companies. On the other hand, a significantly greater number of larger companies (54%) than smaller companies (41%) make advanced use of ICTs.

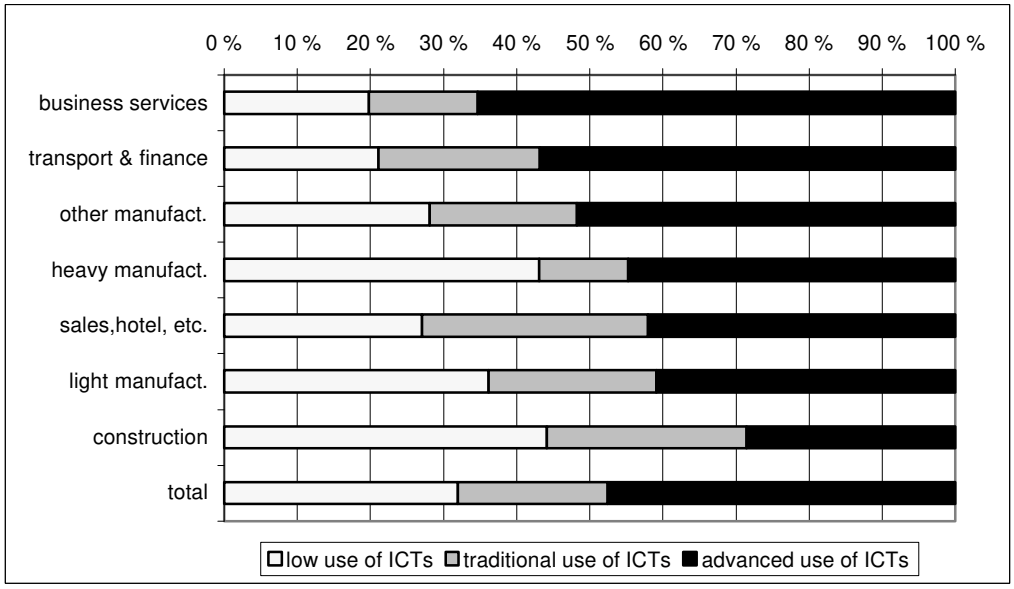
Figure 3.35. Intensity and modernity of ICT use by company size



$\chi 2 = 33.2$, df= 2, p= 0.000***

Differences among sectors are significant as well (Figure 3.36.). In heavy manufacturing and construction, more than 40% of all companies make little use of modern ICTs. On the other hand, the same share for the transport & finance sector and for business services is only half as big (about 20%). Advanced use of modern ICTs is the highest among companies in business services; here two out of three companies belong to this category. Also, in the group of other manufacturing industries and in the transport & finance sector, more than 50% of all companies use modern ICTs in a more advanced way. Traditional use of ICTs is the most widespread among companies in the sales & hotel industry.

Figure 3.36. Intensity and modernity of ICT use by industrial sector



$\chi 2 = 53.6$, df= 12, p= 0.000***

3.1.7 A functional perspective

The functional perspective on modern ICTs was discussed in the first interim report. The following table comprises the various functions of modern ICTs in a schematic way and displays the aim related to single functions.

Table 3.8. Alternative perspectives on information and communication technology

Metaphor	Function	Aim
ICTs as a tool	support of workers in the work process	increase quality and rapidity, improve capability to cope with complexity
automation technology	elimination of human labour	costs saving
control device	monitoring and steering the work process, controlling the production environment	avoid technical defects and the interruption of the production process, avoid environmental damages
feedback mechanism	support adaptation and learning processes	innovation
organisation technology	integration of tasks, functions and processes	organisational flexibility, decentralisation of decision-making
medium, network technology	creation of technical connections among people and with machines	rapid exchange of information and knowledge

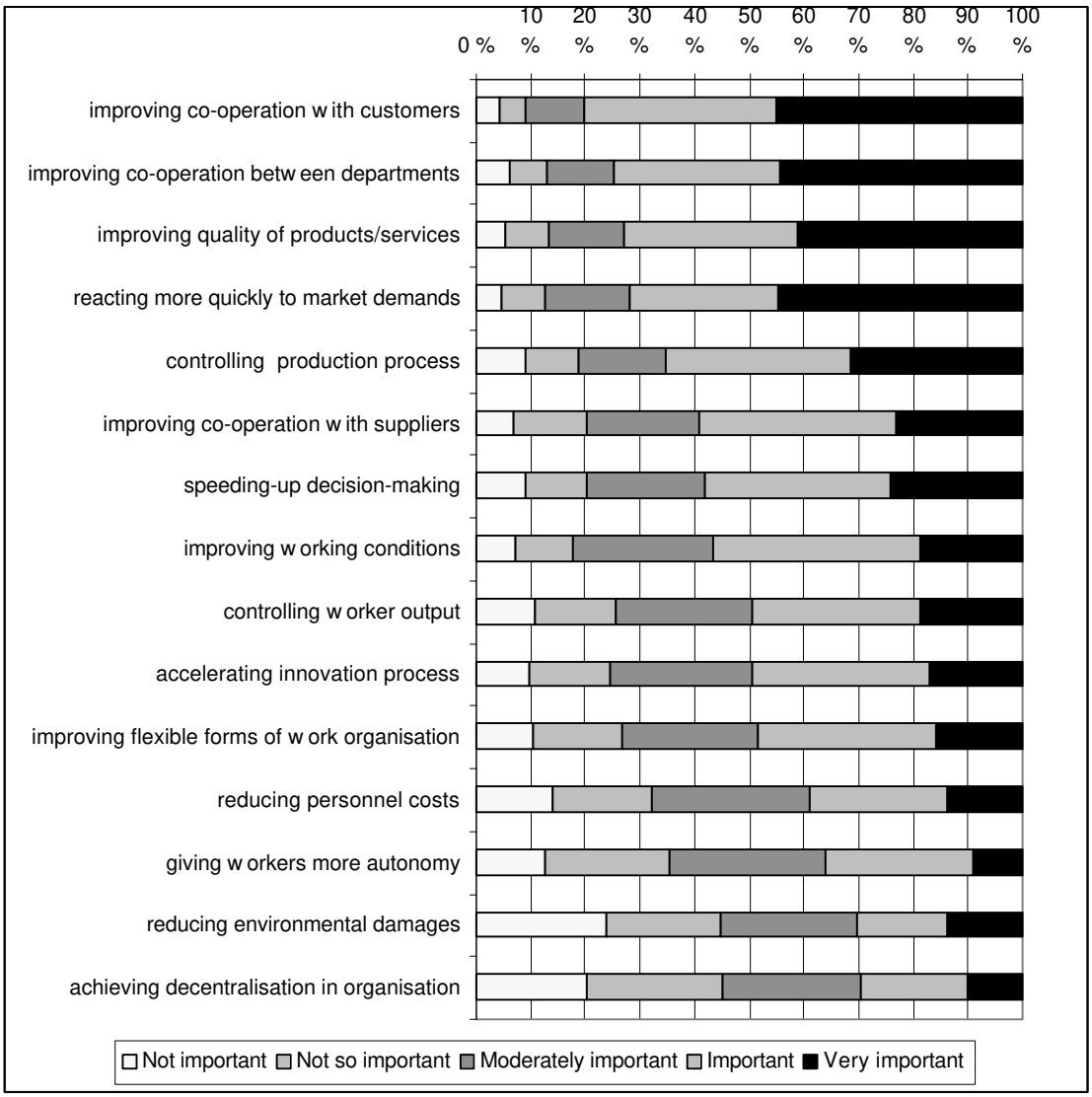
In the questionnaire, the respondents were asked to assess how important the 15 different functions in introducing ICTs in the company were. According to the ICT metaphor, the functions were the following:

Table 3.9. ICT metaphors and functions

Metaphor	Expressed functions in the questionnaire
ICTs as a tool	improving quality of products/services
	speeding-up decision-making
Automation technology	reducing personnel costs
Control device	controlling production process
	controlling worker output
	reducing environmental damages
Feedback mechanism	accelerating innovation process
	reacting more quickly to market demands
Organisation technology	achieving decentralisation in organisation
	improving flexible forms of work organisation
	giving workers more autonomy
	improving working conditions
Network technology	improving co-operation with customers
	improving co-operation between departments
	improving co-operation with suppliers

Figure 3.37. shows the importance of ICT functions in the implementation of ICTs in general. Companies in the data mostly aim to use ICTs as network technology, especially to improve co-operation with customers and departments. It also seems important to them to use ICTs as a tool to improve the quality of products or services and to react more quickly to the market demands. Achieving decentralisation or reducing environmental damages by introducing ICTs in the companies seem to be considered the least important functions.

Figure 3.37. Importance of ICT functions in implementation of ICTs



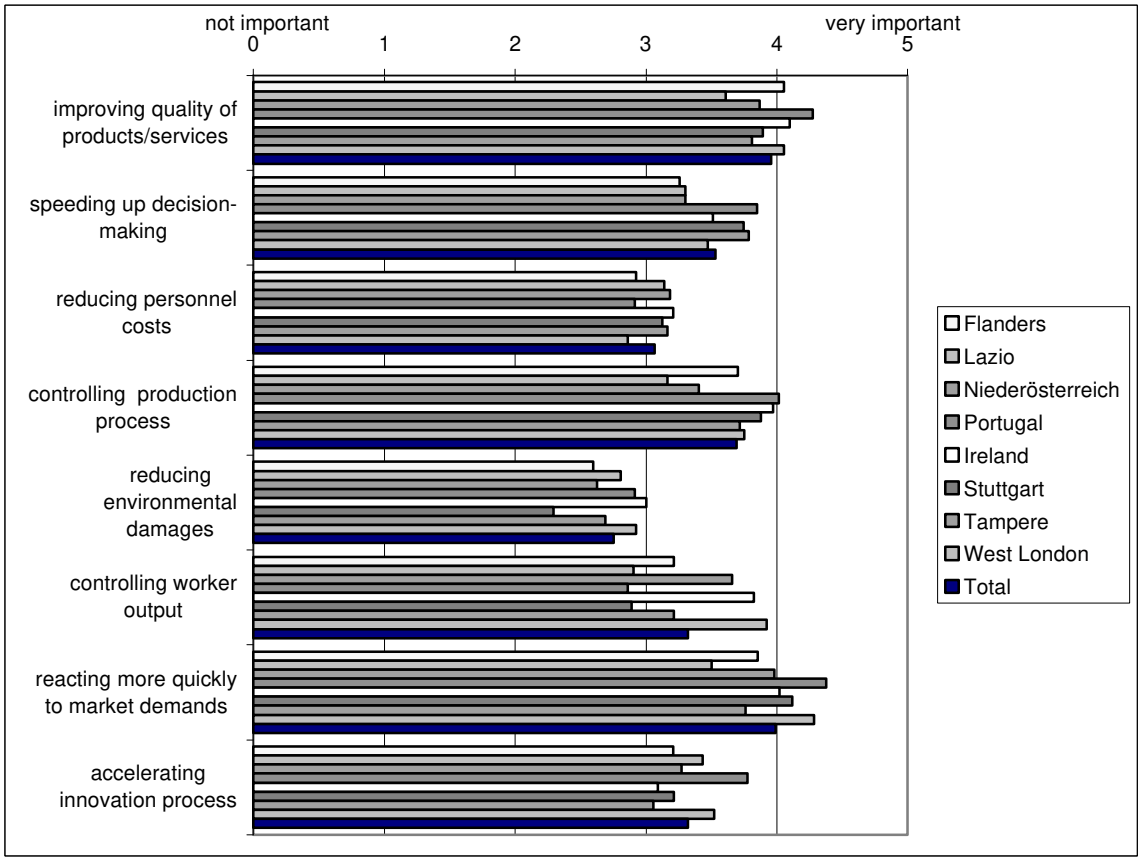
The following figures present the mean[7] of the importance of different functions by region and industrial sector. The functions are divided into two parts by region (Figures 3.38. and 3.39.) and sector (Figures 3.40. and 3.41.). In Figures 3.38. and 3.40., the functions of ICT as a tool, automation technology, control device and feedback mechanism are presented. Figures 3.39. and 3.41. show the functions of organisation and network technology. In Portugal, the companies seem to regard most of the different functions as important more often than in other regions. Companies in Flanders and the Republic of Ireland also use ICTs as a tool to improve the quality of their products or services more often than other companies elsewhere. Speeding up the decision-making

[7] The values of these function variables were 1= "not important", 2= "not so important", 3= "moderately important," 4= "important", 5= "very important".

is an important aim in the Tampere region and the Stuttgart area. The regions differ only very little in using ICTs as automation technology.

Companies in the Republic of Ireland regard ICTs as an important control device more often than those in other regions. It is more common for companies to control their workers' output in using ICTs in the West London area, where accelerating the innovation process is also an important ICT function. Along with the Portuguese companies, the firms in the Tampere region and in the West London area use ICTs to introduce organisational flexibility and decentralisation quite often. ICTs' function as a network technology is valued the most in the Tampere region and the Stuttgart area.

Figure 3.38. Importance of ICT functions: as a tool/automation technology/control device/feedback mechanism by region



Manufacturing companies seem to use ICTs more often as automation technology or as a control device than service sector companies. The other functions are more important for the service sector, especially their organisation and networking aspects.

Importance of ICT functions does not vary much by company size. Large companies consider ICTs as a technology to improve co-operation between company departments and to achieve decentralisation in the organisation more often than small firms.

Figure 3.39. Importance of ICT functions: as organisation/network technology by region

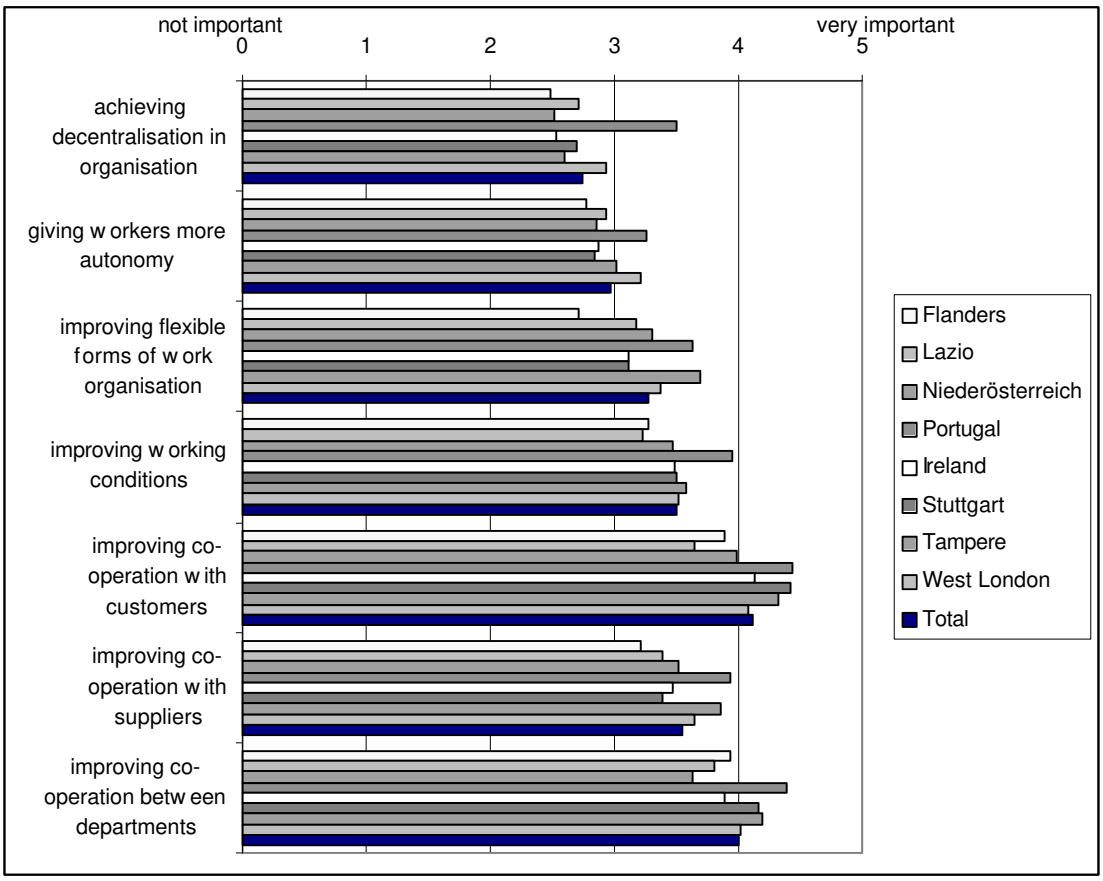


Figure 3.40. Importance of ICT functions: as a tool/automation technology/control device/feedback mechanism by sector

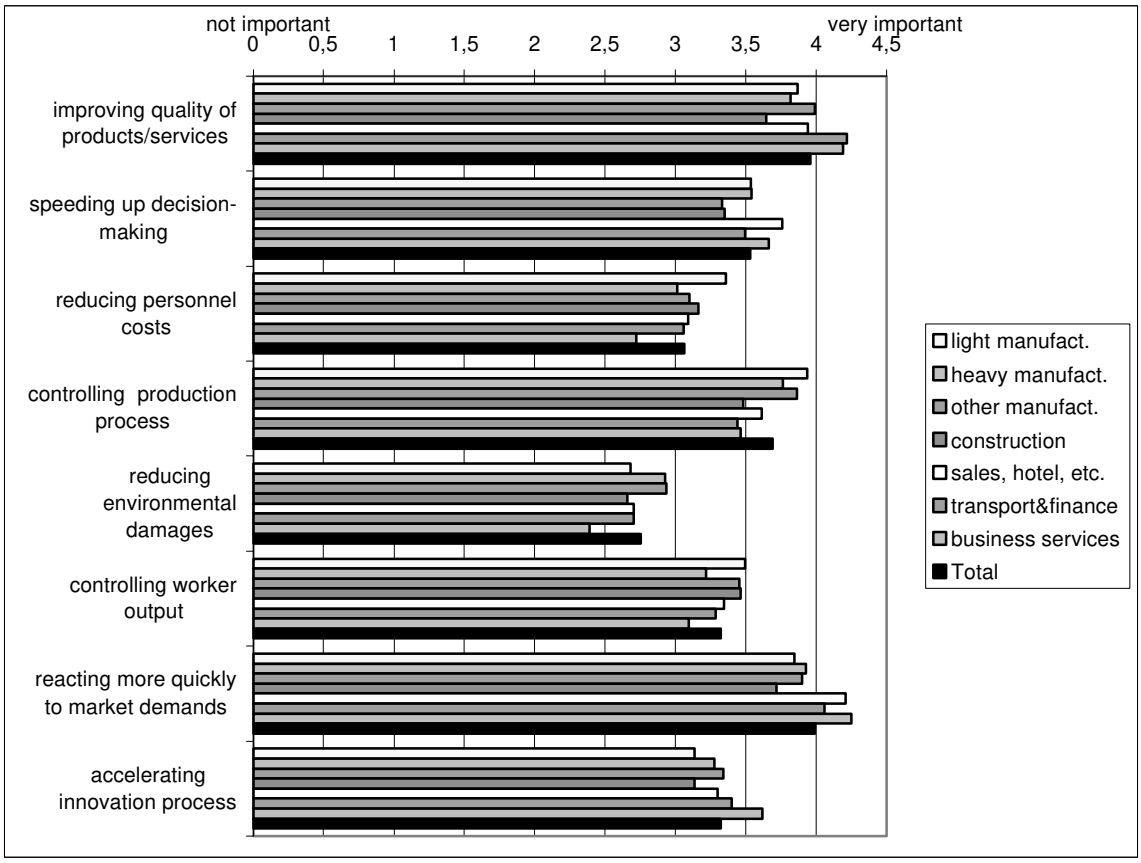
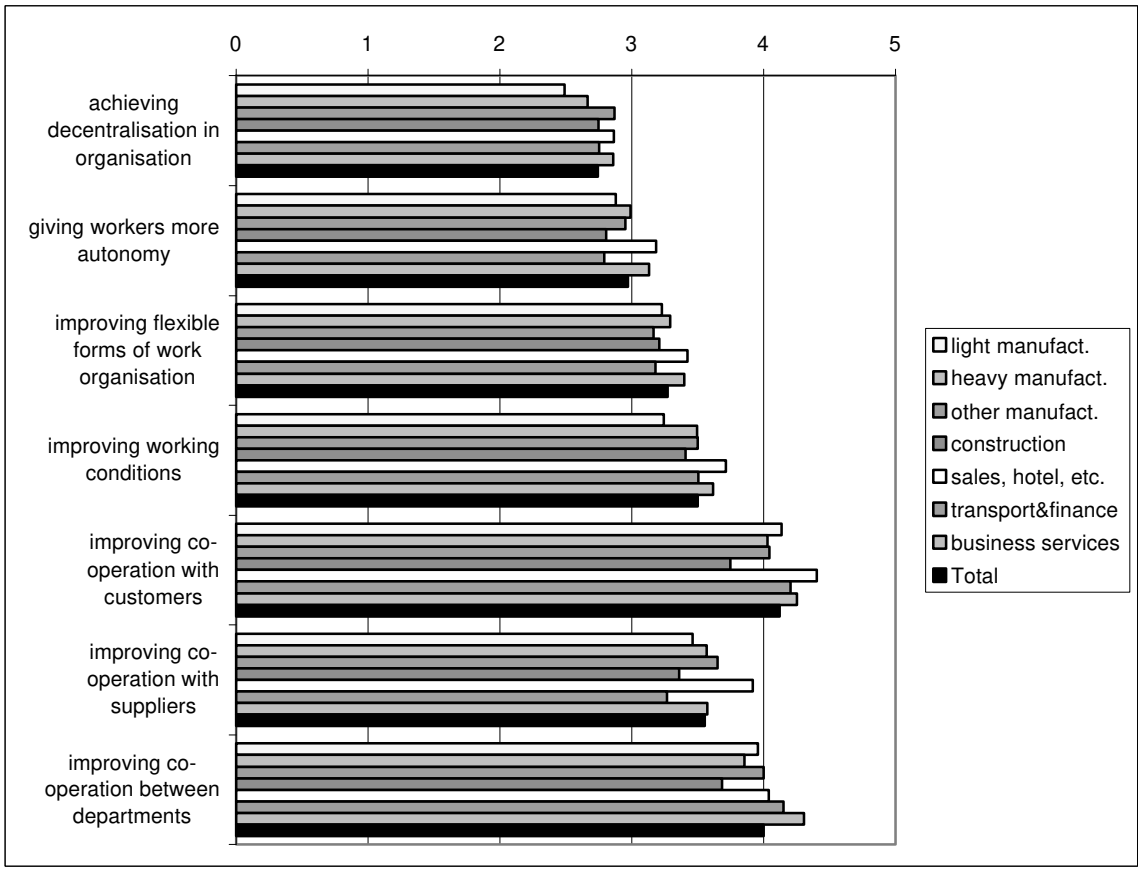


Figure 3.41. Importance of ICT functions: as organisation/network technology by sector



Based on a cluster analysis[8], we differentiated between the two main functions of modern ICTs: "the control function" (Table 3.10.), on the one hand, and the "co-ordination and communication function" (Table 3.11.) on the other. We than analysed in what way the intensity and modernity of ICT use and the function they are used for are related. Considering the importance of ICTs as a control device, the three user groups do not differ from each other very much. Instead, the co-ordination and communication function of modern ICTs is far more important among advanced users than among low users, with traditional users of ICTs being somewhere in the middle.

[8] This analysis revealed two underlying factors explaining more than half of total variance. One factor contains the items 'controlling worker output', 'reducing personnel costs' and 'controlling production process'. It obviously means that ICTs are used as a 'control device'. The other combines the other aims, and refers to more active and modern use of ICTs (e.g., decentralisation, speeding up innovation process, autonomy). This factor is called 'co-ordination and communication device'.

Table 3.10. Control function and intensity and modernity of ICT use

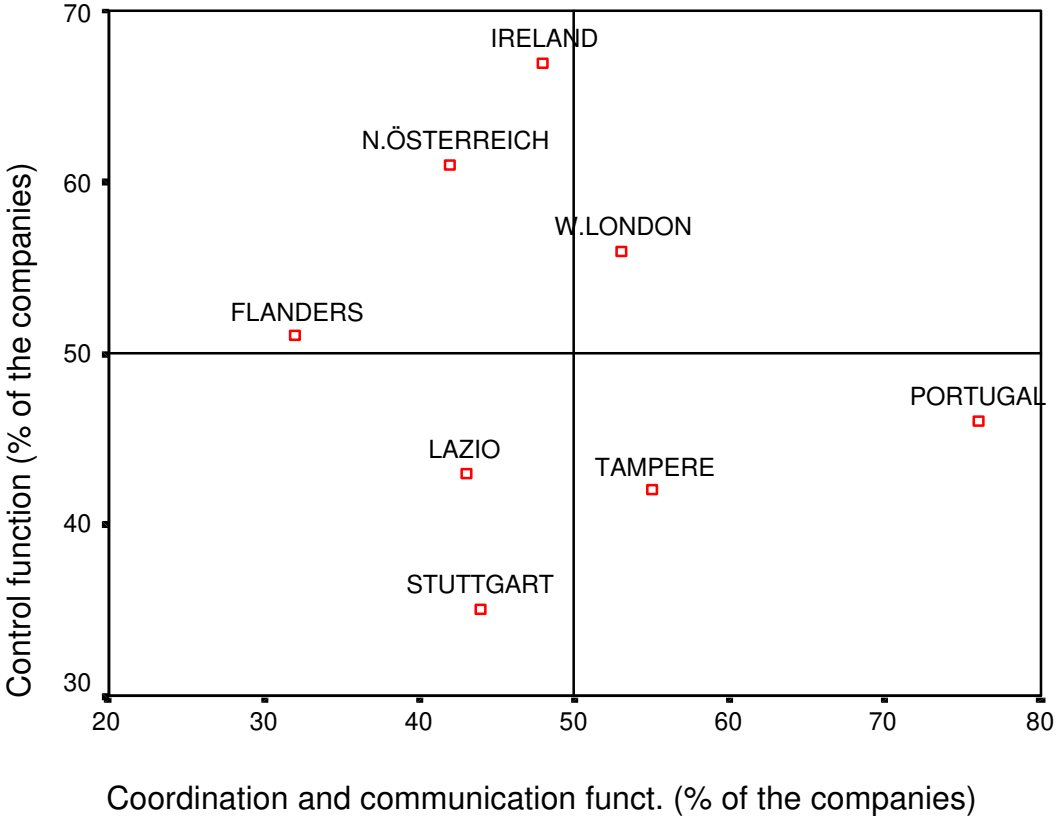
	Low importance of function	High importance of function	Total
Low use of ICTs	70 48%	76 52%	146 100%
Traditional use of ICTs	35 44%	45 56%	80 100%
Advanced use of ICTs	139 53%	124 47%	263 100%
Total	244 50%	245 50%	489 100%

Table 3.11. Co-ordination and communication function and intensity and modernity of ICT use

	Low importance of function	High importance of function	Total
Low use of ICTs	94 64%	52 36%	146 100%
Traditional use of ICTs	44 55%	36 45%	80 100%
Advanced use of ICTs	106 40%	157 60%	263 100%
Total	244 50%	245 50%	489 100%

The functions do not vary significantly by company size or sector, but regional differences do exist. Figure 3.42. presents the share of companies in different regions considering both of these functions as highly important. The regions can be summed up in four different categories. First, there are the Stuttgart area and Lazio, in which companies do not regard either of these functions as important, compared to companies in other regions. In the Republic of Ireland, Niederösterreich and Flanders, over half of the companies regard only the control function as important. The majority of companies in Portugal and the Tampere region, on the other hand, see only the co-ordination and communication function as important, whereas in the West London area both functions are equally considered important.

Figure 3.42. High importance of co-ordination and communication function and control function by region



Concerning the company ICT systems and their main function, the cluster analyses revealed some distinctive trends. The more isolated the ICT system is, the more the company aims to reduce personnel costs, control the output of the workers, and avoid environmental damages. Instead, the more advanced an ICT system, the more the companies try to speed up their decision-making, make their organisations more flexible, and improve networking with the implementation of the ICTs.

3.1.8 Summary of the regional differences in ICT application

In Tables 1-3 of Appendix 3, regional profiles are presented referring to the key aspects of ICT applications. The factors that show major regional differences are taken into account. The marks on the tables display the regional difference from the average value in each factor. One plus means that the regional value is at least five percent higher than the average and two plusses that the value

is at least ten percent higher. Similarly, the minuses indicate that the value is lower than the average. Two dots (..) mean that the factor does not occur at all in the region.

It seems that Flanders, Lazio and Niederösterreich can be seen as less developed in the application of ICTs than other regions. For example, in Flanders, the companies rely more than in any other region on one computer system, which is relatively often the stand-alone PC. The companies have less external data communication and automation in production, and they apply communication technology less than companies on average do. Companies in Lazio and Niederösterreich are similar to those in Flanders.

Neither the co-ordination and communication function nor control function seems to be an important motive for applying modern ICT s in companies in the Stuttgart area and Lazio (see Figure 3.42. above). Instead, in the Republic of Ireland, Flanders and Niederösterreich companies use ICTs as a control device.

Companies in Portugal and the Stuttgart area can be characterised as heavy users of automation, especially in production. In addition to this, telematic ICT systems are more often applied in the Stuttgart area than in any other region. The Republic of Ireland, the Tampere region and the West London area are the most advanced in using communication technology. Companies in the Tampere region and the West London area use telecommunication systems most often. The majority of companies in all of the three regions give high priority to co-ordination and communication function.

3.2. The organisational dimension

After having discussed the technological dimension of technological practices, we will now turn to the organisational dimension. Here we focus on the question of whether there have been organisational changes in the company during the past five years (1994-1999).

3.2.1 Some general trends

Tables 4-6 in Appendix 3 contain an overview of organisational changes by region, sector and size. Slightly more than 75% of all companies that have taken part in the research project have

undergone organisational changes during the period 1994 - 1999. In more than half of all cases in which restructuring has taken place, modern ICTs were seen as playing an important role either as a driving factor or as a facilitating factor.

The share of modernising companies is the greatest in Portugal (83%), the Stuttgart area (85%) and the Tampere region (83%), while the share of companies that have not undertaken any organisational restructuring processes is particularly great in the West London area (32%). Among the companies that have introduced new organisation forms, those from the Republic of Ireland (72%), Portugal (68%) and Niederösterreich (67%) see modern ICTs most often as an important supporting or stimulating factor. On the other hand, less than 50% of all modernising companies in Flanders (35%) and in the Tampere region (43%) mention modern ICTs as important enabling or facilitating the process of organisational change.

More than 40% of all companies have not introduced any of the strategic elements of organisational restructuring listed in the questionnaire. Group work and teamwork, subcontracting or geographical relocation, strategic alliances downsizing or splitting of the company, and profit or cost centres were slightly more introduced (between 30% and 40%) than flatter hierarchies or subcontracting networks (less than 30%). Modern ICTs seem to be more or less equally important for all elements of organisational restructuring.

Companies in the Tampere region are leading in introducing group or teamwork (60%) and flatter hierarchies (46%). It is interesting to mention that particularly for the introduction of group and teamwork, modern ICTs seem to be less important as a supporting or facilitating factor in this region. Companies in Lazio have also undergone a shift towards group and teamwork, and they are ahead concerning the introduction of profit centres. The share of companies having introduced group work and the profit or cost centre model is the smallest in Niederösterreich.

In Portugal, the share of companies that have been downsized or split is surprisingly large. While in all other regions only about 1/3 of all companies have applied the strategy of becoming leaner, in the case of Portugal the share is over 75%. These changes were also more common in the Stuttgart area than in the rest of the regions. Subcontracting or geographic re-localisation and strategic alliances with other companies were the most commonly used by companies in the Stuttgart and

the West London areas. Instead, companies in the Republic of Ireland and in the Tampere region had established subcontracting networks in more numerous cases than in other regions.

In all industries, more than 60% of all companies have introduced organisational changes during the past five years. Companies in business services, in the transport & finance sector and in other manufacturing are more advanced in introducing organisational innovations (over 80% of the companies), whereas companies in the sales and hotel sector and in the construction industry are less innovative in this respect (less than 70%). Particularly, companies in the service sectors regard modern ICTs as an important stimulating or enabling factor for organisational changes.

Business service companies are among the top introducers of all kinds of organisational changes, except for flatter hierarchies. Group or teamwork, downsizing or splitting the company, and subcontracting or geographic relocalisation are also common to companies in the light and other manufacturing sectors (over 40% of the companies). Strategic alliances with other companies are established more often in the transport & finance sector.

Not surprisingly, larger companies are more involved in organisational restructuring processes than smaller ones. However, this result needs to be commented on. It is very likely that, in smaller companies with less formal organisational rules, restructuring seldom gets an official status. Group work or teamwork may be practised naturally in small companies and flat hierarchies also seem to be a natural element in small companies. Therefore, small companies may report organisational changes less often. Also, not surprisingly, larger companies regard the introduction of modern ICTs more often as an important factor that facilitates organisational restructuring processes.

We also investigated whether organisational restructuring cumulates in certain companies (Table 3.12.). In 60% of all companies, more than one organisational change has taken place, and more than three changes had occurred in about a quarter of all companies.

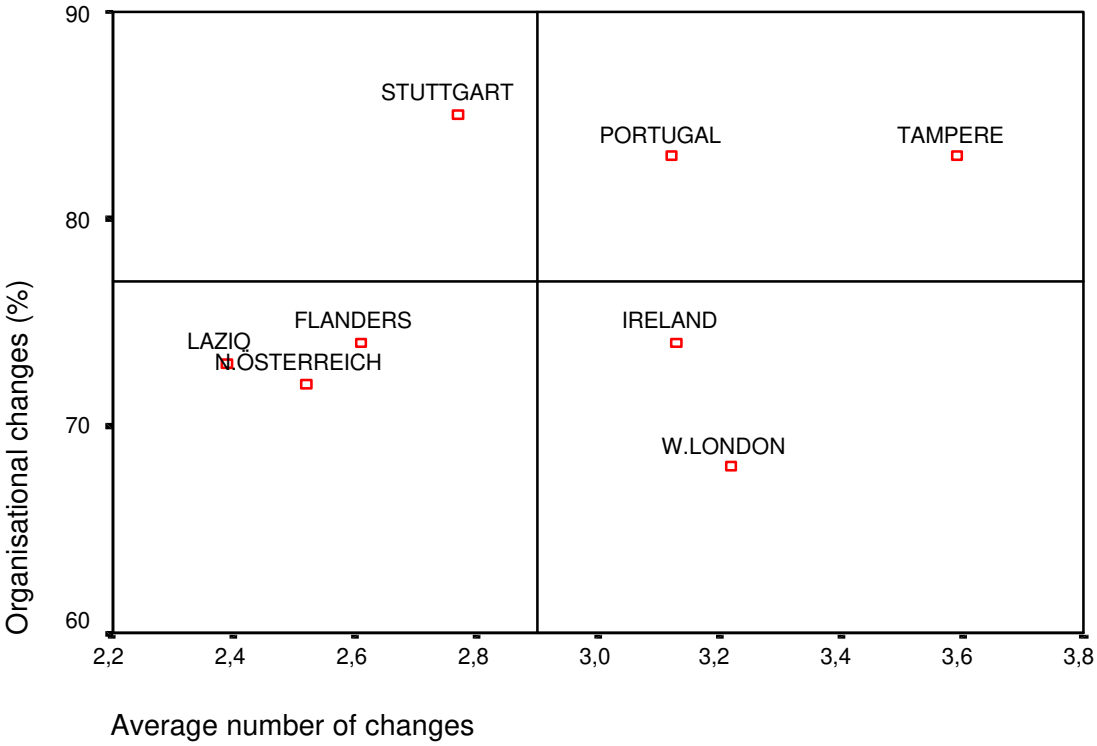
Table 3.12. Number of organisational changes

	Percentage	Cumulative percentage
No changes	22%	22%
1 change	18%	40%
2 changes	18%	58%
3 changes	18%	76%
4+ changes	24%	100%

On average, the number of organisational changes was 2,9 in the companies having restructured their organisation. In larger companies, there had been slightly more changes than in companies with fewer than 50 employees. According to industrial sectors, there was little variation, except that companies in the construction industry had experienced fewer and business service sector companies more numerous changes. But the number of organisational changes in the restructured companies differed a lot regionally.

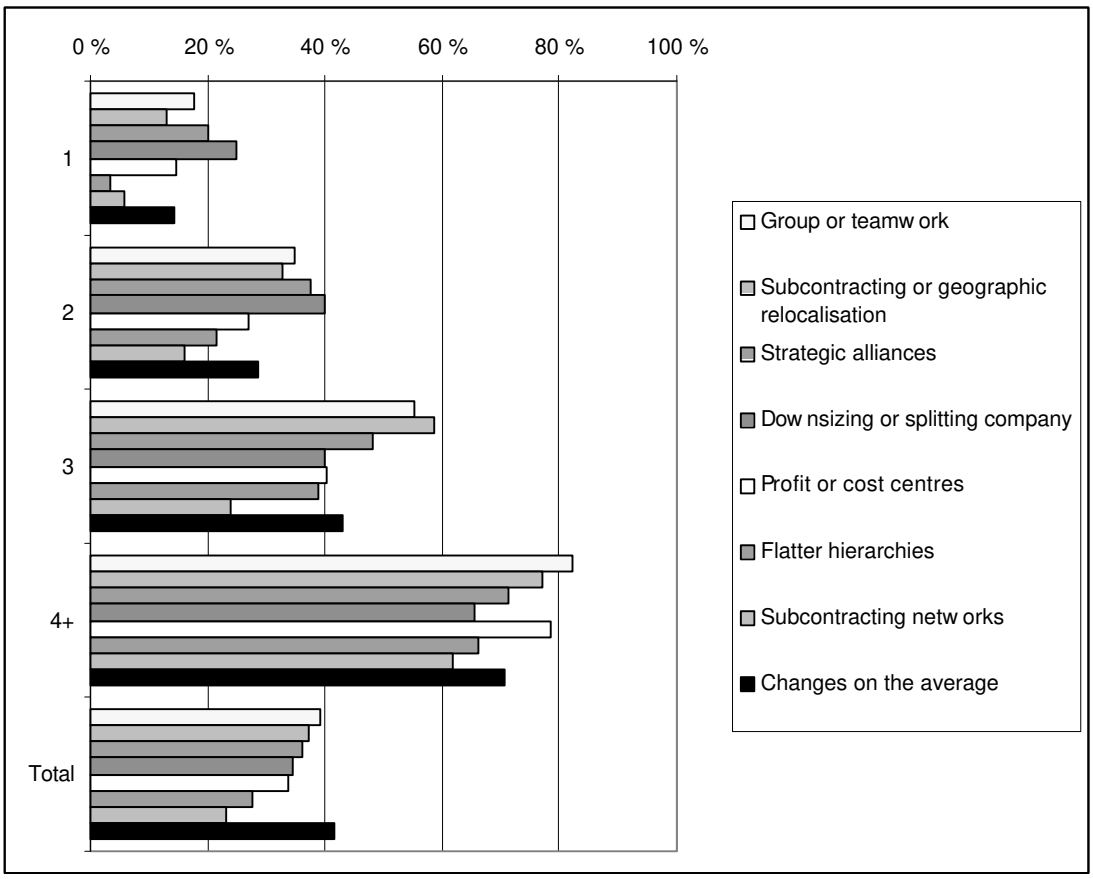
In Lazio, Niederösterreich and Flanders, there were fewer companies conducting organisational restructuring and the number of changes in the restructuring companies was smaller than in other regions (Figure 3.43.). In the Republic of Ireland and the West London area, instead, the restructured companies had undergone several changes simultaneously. Over 80% of the companies in the Stuttgart area, Portugal, and the Tampere region had introduced organisational changes, but, in addition to this, companies in Portugal, and especially companies in the Tampere region had restructured their organisations more extensively.

Figure 3.43. Share of organisational restructured companies and average number of organisational changes by region



We also analysed whether the number of the organisational changes had an influence on the types of changes (Figure 3.44.). If the company had faced less than three organisational changes, the changes typically concerned downsizing or splitting the company and establishing strategic alliances. Along with more numerous changes, the introduction of group or teamwork became more common as well as the establishment of profit or cost centres.

Figure 3.44. Introduction of different organisational changes by number of changes in company



3.2.2 Internal and external organisational changes

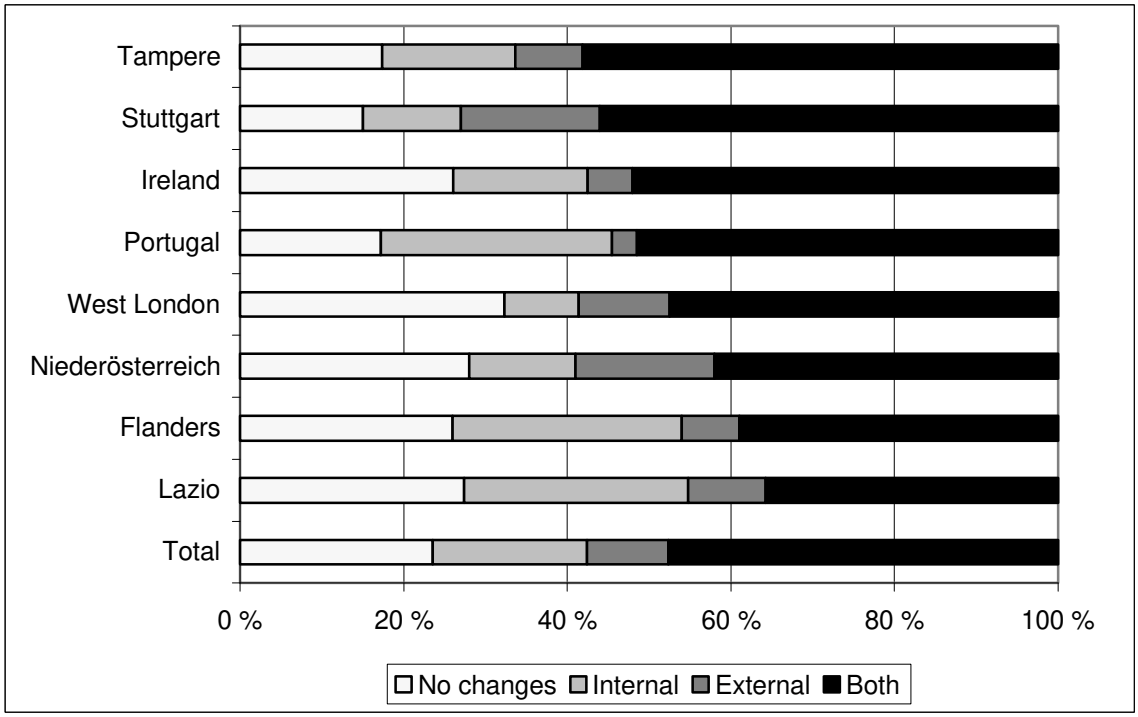
Furthermore, we differentiated between internal and external organisational changes. Group work or teamwork, cost centres, company splitting, and flatter hierarchies were subsumed under internal changes, whereas external changes include subcontracting or geographical relocalisation, strategic alliances, and subcontracting networks.

The most common pattern of organisational change is the concurrent restructuring of the internal organisation and the external co-operation forms, which supports our argument of cumulative forms of organisational restructuring. Close to 60% of all companies in the Stuttgart area and in the Tampere region have changed internally and externally concurrently (Figure 3.45.). This share is the smallest in Lazio, where about 35% of all companies have been engaged in both internal and external restructuring processes.

If we take both restructuring strategies separately, we can draw the conclusion that companies focus more on internal than external changes. Companies in the Stuttgart area and in Niederösterreich seem to represent an exception from this general trend, as they are slightly more inclined in external restructuring processes. Companies in Flanders, Lazio and Portugal have had more changes in only internal restructuring than other regions. Modern ICTs seem to be as important for the restructuring of the internal organisation as for changes in the co-operation forms with external organisations.

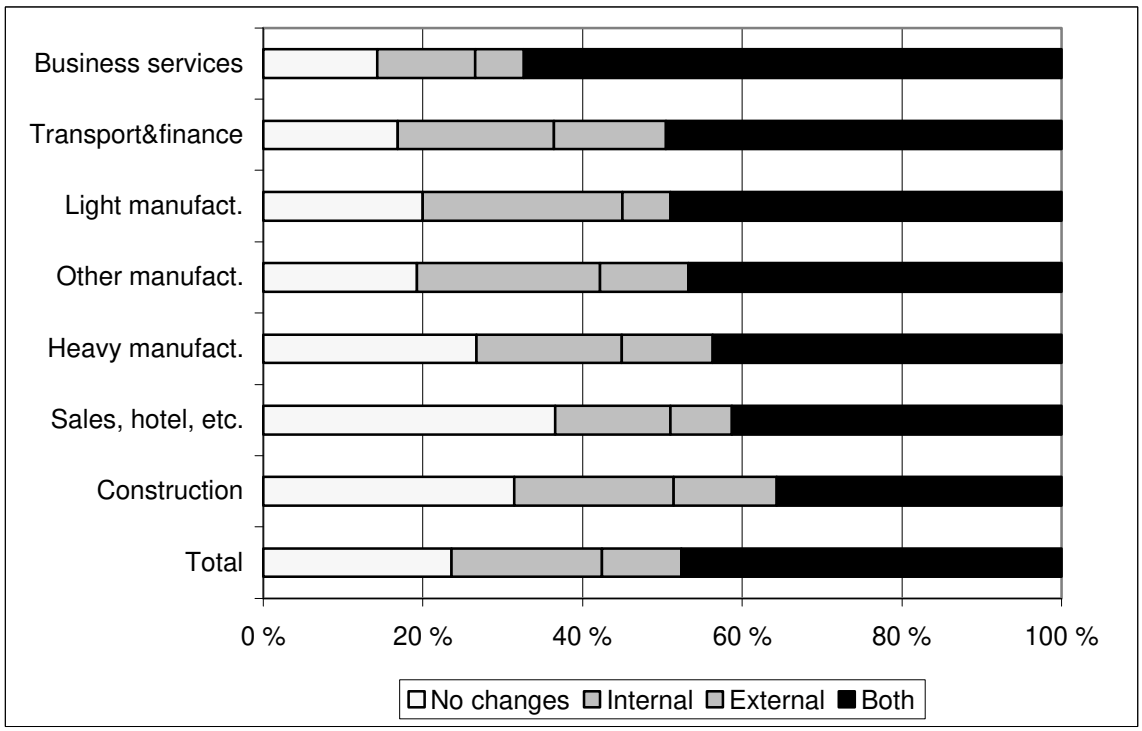
There also seems to be a clear difference in internal and external organisational changes in different industrial sectors (Figure 3.46.). It is typical of business services to undertake both types of changes concurrently. Instead, manufacturing companies more commonly than service companies undertake only internal changes. External changes concentrate more often on companies in the transport & finance sector. As noted earlier, larger companies have undertaken organisational changes more often than smaller ones (Figure 3.47.). In addition to this, larger companies concentrate more often on internal changes or they undertake internal and external changes concurrently. Small firms, on the other hand, focus more on external changes.

Figure 3.45. Organisational changes by region



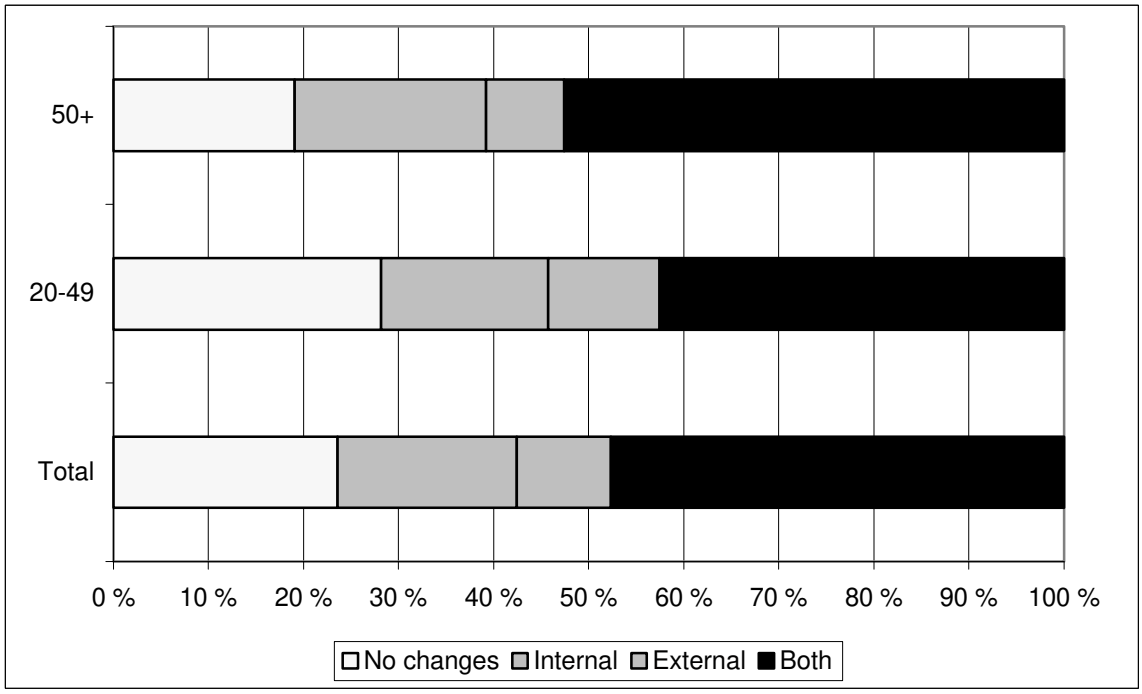
$\chi 2 = 61.1$, df= 21, p= 0.000***

Figure 3.46. Organisational changes by industry



$\chi 2 = 41.5$, df= 18, p= 0.001***

Figure 3.47. Organisational changes by company size



$\chi 2 = 13.7$, df= 3, p= 0.003**

3.2.3 Different modes of organisation

Organisations can be distinguished by the degree of vertical and horizontal integration or de-integration. Vertical integration refers to the aspect of centralisation of decision-making and exercise of control. In highly centralised companies, the decision-making power is concentrated at the top of the companies, orders are given and also controlled centrally. Because top management delegates its decision rights to the lower levels of the hierarchy, formal rules of co-ordination and control are installed. A strictly vertical information flow along hierarchical lines is typical of centralised organisation forms.

In decentralised organisations, instead, execution of tasks is not separated from decision-making, both take place on the same organisational level. No centralised hierarchical control based on formal rules exists. On the contrary, various types of self-control are installed. Co-ordination of activities takes place through monitoring and adjusting to each other. The model implies intensive horizontal information exchange.

Horizontal integration refers to the aspect of specialisation and autonomy of action. In the case of highly specialised organisations, units are not self-sufficient, as they are not able to produce whole products or major parts themselves. On the other hand, complex and less specialised organisation units are in general highly independent, as they are quite self-sufficient in fulfilling their tasks and do not depend on contributions from other units. In organisations with highly specialised units, the demand for horizontal co-ordination is much higher than in companies with more independent units. On the basis of what has been said so far, we can distinguish the following four organisation forms (Mintzberg 1979, Nonaka and Takeuchi 1995, Lam 1999):

Table 3.13. Organisation forms

		Centralisation (and related vertical co-ordination logic)	
		Centralised organisation	**Decentralised organisation**
Interdependence (and related horizontal co-ordination logic)	**Specialised operational units**	Machine bureaucracy	Professional bureaucracy
	Integrated operational units	J-model	Operational adhocracy

For our analysis, we used group work or teamwork as an indicator for operational integration, and flat hierarchies as an indicator for vertical de-integration. Based on these two indicators, we found the following distribution of various organisation forms in our sample:

Table 3.14. Distribution of organisation forms in data

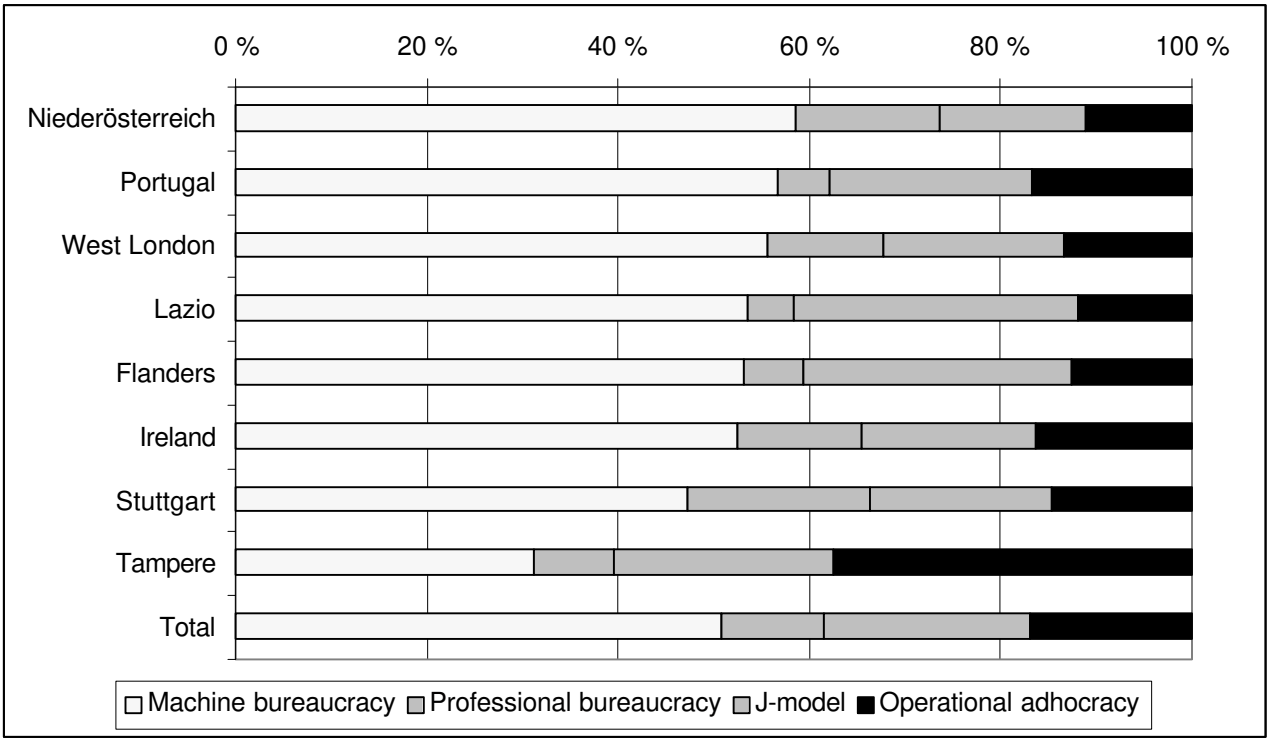
		Vertical de-integration: flat hierarchies	
		yes	no
Operational integration: group or team work	yes	operational adhocracy 120 17%	J-model 154 22%
	no	professional bureaucracy 75 11%	machine bureaucracy 362 51%

According to our data, it seems that machine bureaucracy is still the dominant organisation form in the companies[9]. The J-model, which is characterised by group work and hierarchical structures, is applied by 22%; adhocracy as the most flexible organisation form is typical of 17% of all companies in our sample. Only 10% of all companies are structured according to the professional bureaucracy model.

How are the organisation forms spread in the different regions? The following figure gives an overview.

[9] In the questionnaire we asked whether organisational changes had taken place during the past five years. This does not exclude the fact that changes had occurred before this period. Thus, companies characterised by us as machine bureaucracy may actually have undertaken restructuring measures earlier.

Figure 3.48. Organisation forms by region

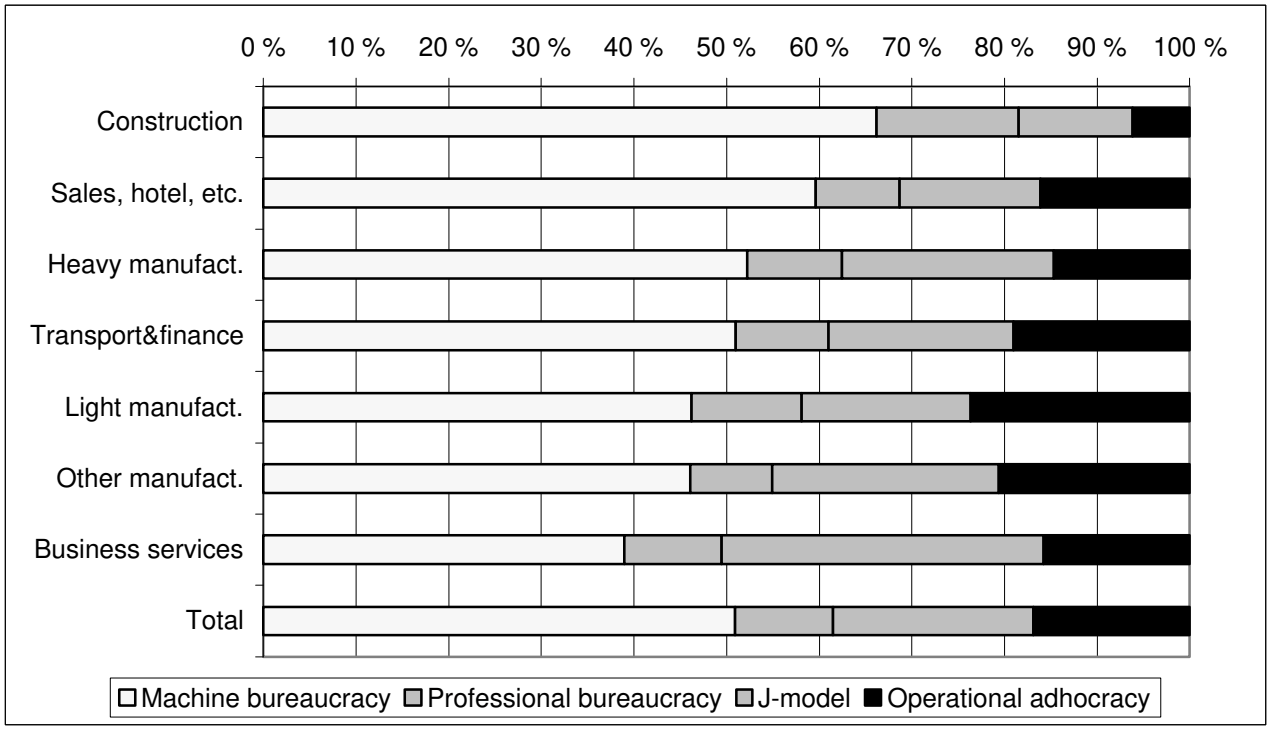


$\chi 2 = 62.6$, df= 21, p= .000***

In Niederösterreich, the West London area, and Flanders, the majority of companies are still organised according to the Fordist principles (Figure 3.48.). On the other hand, less than 1/3 of all companies in the Tampere region can be characterised by machine bureaucracy. The professional bureaucracy model can be found most often in the Stuttgart area. In Flanders and Lazio, every fourth company has applied the J-model; adhocracy as the most flexible organisation form is the most common in companies in the Tampere region. Here the difference to the other regions is very significant.

According to industries, we can find some interesting results (Figure 3.49.). Machine bureaucracy is less common in the business services sector than in other industries. In this sector, the J-model is more dominating. On the other hand, 2/3 of all companies in the construction sector are still organised according to the traditional Fordist principles: functional de-integration and hierarchical integration. Adhocracy, the most flexible organisation model, can hardly be found in this sector.

Figure 3.49. Organisation forms by sector



$\chi 2 = 31.9$, df= 18, p= 0.022*

One would have hardly expected that machine bureaucracy is more widespread in small companies (59%) than in larger companies (41%). It is, however, very likely that small companies report less organisational changes, as they are inherently more flexible. Therefore, small companies do not need to introduce group work or flat hierarchies as organisation measures in order to increase flexibility and innovativeness.

Operational adhocracy and professional bureaucracy can be found more often in larger companies than in smaller companies. Concerning location of company, we can hardly find differences concerning the applied organisation form. Machine bureaucracy is the dominating organisation model in fully independent companies (59%), whereas in parent companies we can find the J-model (37%) more often.

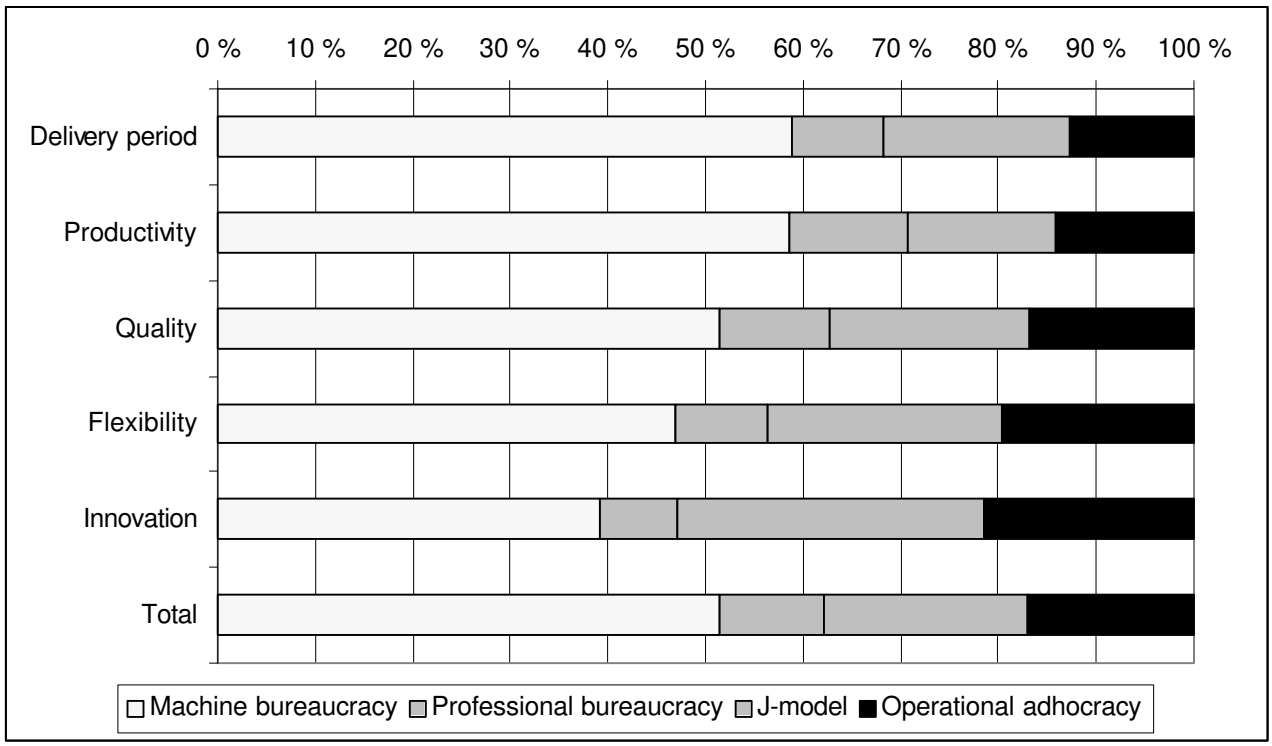
Not surprisingly, machine bureaucracy is the most widespread organisation form in companies with standardised products (59%), whereas the J-model as well as operational adhocracy can be found more often in companies producing variants or in companies where the product or service is specified by the customer. Furthermore, operational adhocracy is used more often in companies

operating on the European and global markets. In regionally and nationally oriented companies, on the other hand, machine bureaucracy is a more widespread organisation form.

Obviously, the market position has some influence on the organisation form introduced by companies. Two out of three companies operating on local markets only are organised according to the traditional Fordist principles, whereas the share is just 39% among the companies that are major players on the international market. In the latter category, we find the operational adhocracy model rather widespread. The J-model is also more common in companies operating internationally, regardless of whether they are major or minor players on the market.

How are companies' most important achieving criteria and organisation forms linked? The following table gives an overview.

Figure 3.50. Organisation forms by company's most important achieving criterion



$\chi 2 = 11.4$, df= 12, p= 0.493

Most obvious is the fact that companies striving for innovation apply more flexible organisation forms, such as the J-model (33%) and operational adhocracy (21%), more often than other

companies. On the other hand, in the companies that consider productivity and delivery time as their key achieving criteria, the machine bureaucracy model is the most widespread.

3.2.4 Technology system and organisation models

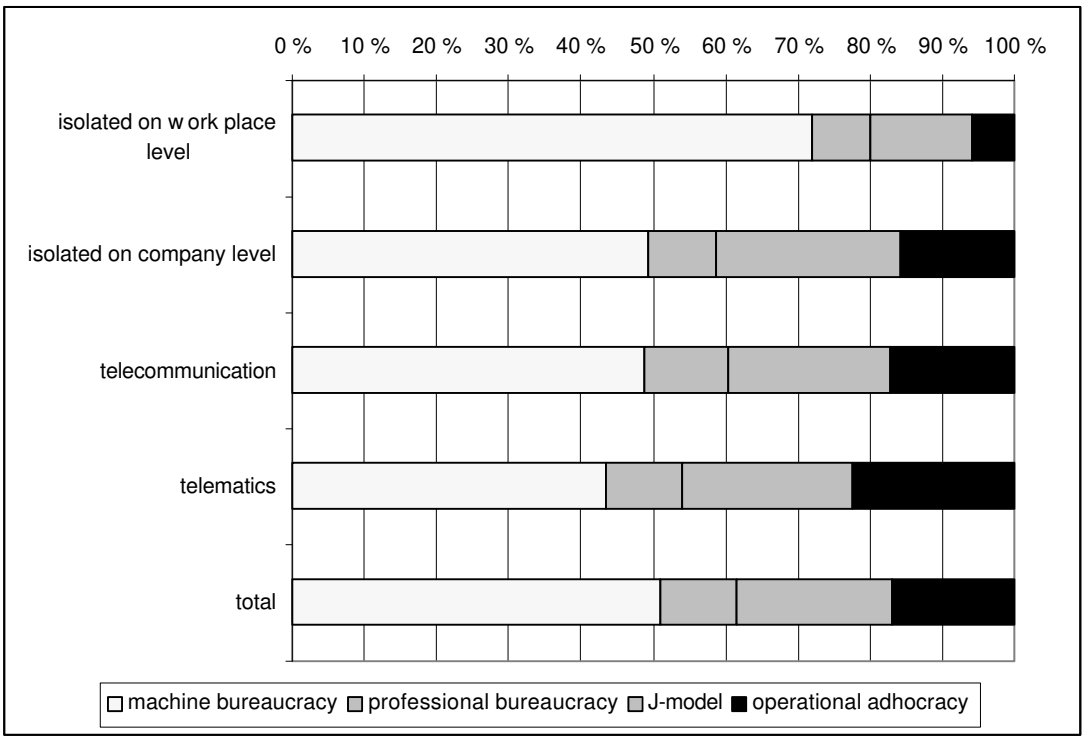
In what way are the technological systems and the organisation forms linked? One could expect, for example, that the application rate of telematic systems is higher in machine bureaucracy and in the J-model, while telecommunication could be found more often in companies organised according to the professional bureaucracy model. As in adhocracies, there is little need for technically mediated communication. Therefore, we can expect little use of ICTs for workflow co-ordination.

Table 3.15. Linkages of organisation forms and technical systems

Organisation form	Technical system
J-model Centralised, integrated	Computerisation of components Telematic systems for vertical co-ordination
Machine bureaucracy Centralised, specialised	Telematic systems for horizontal and vertical co-ordination Intensive use of other ICTs
Operative adhocracy Decentralised, integrated	Low use of ICTs to support co-ordination
Professional bureaucracy Decentralised, specialised	Computerisation of components Telecommunications systems to support mutual adjustments

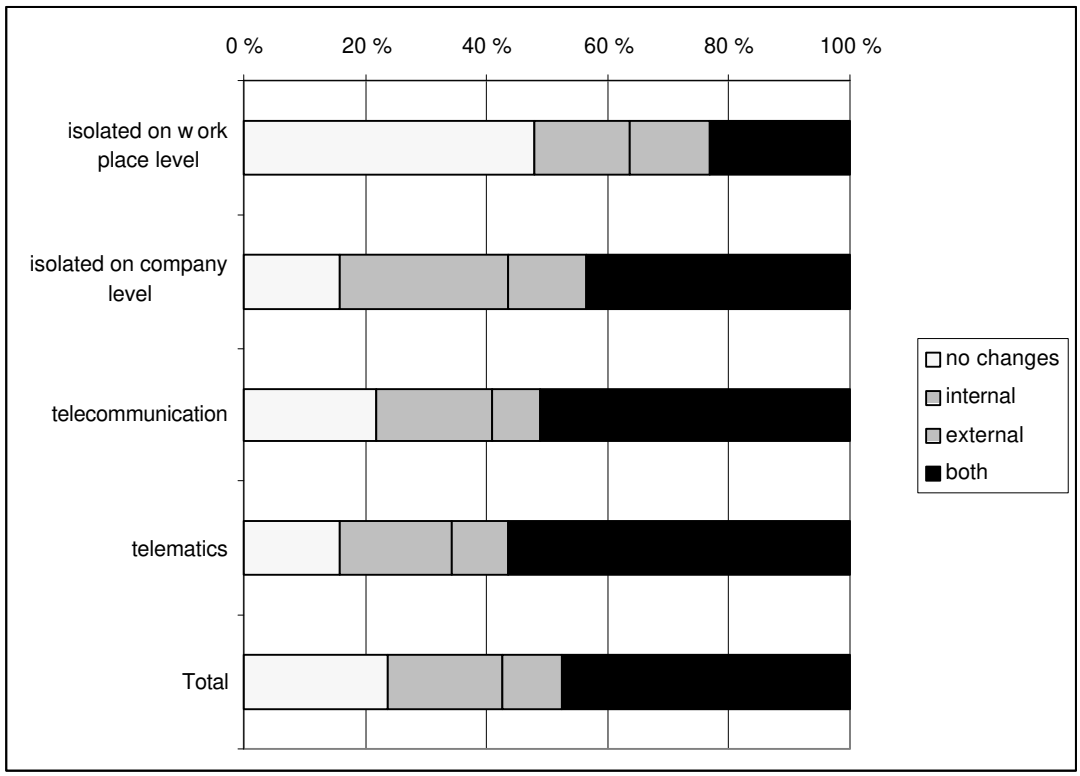
Such a perfect matching cannot be found in our data set, as Figure 3.51. shows. Actually, the results indicate trends that are contrary to our expectations. We might speculate that most companies do not restructure their business organisation in a very systematic and strategic way, as ICT systems and organisation forms are not suitable in many cases.

Figure 3.51. Companies' ICT system by organisation forms



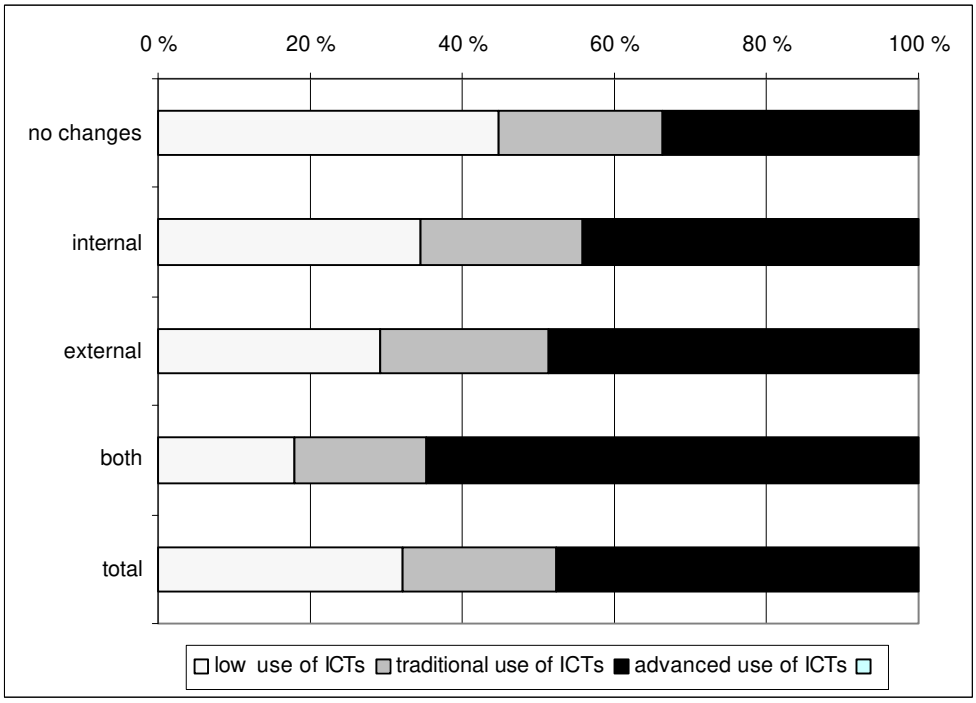
If we take a broader perspective on the organisational changes and investigate the relation of ICT systems and internal and external restructuring, clearer results can be obtained (Figure 3.52.). It is obvious that in companies that apply an isolated ICT system it is much more common that no organisational changes have occurred. This is the case in nearly half of these companies. Concerning the other types of ICT systems, the share of companies having not undertaken organisational changes is about the same. But along with more advanced ICT systems, companies also introduce more both internal and external organisational changes.

Figure 3.52. Companies' ICT system by internal and external organisational changes



The intensity and modernity of ICT use and organisational restructuring also seem to be closely related (Figure 3.53.). Among the companies that did not take or hardly took any measures in organisational restructuring, the share of low ICTs users is the largest. Concerning all other categories of organisational renewal: internal restructuring, external restructuring, the concurrent introduction of both types of changes, the companies dominate that use modern ICTs in a more advanced way. The share of advanced ICTs users is particularly big among companies that have undergone both internal and external restructuring.

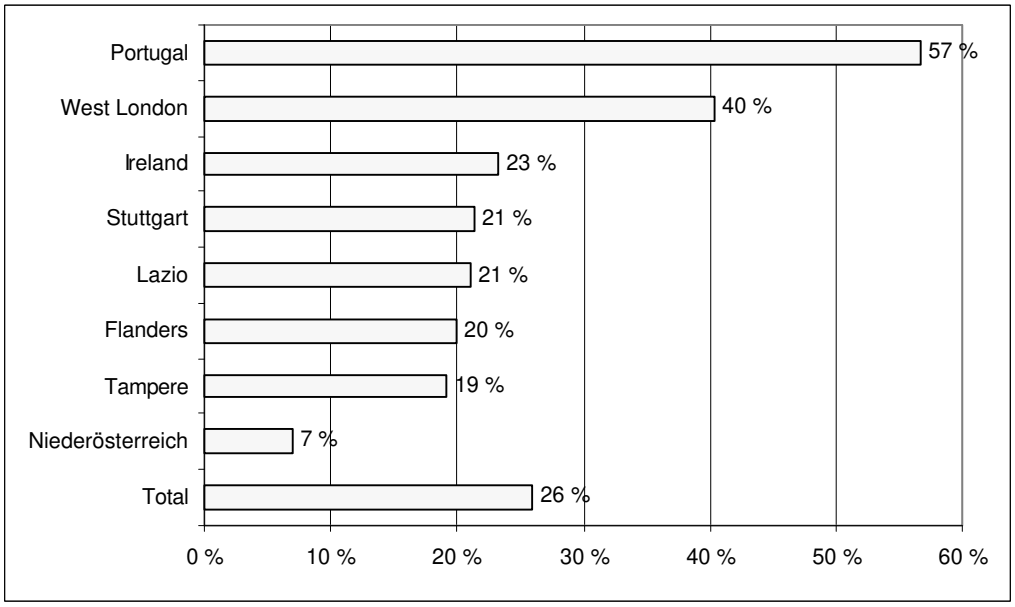
Figure 3.53. Organisational changes by intensity and modernity of ICT use



3.2.5 Call centres

The introduction of call centres can also be interpreted as an organisational restructuring measure. On average, 26% of the companies have a call centre (Figure 3.54.). They are the most common in Portugal, where more than a half of the companies have a call centre. They are also quite frequent in the West London area (40%). At the same time, only 7% of the companies in Niederösterreich use a call centre.

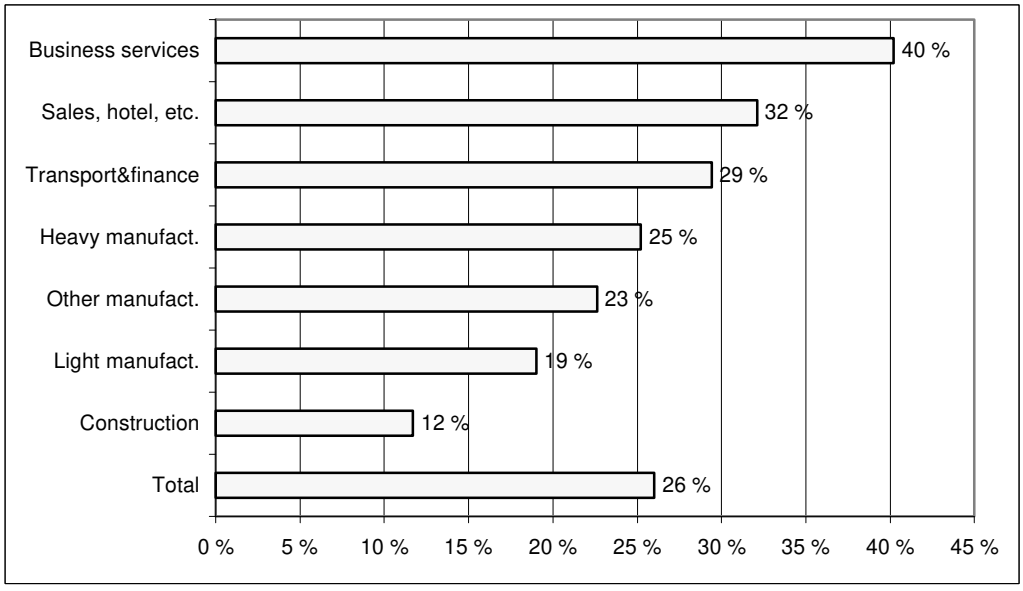
Figure 3.54. Call centres by region



χ^2 = 88.4 df = 14, p 0.000***

Call centres are the most common in business services (40%), the sales & hotel industry (32%), and in the transport & finance sector (29%) (Figure 3.55.). On the other hand, they are used the least in the construction sector (12%).

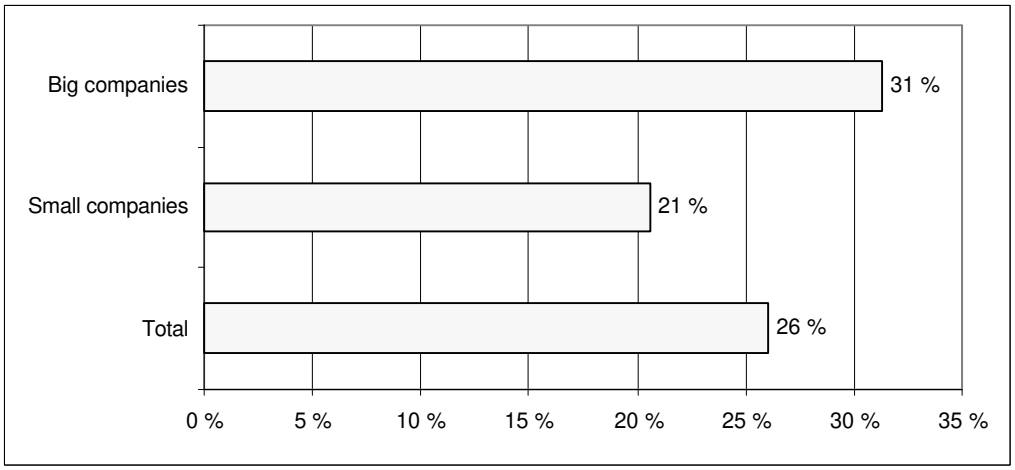
Figure 3.55. Call centres by industry



χ^2 = 30.7 df = 12, p 0.002**

Not surprisingly, there are differences according to size of company (Figure 3.56.). Almost every third of larger companies has a call centre, whereas within smaller companies only one fifth of the companies uses them.

Figure 3.56. Call centres by company size



χ^2 = 12.4 df = 2, p 0.002**

3.2.6 Summary of the regional differences in organisational restructuring

In Table 7 of Appendix 3, we compiled the most obvious regional differences. Internal organisational changes are widespread among companies in Flanders, Lazio and Portugal. Companies in Niederösterreich, on the other hand, have introduced fewer internal changes but they have restructured their relationships with other organisations more often.

Overall, companies in Portugal, the Stuttgart area and the Tampere region have undertaken more organisational changes than companies elsewhere. Companies in the Stuttgart area have focused their restructuring strategies on external changes. In the Tampere region, companies have introduced quite often internal and external changes concurrently.

Companies in the Republic of Ireland cannot be characterised in a specific way with the exception of having established subcontracting networks more often. In general, companies in the West London area have introduced fewer organisational changes than elsewhere, but it seems to be more common to firms in this region to subcontract functions or to relocate their activities and build up strategic alliances with other companies.

4. THE PROCESS OF INTRODUCING ICTS

4.1. Barriers in introducing ICTs

As can be seen in Figure 4.1., the main barriers in introducing ICTs are technical problems and expenses. The most important barriers are ICT costs, the incompatibility of the new ICTs with the existing technical systems, the lack of required qualifications to handle ICTs, and difficulties in finding adequate software. Resistance within management and resistance by workers or the labour union are seen as a less impeding factor in the process of introducing ICTs. Also, rigid organisational structure is less often mentioned as a barrier in the technical change process.

Whether a factor is seen as a barrier in the innovation process or not differs by region and sector. In general, companies in Lazio and Niederösterreich interpret various factors less often as barriers than companies in other regions. Technical problems seem to hinder the introducing of ICTs more often in companies in Portugal, the Tampere region and the Republic of Ireland (Figure 4.2.). ICT costs and other non-technical problems have had a negative effect on the implementation process in companies in Portugal and the Republic of Ireland in particular (Figure 4.3.).

Problems concerning the introduction of modern ICTs seem to arise quite often in manufacturing, and especially in the sales, hotel & restaurant sector. In business services, data security and data protection legislation are fairly often seen as the hindering factor in the use of ICT (Figure 4.4. and 4.5.).

Figure 4.1. Importance of different barriers in introducing ICTs

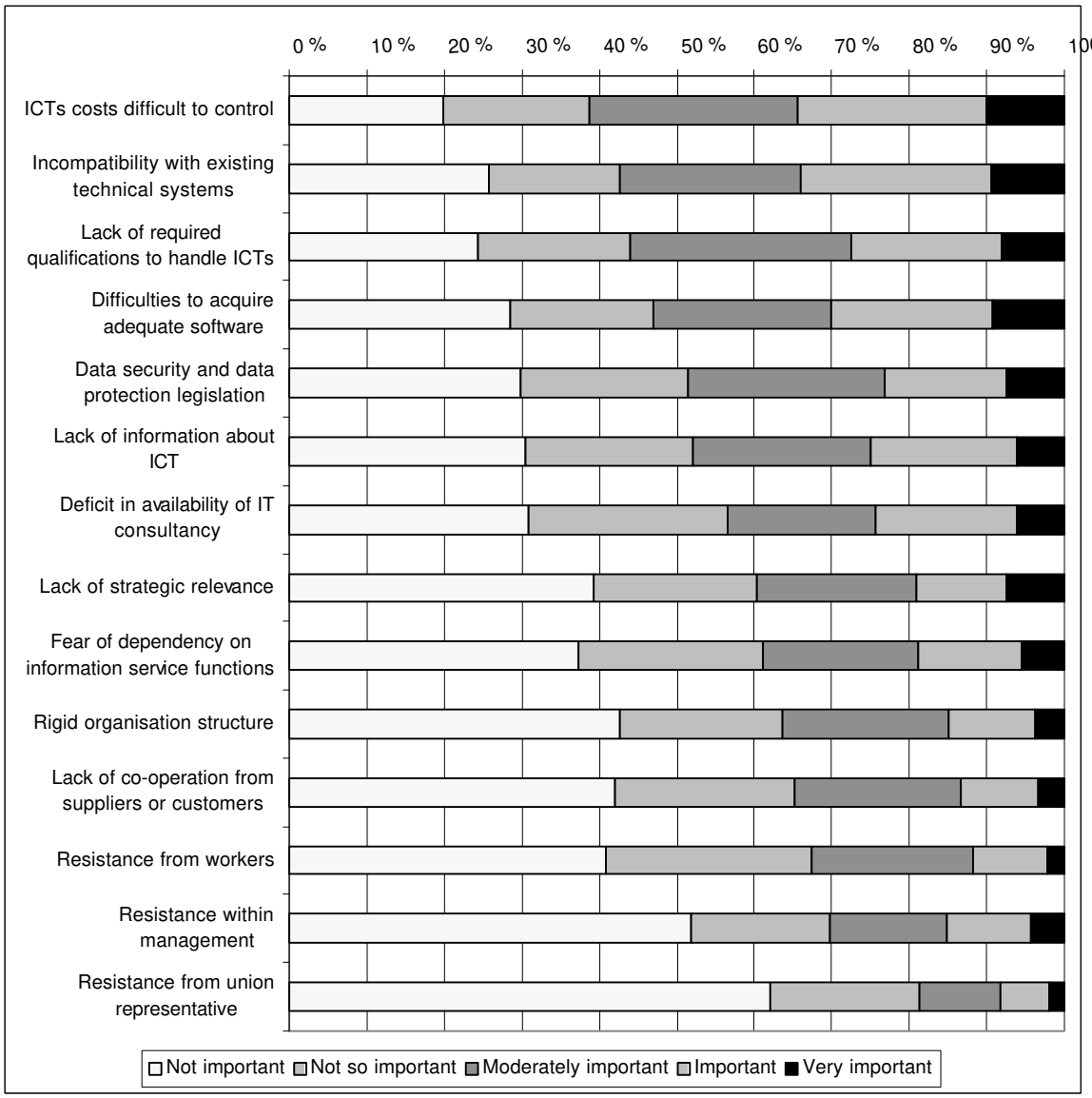


Figure 4.2. Importance of technical problems in introducing ICTs by region

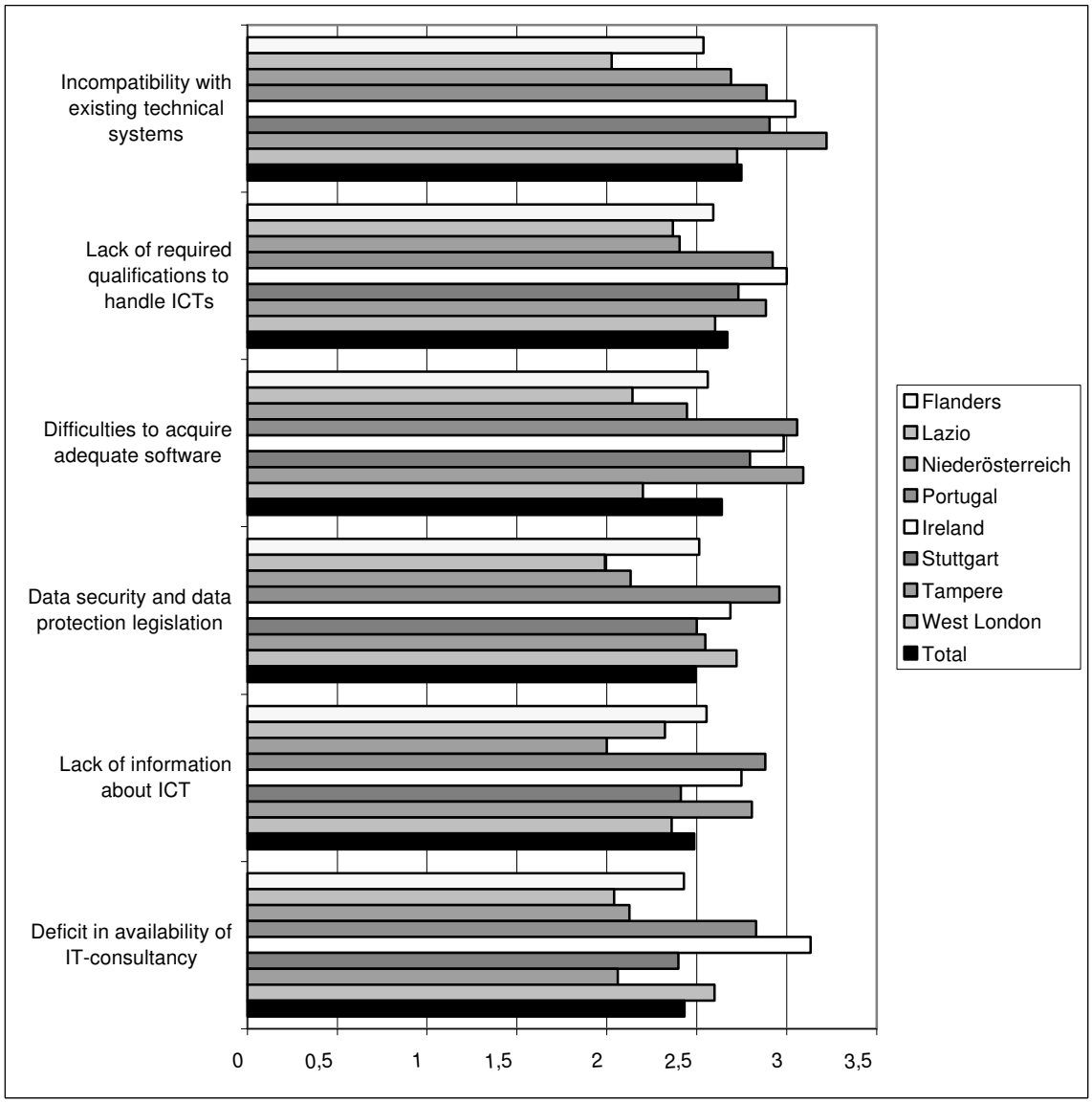


Figure 4.3. Importance of non-technical problems in introducing ICTs by region

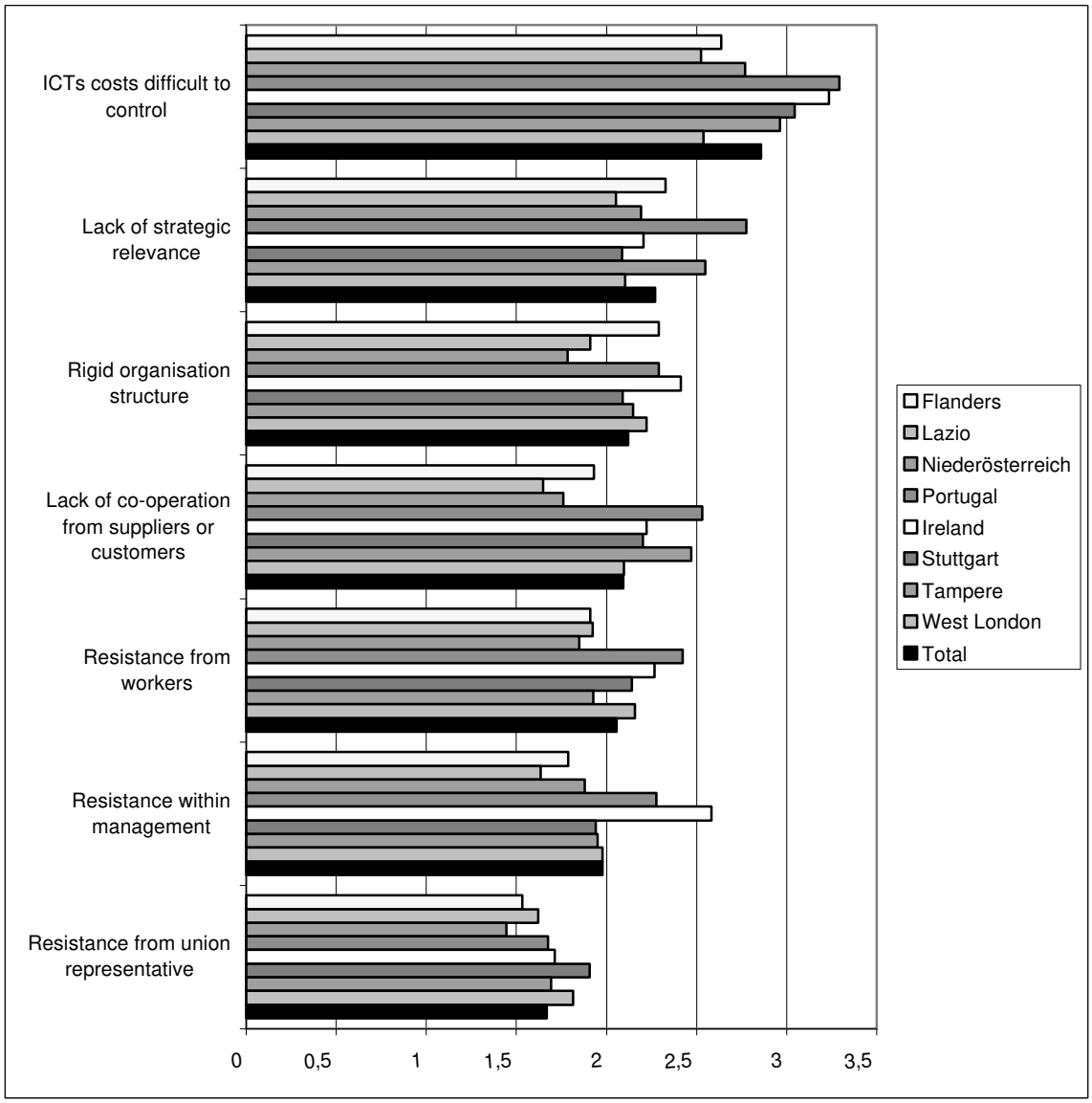


Figure 4.4. Importance of technical problems in introducing ICTs by sector

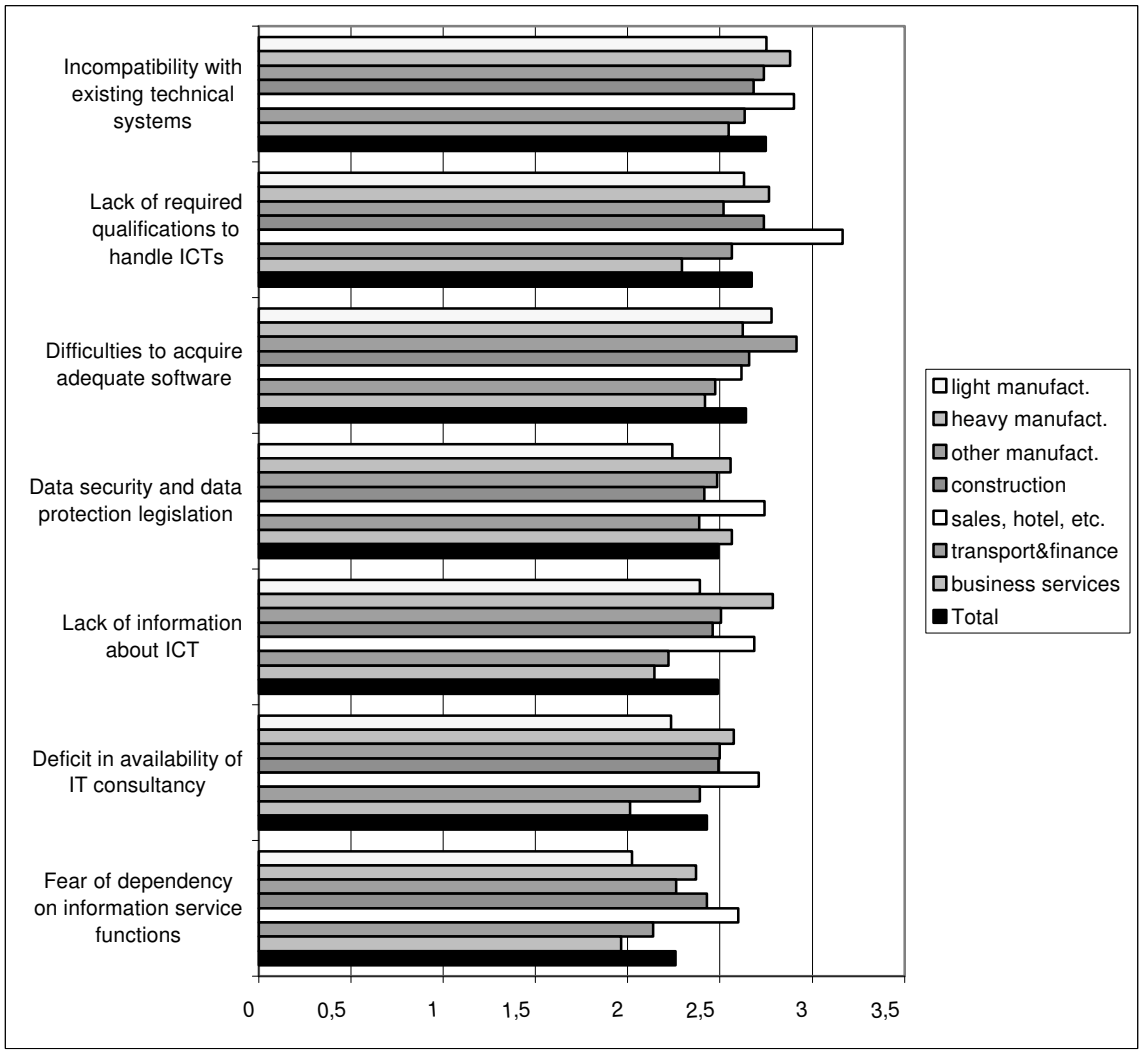
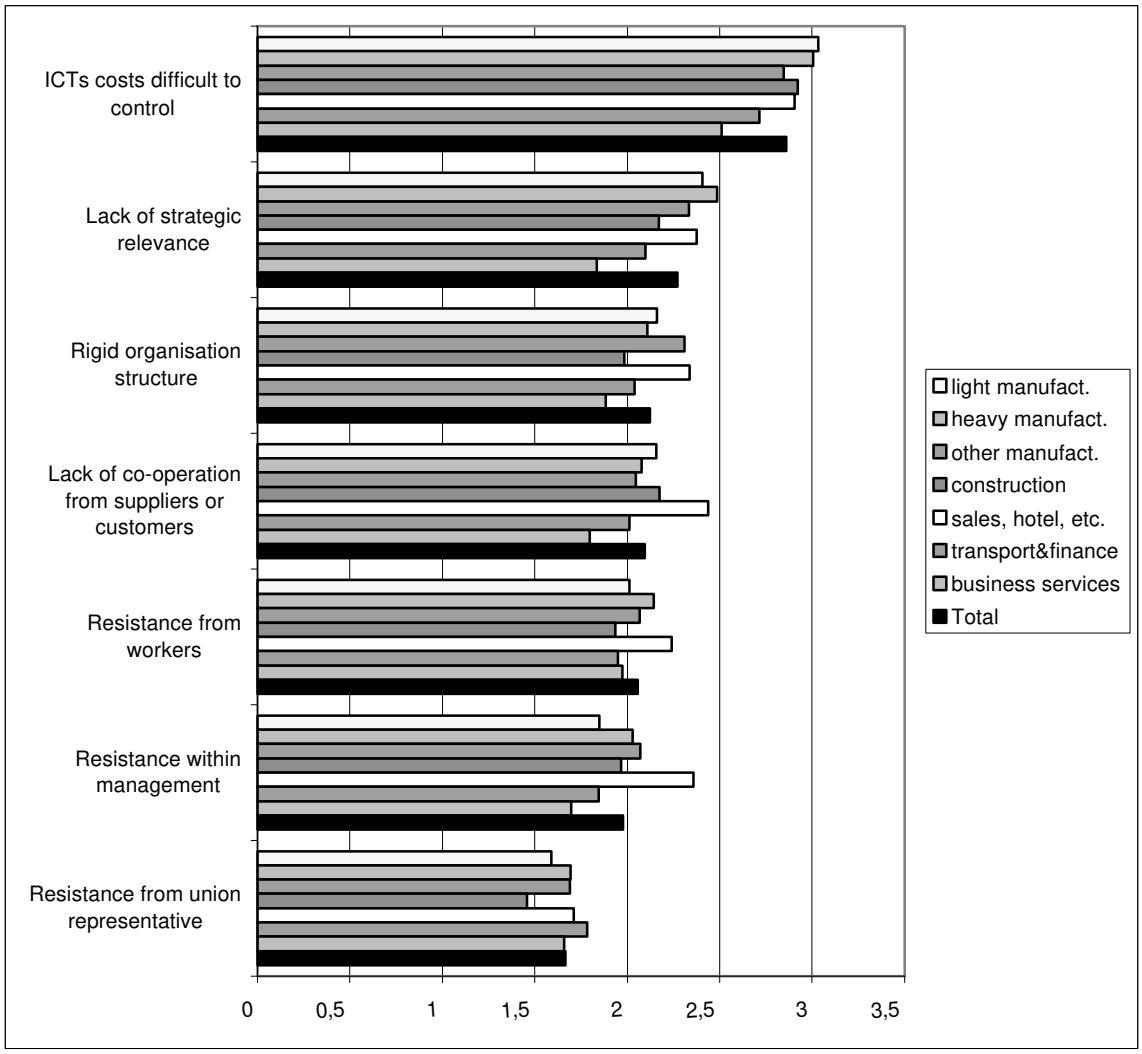


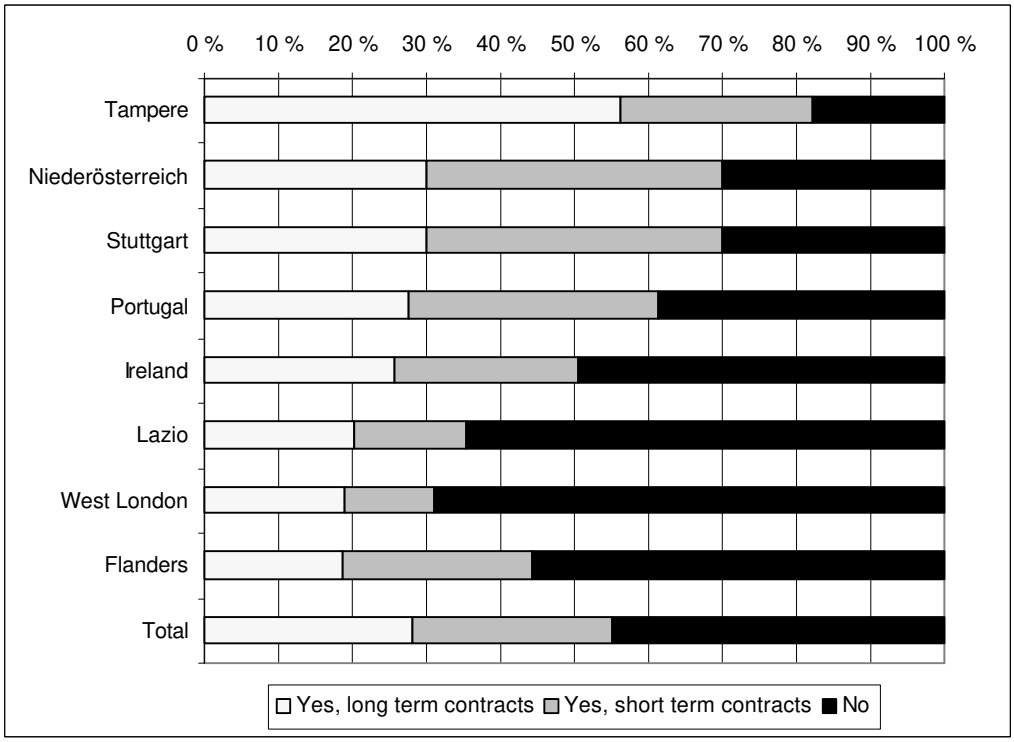
Figure 4.5. Importance of non-technical problems in introducing ICTs by sector



4.2. Subcontracting the implementation and development of ICTs

Over half of all companies in our sample use external aid for the implementation and development of their ICTs. As Figure 4.6. shows, subcontracting the implementation and development of ICTs to service providers is a typical practice in companies in the Tampere region (83%). They usually make long-term contracts (56%). Subcontracting is also common in companies in the Stuttgart area (70%), Niederösterreich (70%) and Portugal (61%). On the other hand, only 31% of the companies in the West London area and 35% in Lazio subcontract the implementation and development of ICTs to ICT service providers.

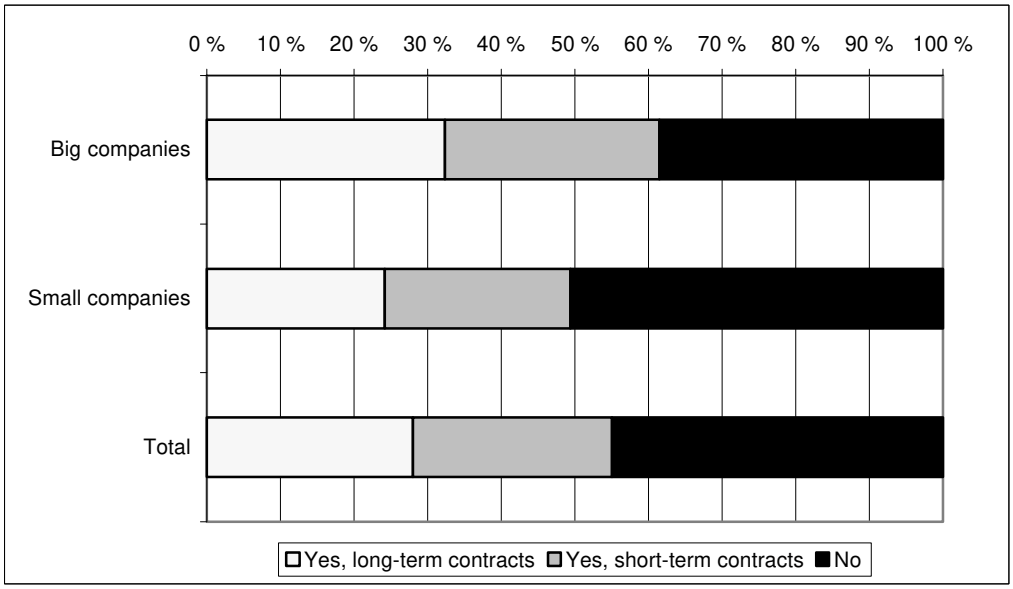
Figure 4.6. Subcontracting implementation and development of ICTs to ICT service providers by region



$\chi^2 = 114.6$ (df = 14), p= 0.000***

Subcontracting is more common in large companies as could have been expected. In Figure 4.7., we can see that a total of 61% of the larger companies have subcontracted the implementation and development of their ICTs systems to service providers, whereas subcontracting takes place less often in smaller companies (49%). The analysis of subcontracting the implementation and development of ICT system to service providers by industrial sector does not produce statistically significant results.

Figure 4.7. Subcontracting implementation and development of ICTs to service providers by size of company

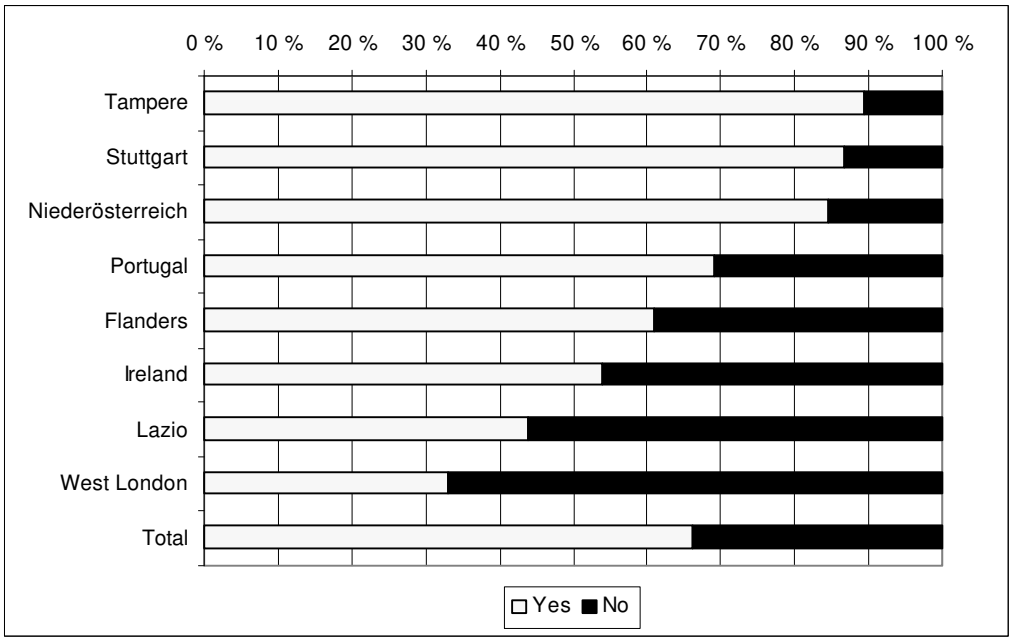


χ^2 = 12.2 (df = 2), p 0.002**

4.3. Involvement in introducing ICTs

There are clear regional differences concerning user involvement in processes of implementing and developing ICT systems (see Figure 4.8.). Users are involved particularly often with companies in the Tampere region (89%), the Stuttgart area (87%) and Niederösterreich (85%), whereas in the West London area (33%) and Lazio (44%) less than half of the companies involve users in this process.

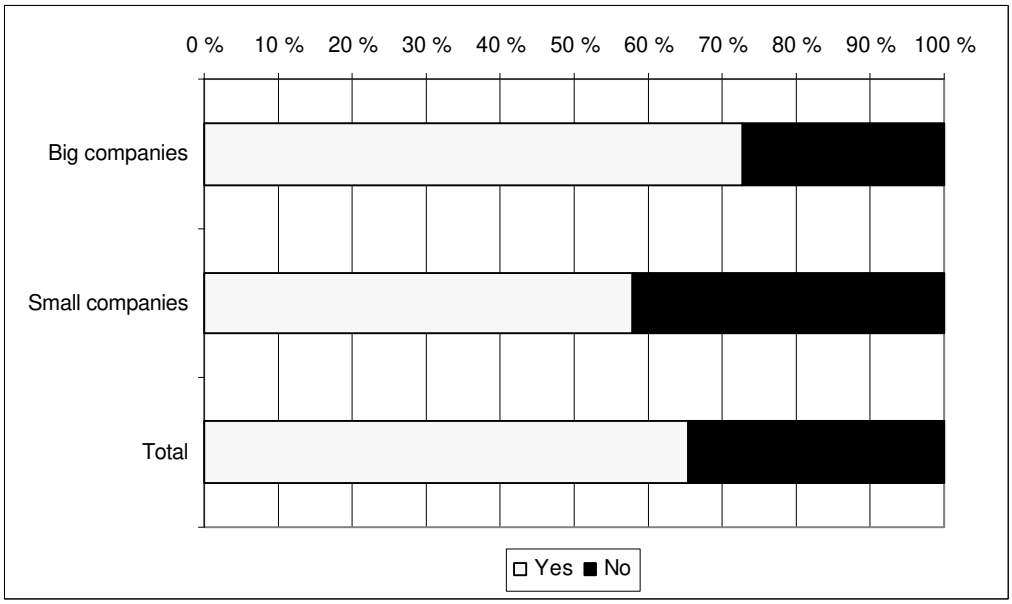
Figure 4.8. Involvement of users in process of implementing and developing ICT systems by region



χ^2 = 127.6 (df = 7), p 0.000***

User involvement does not differ much when looking at company size (Figure 4.9.). Altogether 73% of the bigger companies and 58% of the smaller companies practise user involvement. When looking at industries, no statistically significant difference can be found.

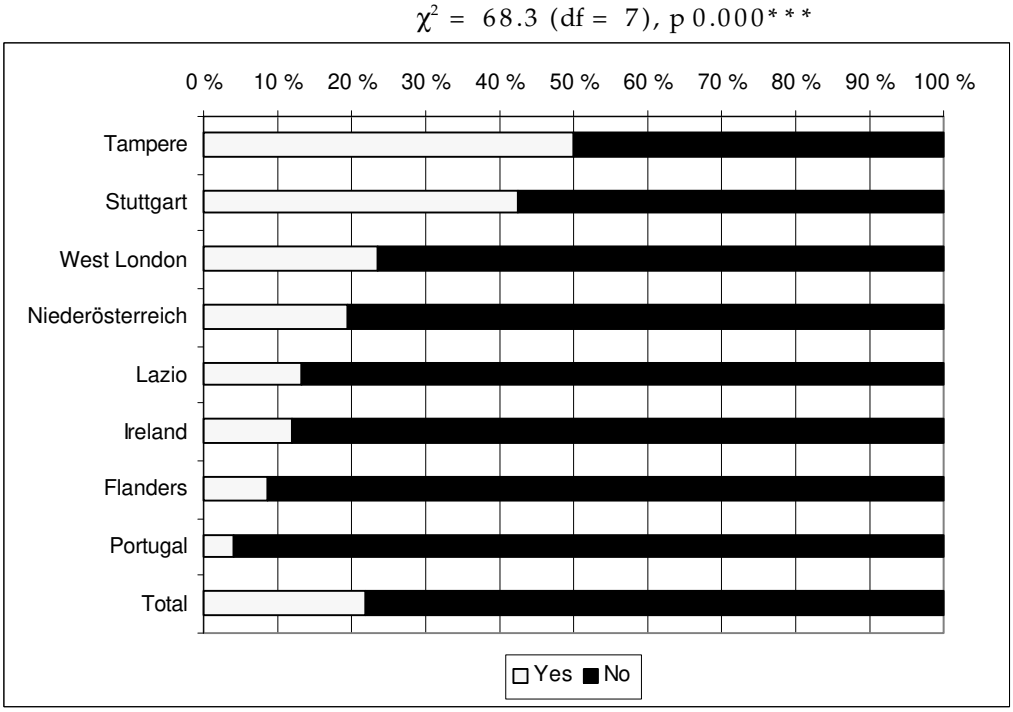
Figure 4.9. Involvement of users in implementation and development of ICT by size of company



χ^2 = 18.4 (df = 1), p 0.000***

On the whole, the involvement of union representatives in the process of implementing and developing the ICT system is quite exceptional (Figure 4.10.). However, there are some regional differences. In half of the companies in the Tampere region, union representatives are involved in the process of implementing modern ICTs. The share is 43% in the Stuttgart area and 24% in the West London area. In all other regions, fewer than 20% of companies practise this kind of involvement; in Portugal particularly few (4%). Analysing the involvement of union representatives in implementing and developing ICT systems by sector or size does not produce statistically significant results.

Figure 4.10. Involvement of union representatives in process of implementing and developing ICT system by region



5. SOCIAL CONSEQUENCES OF THE USE OF MODERN ICTS

5.1. Changes in the importance of skills and competencies

The introduction of modern ICTs has created a huge demand for a variety of different skills. Here information-processing skills have to be mentioned first. A total of 83% of all companies in the overall sample mentioned that these digital skills have become more important during the past few years. About 2/3 of all respondents also argue that responsibility (69%), social competencies (65%) as well as creativity & entrepreneurship (64%) have become more essential in economic life. And, still, more than 50% of all companies expressed a growing need for international skills (52%) and practical knowledge (55%).

There are, of course, regional differences concerning the importance of specific skills (Figure 5.1). A growing need for international skills, for example, is expressed by a great majority of companies in the Tampere region (76%), in Portugal (64%) and in the Stuttgart area (62%). Not surprisingly, only 26% of all companies in the Republic of Ireland express the same view. Regional differences shrink, as far as social skills and competencies are concerned. Again, most often companies in the Stuttgart area (75%) and the Tampere region (73%) state a growing importance of this particular type of skills, while in Lazio and in Niederösterreich, less than half of the companies emphasise the growing importance of social skills and competencies.

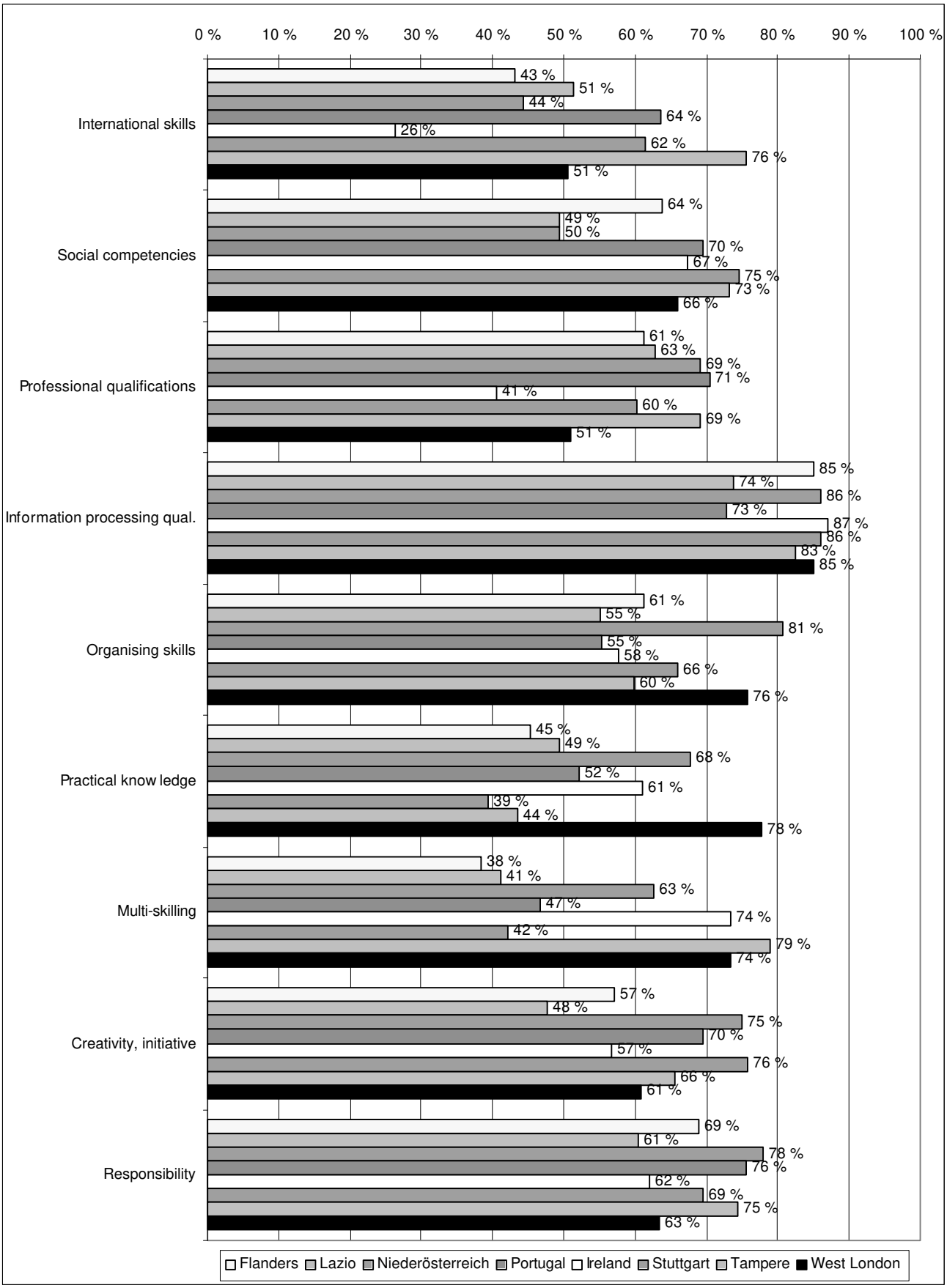
An increasing demand for professional skills seems to exist particularly in Portugal (71%), the Tampere region (69%) and in Niederösterreich (69%). This is obviously less often the case in companies in the Republic of Ireland (41%) and in the West London area (51%). Information-processing skills, for which a growing demand is most often stated in the overall sample (83%), seem to be less important for companies in Portugal (73%) and in Lazio (74%). A growing importance of organisational skills is mentioned very often by companies in Niederösterreich (83%), whereas the share of companies stressing the demand for this particular type of skills is much smaller in Lazio and Portugal (about 55% in each region).

The importance of practical knowledge is not assessed equally by the respondents in each region. Companies in the West London area (78%) and Niederösterreich (68%) in particular see a

growing need for practical knowledge, while there seems to be less demand for this qualification in companies in the Stuttgart area (39%), in the Tampere region (44%), and in Flanders (45%).

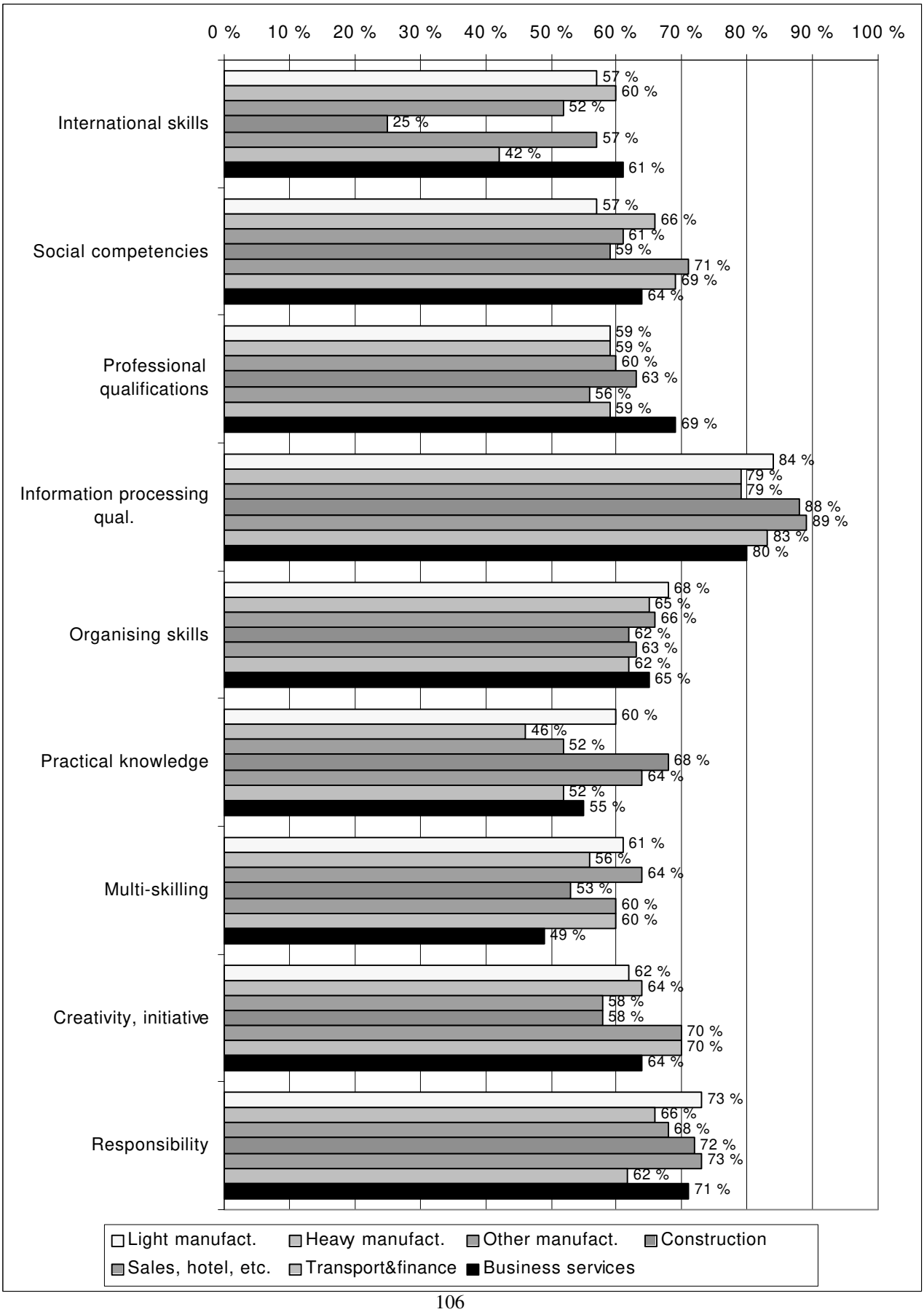
Regional differences are quite significant as far as multi-skilling is concerned. While in the Tampere region (79%), in the West London area (74%), and in the Republic of Ireland (74%) a great majority of companies assumes that the importance of this type of competence is growing, only a minority of companies in Flanders (38%), Lazio (41%) and the Stuttgart area (42%) shares the same view. Creativity and entrepreneurship, on the other hand, seem to be less important in companies in Lazio than in all other regions. Regional differences shrink when the importance of responsibility and entrepreneurship is assessed.

Figure 5.1. Skills by region



In general, companies' assessments on the importance of various skills and competencies differ less significantly when we look at the industrial level (Figure 5.2.) compared to the regional level. Companies from various industries do not differ very much in their assessments of the importance of organisational skills, social skills, responsibility, and professional skills. Also, information-processing competencies are equally important to all sectors. The transport and finance sector is the only sector in which a bigger share of companies states that the importance of international skills is growing. Industries differ more significantly when we look at practical knowledge, multi-skilling as well as creativity & entrepreneurship. Practical knowledge is less important to companies in the heavy manufacturing industry (46%), in industries subsumed under the heading of other manufacturing (52%), and in the transport & finance sector (52%). It seems to be essential in the construction industry (68%), however.

Figure 5.2. Skills by industry



Firm size seems to be less important when companies assessed the demand for specific skills and competencies. Social competencies, professional skills and information processing qualifications seem to be more important for larger companies, while smaller companies mention the demand in organisational skills and practical knowledge more often. All other qualifications are equally important for both size groups.

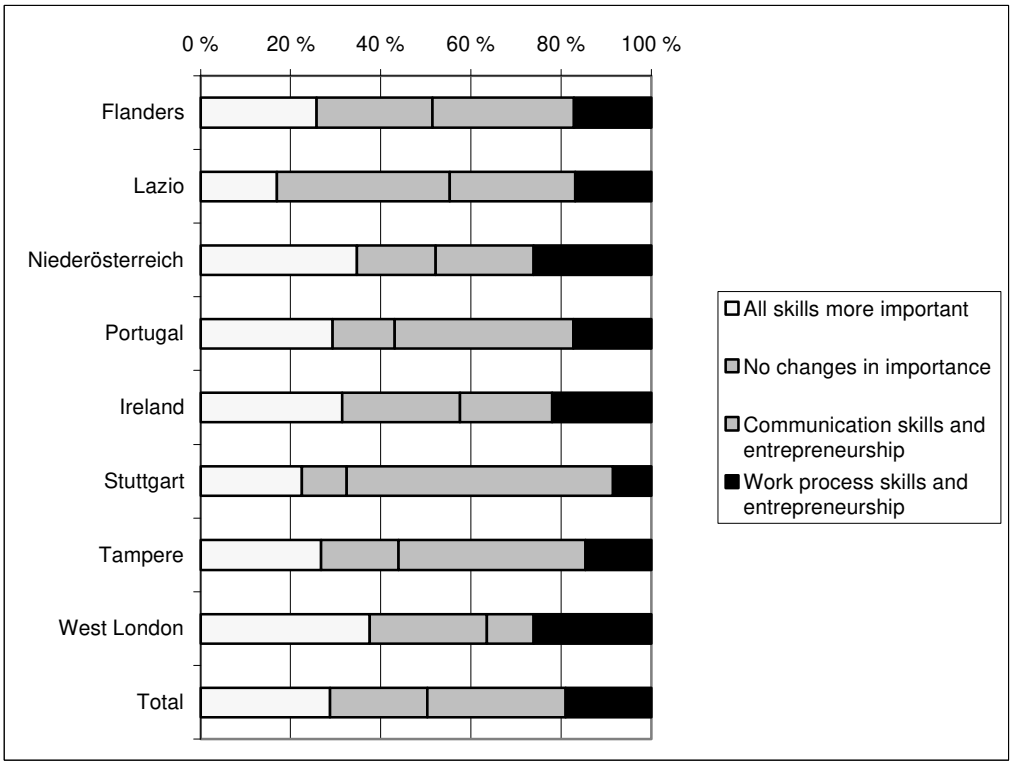
It is interesting to mention that companies having undertaken organisational changes report an increase in the importance of various types of skills and competencies more often than conservative companies. And companies having undergone both internal and external changes are even more decisive in their assessments concerning the growing importance of almost all types of skills and competencies. Only multi-skilling seems to be of great importance for companies that have not been involved in organisational changes.

Based on a factor analysis[10] we reduced the number of skills and competencies to three. They can be characterised as "work process related skills", "entrepreneurship" and "information-processing and communication skills".

As Figure 5.3. shows, communication skills and entrepreneurship are the most important factors in the Stuttgart area (59%), the Tampere region (42%), Portugal (40%) and Flanders (31%). At the same time, there seems to be a more urgent need for work process skills and entrepreneurship in Niederösterreich (26%), the West London area (26%) and the Republic of Ireland (22%). Some companies do not see an increasing importance in any of the above skills and competencies: in Lazio 39%, and in the West London area, the Republic of Ireland, and Flanders 26% each. In the West London area (38%), Niederösterreich (35%), and the Republic of Ireland (32%), on the other hand, the share of the companies that see an increasing demand for all qualifications is the greatest.

[10] The change in importance of different skills made according to Cattell's scree test three significant factors. The first factor was work process skills, which includes practical knowledge, organising skills, multi-skilling and professional qualifications. Responsibility and creativity & initiative made the second factor, entrepreneurship. The third factor, information processing and communication skills, contains information processing qualifications, international skills and social competencies. Cluster analysis was applied on these factors, which produced four clusters. The companies in the first cluster considered all the clustered skills relatively more important. In the second cluster, none of the skills was assessed as important. In the third cluster, the increasing importance of information processing and communication skills is predominating, and in the fourth cluster, work process skills.

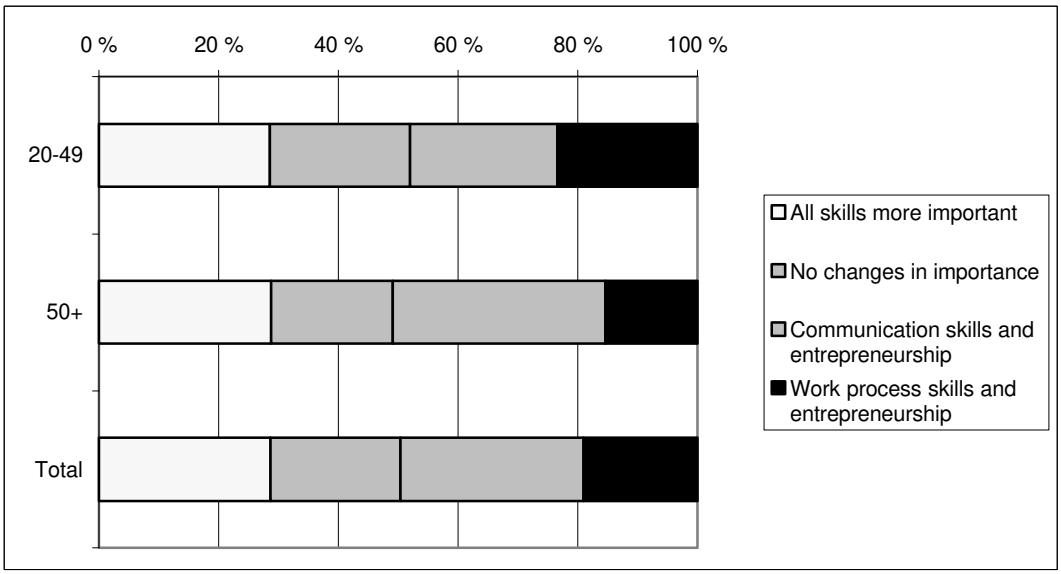
Figure 5.3. Skills clusters by region



$\chi 2 = 77.4$ df= 21, p= 0.000***

There are some differences in the relevance of skills when we look at firm size (Figure 5.4.). Communication skills and entrepreneurship are more important in larger companies (36%). On the other hand, work process skills and entrepreneurship are more important in smaller companies (25%). Companies that do not mention an increase in demand for any kinds of skills can be found more often among smaller companies (23%).

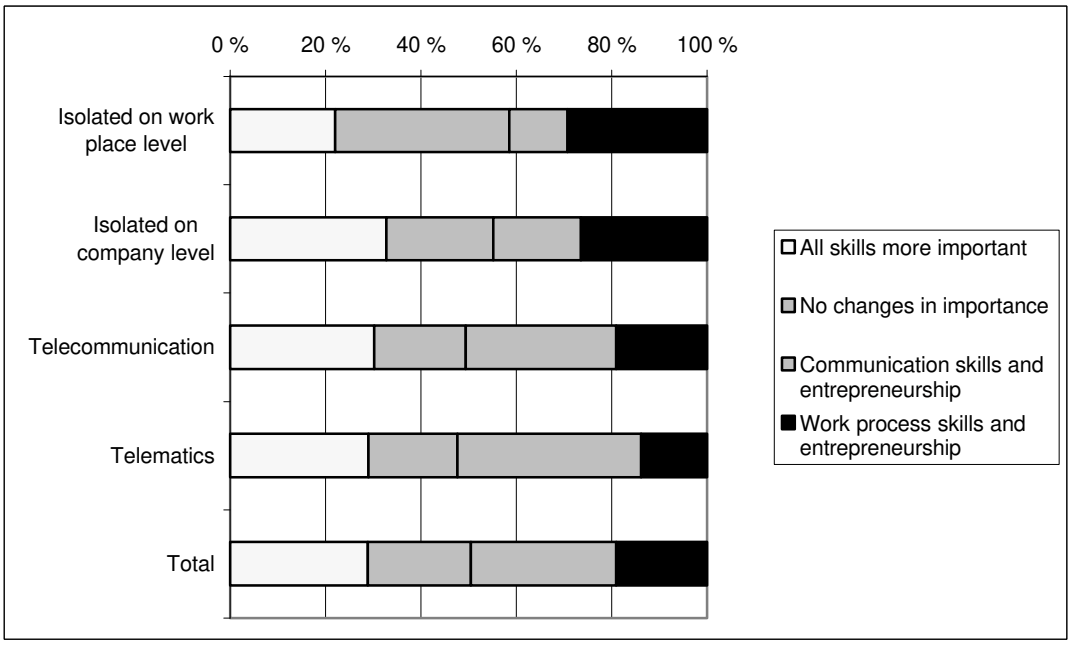
Figure 5.4. Skills cluster by number of company personnel



$\chi 2 = 11.8$ df= 3, p= 0.008**

Communication skills and entrepreneurship are more important in companies using telematics (39%) and telecommunication (32%), while work process skills and entrepreneurship are more important in firms that have only installed isolated ICT systems (29%). In addition, companies with an isolated ICT system often do not see an increasing demand for any of the above-mentioned skills (37%).

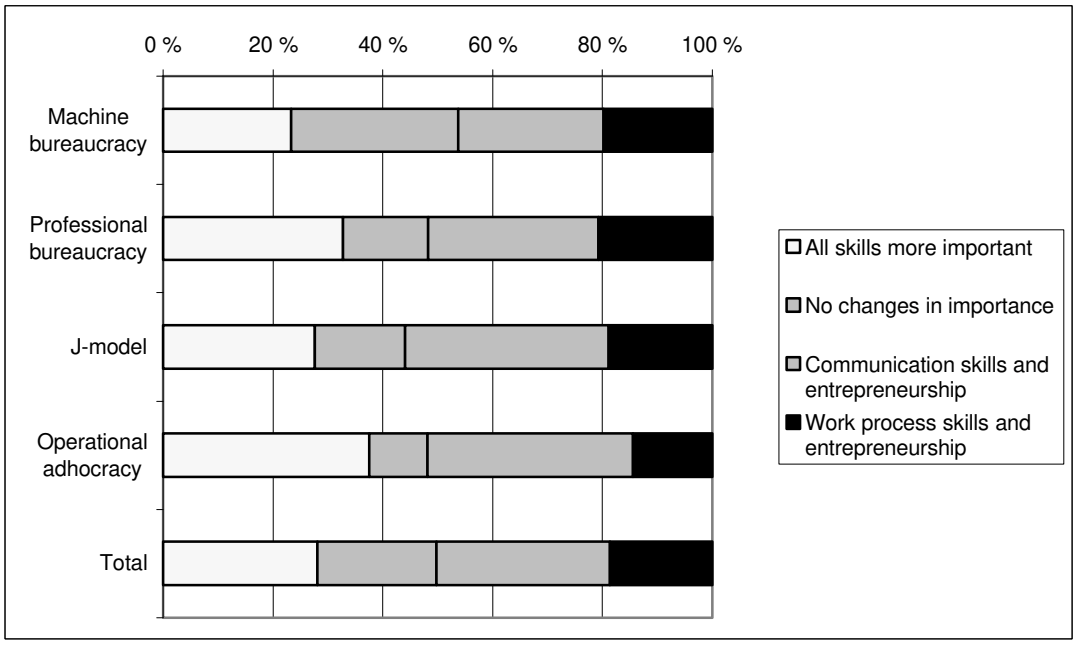
Figure 5.5. Skills cluster by ICT system



$\chi 2 = 37.4$ df= 9, p= 0.000***

We can see clear differences in the assessments of skills when we focus on organisation differences (Figure 5.6.). Communication skills and entrepreneurship are quite important in all kind of companies, but especially in companies applying the operational adhocracy model (38%) or the J-model (37%). Work process skills and entrepreneurship seem to become particularly important in companies organised according to the machine bureaucracy model (20%) and the professional bureaucracy model (21%). Many companies of the machine bureaucracy type see no increasing demand for any kind of skills and competencies (30%).

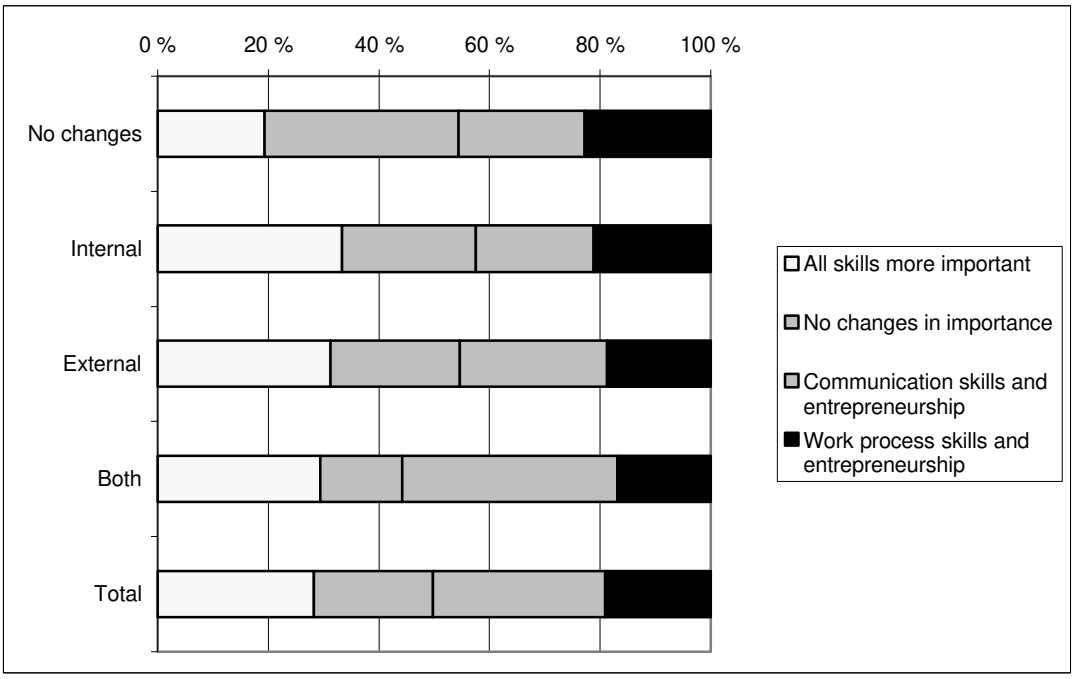
Figure 5.6. Skills cluster by organisation forms



$\chi 2 = 28.9$ df= 9, p= 0.001***

Companies that have not undertaken any organisational changes often see no increasing importance for any kinds of skills and competencies (35%). Communication skills and entrepreneurship become more important for those companies in which both internal and external organisational changes (39%) have taken place.

Figure 5.7. Skills cluster by organisational changes



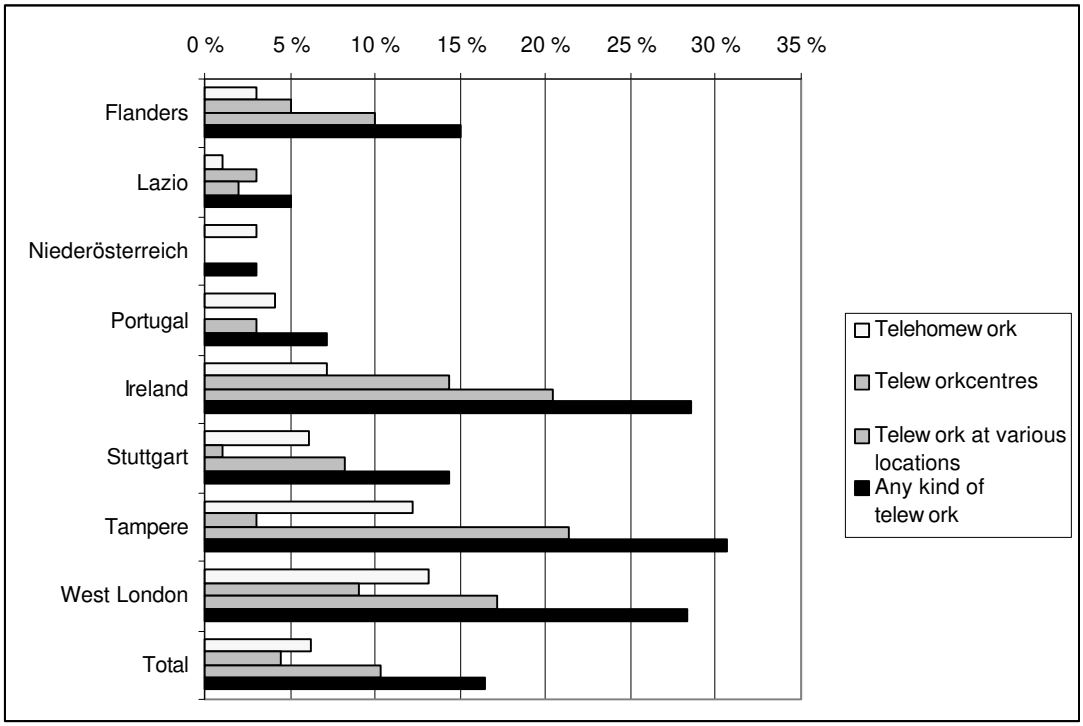
$\chi 2 = 34.3$ df= 9, p= 0.000***

5.2. Teleworkers

In general, only 16% of the companies use telework, but there are clear regional differences. A total of 31% of the companies in the Tampere region, 29% of the Irish companies, and 28 % of the companies in the West London area employ teleworkers. The firms in Niederösterreich, Lazio and Portugal hardly have any telework.

We can distinguish three types of telework: telework done at home, in telework centres and at varying locations (e.g., at customers', travel work). The most widespread type is telework at varying locations (Figure 5.8.); it is the most common in companies in the Tampere region (21%) and Ireland (20%). Approximately 6% of all companies use telework at home, which is the most common kind of telework done in the West London area (13%) and the Tampere region (12%). Telework centres are quite exceptional; only 4% of the companies in the overall sample operate with telework centres. However, 14% of the Irish firms use telework centres.

Figure 5.8. Types of telework by region



Teleworkers are the most widespread in the business sector (31%), although telework is also relatively frequent in other manufacturing (19%) (Figure 5.9.). On the other hand, the share of companies employing teleworkers is comparatively small in the construction sector (10%). Not surprisingly, our findings suggest that larger companies employ teleworkers slightly more often than smaller companies (Figure 5.10.). Teleworkers are more common in companies with advanced ICT systems (see Figure 5.11.), whereas isolated use of computers obviously reduces teleworkers' employment. And, not surprisingly, hiring teleworkers is the most common employment form among companies organised according to the adhocracy model (33%).

Figure 5.9. Telework by industrial sector

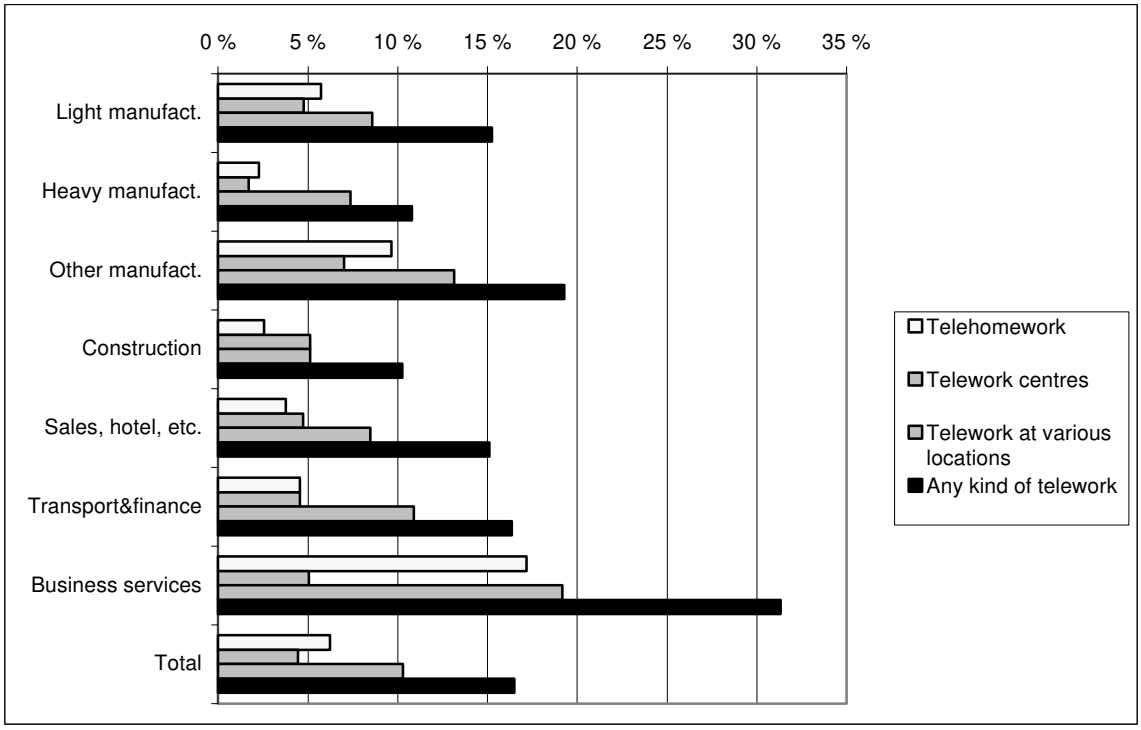


Figure 5.10. Telework by ICT system

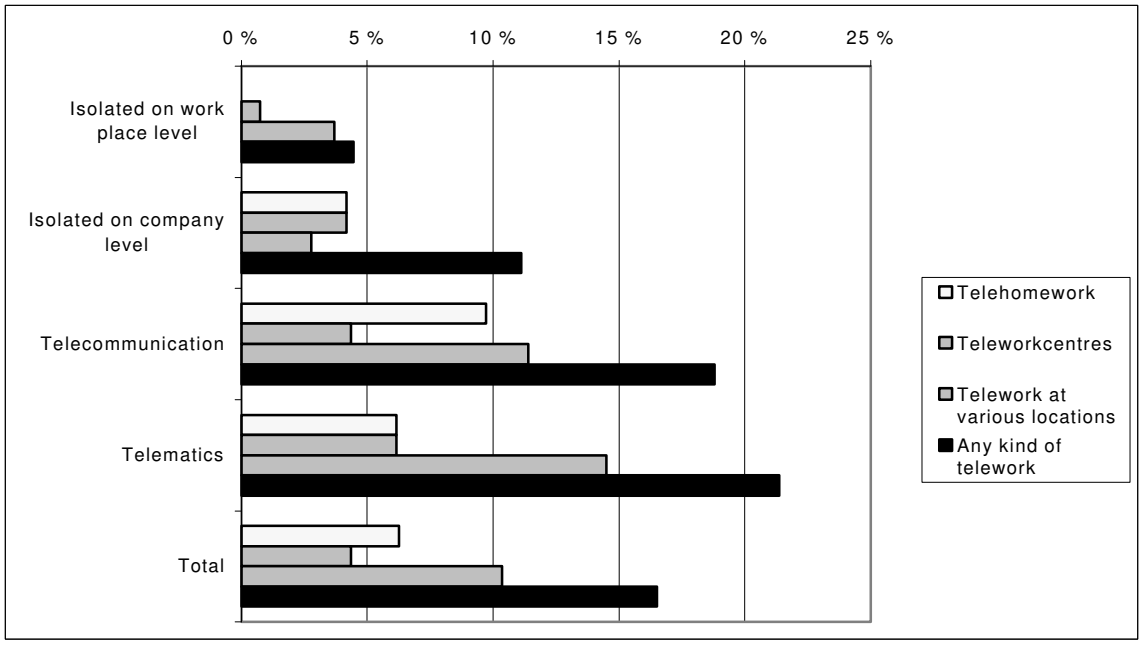
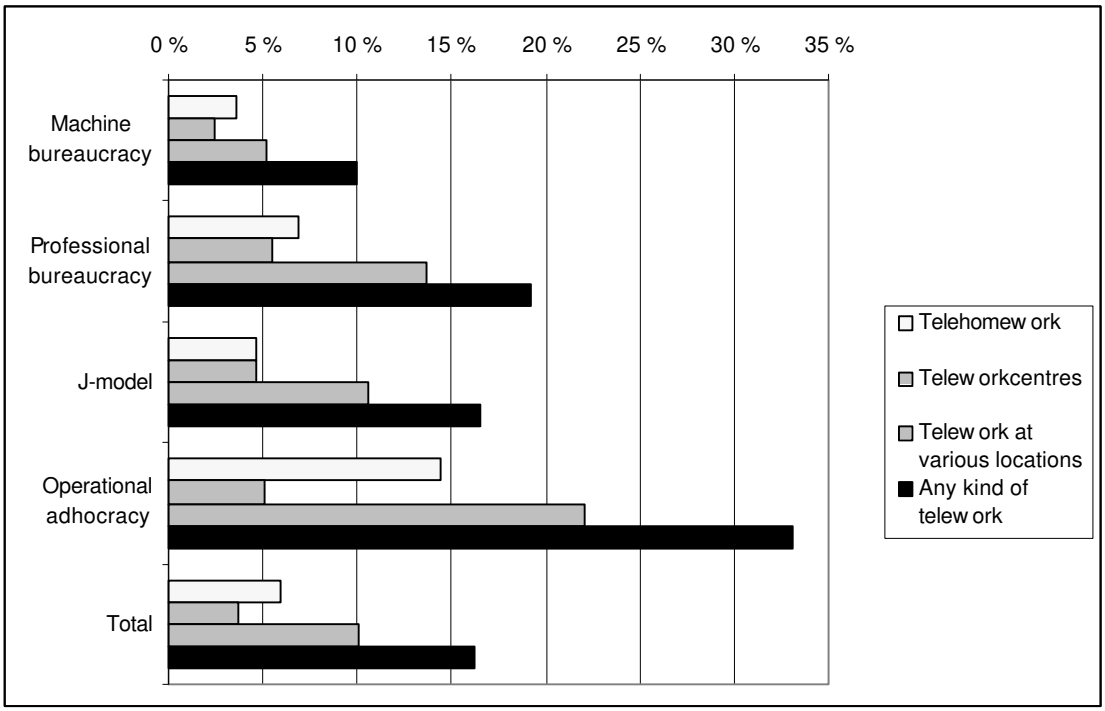


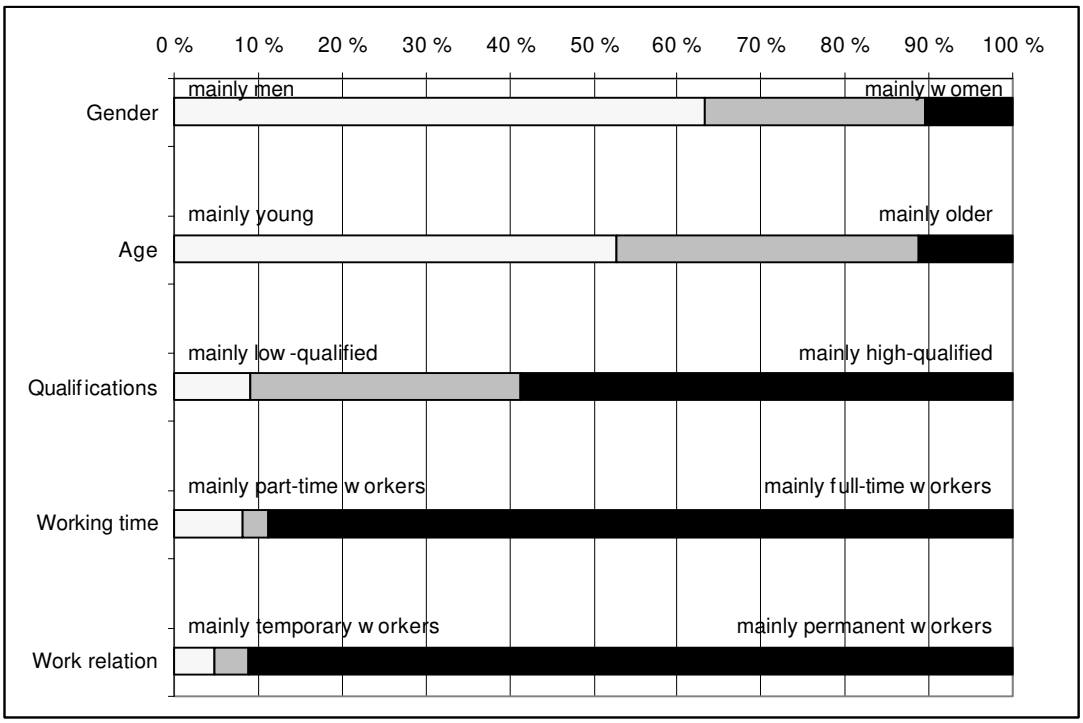
Figure 5.11. Telework by organisation forms



On average, the share of teleworkers of all employees in companies applying telework is 17%. However, there are differences concerning the type of telework. Telework at various locations involves 20% of the workforce, work in telework centres involves 12 % of the employees, and telework at home only involves a small minority of workers.

In Figure 5.12., we can see the distribution of teleworkers by gender, age, qualification, working time, and work relationship in total. Telework cannot be seen as precarious work, since in approximately 90% of the companies, telework is associated with permanent work relations and full-time work. Teleworkers are predominantly men, highly qualified and young, but in about one third of the companies, teleworkers are equally spread regarding gender, age, and qualifications.

Figure 5.12. Teleworkers by gender, age, qualifications, working time and work relationship

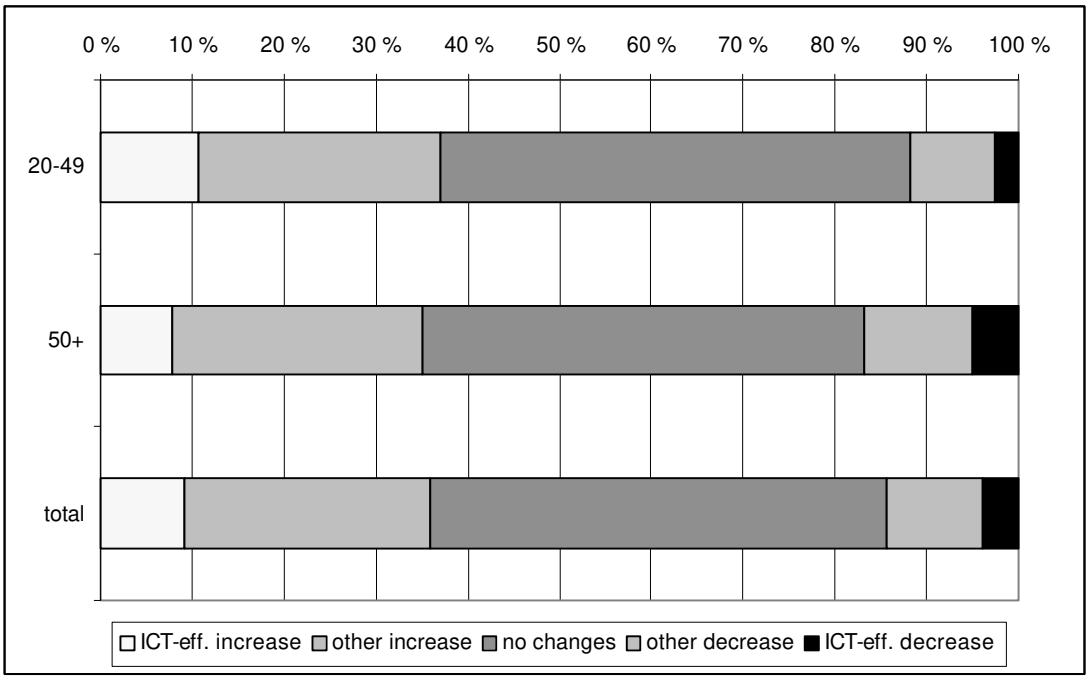


5.3. Employment change

The number of employees was rather stable in half of the companies during the past five years (1995-1999). In 36% of the firms, employment increased by at least 20% during the time period, and 14% of all companies reduced their workforce by the same margin. In both cases of employment changes, only about 25% of the companies assessed the application of modern ICTs as an important facilitating or supporting factor.

Employment has changed less often in small firms, but small firms rather than large firms have more often increased their staff by a 20% margin at the minimum (see Figure 5.13.). While the use of modern ICTs seems to stimulate employment in small companies, it seems to contribute more often to the downsizing of the workforce in larger companies. More than 30% of the small companies with increasing employment and 25% of the small companies with decreasing employment associated the employment change with the use of modern ICTs. Larger companies, on the other hand, relate the use of ICTs more often to the decrease (29%) than to the increase in employment (25%).

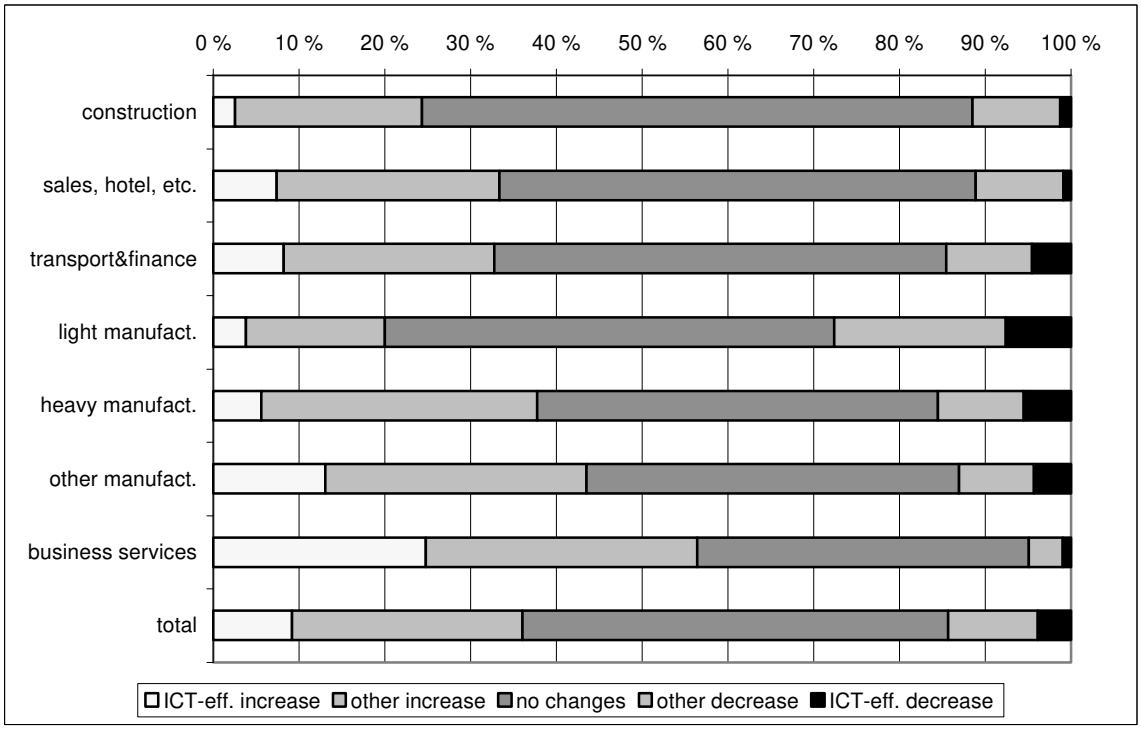
Figure 5.13. Employment change by company size



$\chi 2 = 6.7$, df= 4, p= 0.150

Employment has been more stable in companies in the construction industry, in the sales & hotel sector and in the transport & finance sector (see Figure 5.14.). The greatest share of companies that have increased their personnel by at least 20% can be found in business services (more than 50% of the companies). In the business services sector, ICTs are seen more often as a facilitating or supporting factor of the employment growth than in other sectors. In this sector, 44% of the expanding companies have stressed the importance of modern ICTs in this respect. Also, companies in heavy manufacturing and in other manufacturing have increased their personnel quite often by at least 20%, while 1/3 of the companies in the light manufacturing sector have downsized their personnel by the same margin. Among the latter, about 25% stressed the enabling role of ICTs.

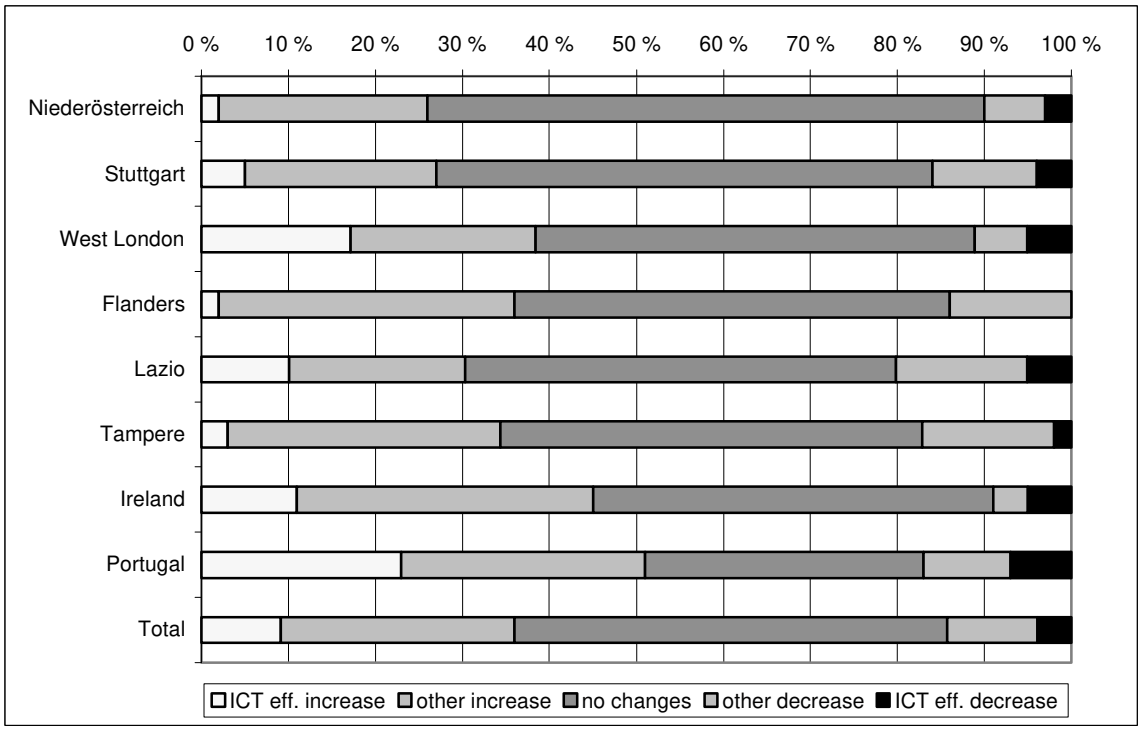
Figure 5.14. Change in employment by sector



$\chi 2 = 80.5$, df= 24, p= 0.000***

As can be seen in Figure 5.15., the share of companies with an employment growth of more than 20% during the past five years is the largest in Portugal (51%) and about half of the companies (45%) relate the increase to the use of modern ICTs. The share of expanding companies that associate their employment increase with the use of modern ICTs is also comparatively large in the Republic of Ireland and in the West London area. On the other hand, the share of companies that have downsized their personnel by at least 20% is the biggest in Lazio, and 1/4 of them explains the employment change by referring to modern ICTs. Companies in Portugal, the Tampere region and the Stuttgart area have also reduced their personnel by at least 20% more often than those in other regions.

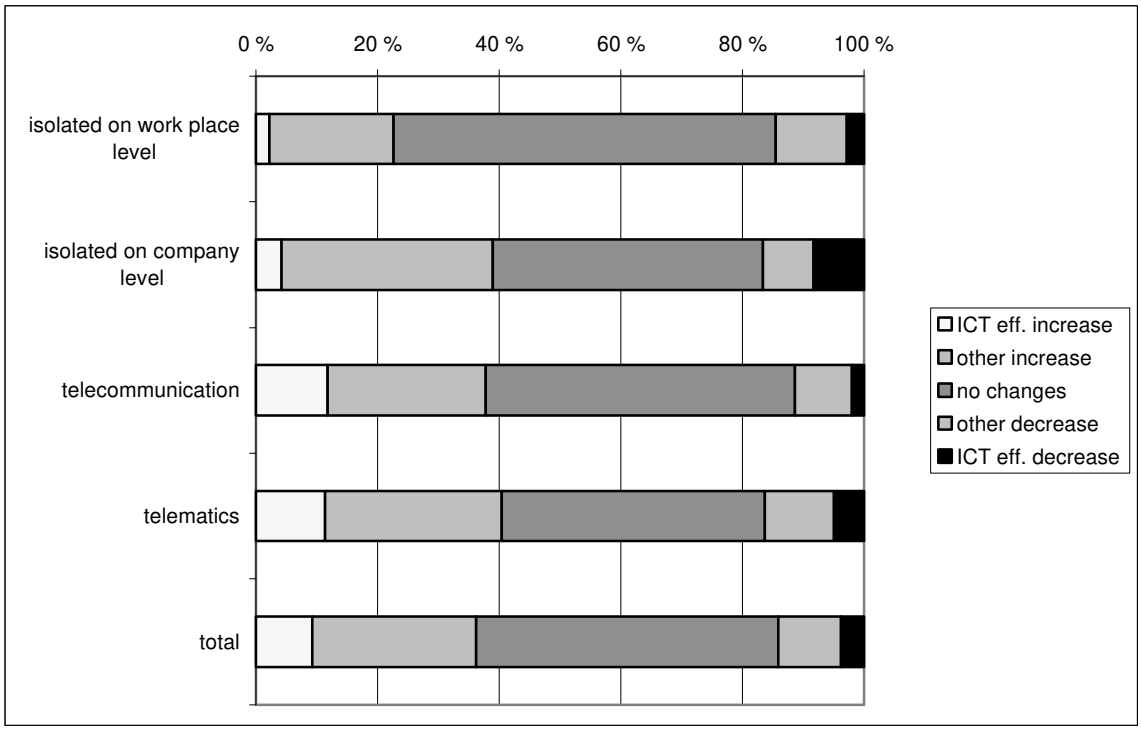
Figure 5.15. Change of employment by region



$\chi 2 = 87.0$, df= 28, p= 0.000***

Figure 5.16. shows that employment has changed the least in companies with totally isolated ICT systems. The decrease in employment is most often associated with the implementation of modern ICTs in companies with no external technical connection. Here every second company that has reduced employment considers ICTs as a causal factor. On the other hand, in about 30% of the companies with telecommunication or telematic systems, the ICT system is seen as the decisive factor that has contributed to an increase in the labour force.

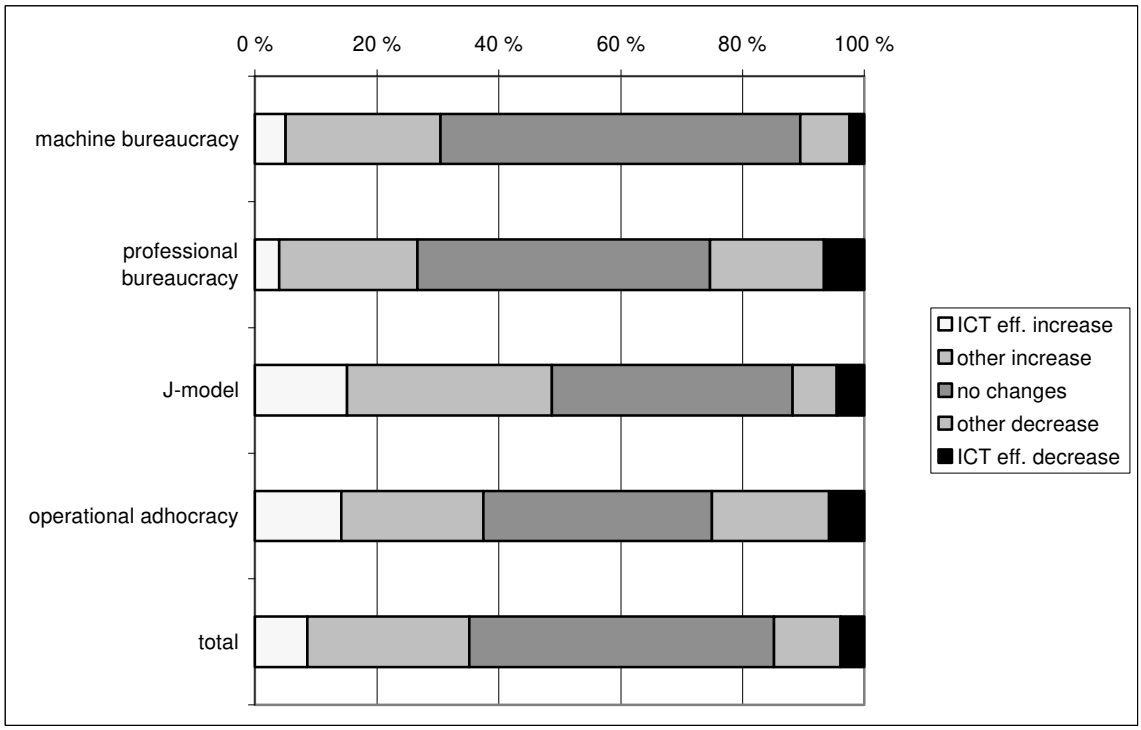
Figure 5.16. Employment change by ICT system



$\chi 2 = 33.4$, df= 12, p= 0.001***

Half of the companies organised according to the J-model organisation form have increased their employment, of which about a third related this to the application of ICTs (Figure 5.17.). Employment growth is second highest in companies with operational adhocracy, and among them, about 40% consider ICTs as an enabling factor. Every fourth of the companies with professional bureaucracy or operational adhocracy has reduced employment by more than 20%, and about a quarter of these companies consider ICTs as a causal factor.

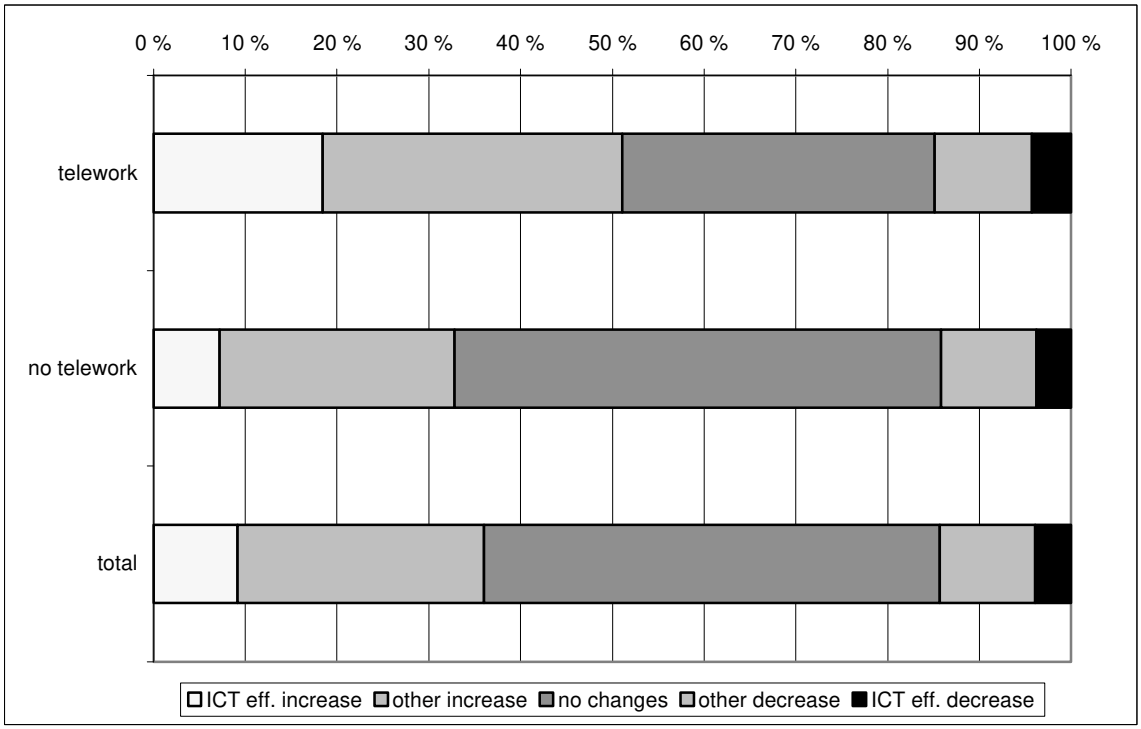
Figure 5.17. Employment change by organisation forms



$\chi 2 = 57.3$, df= 12, p= 0.000***

The use of telework also seems to be intensely related to the changes in employment (see Figure 5.18.). The share of companies having reduced employment is about the same with and without teleworkers, but over half of the companies using telework have increased their employment by 20% during the past five years. A total of 36% of the companies relate this increase to the implementation of ICTs.

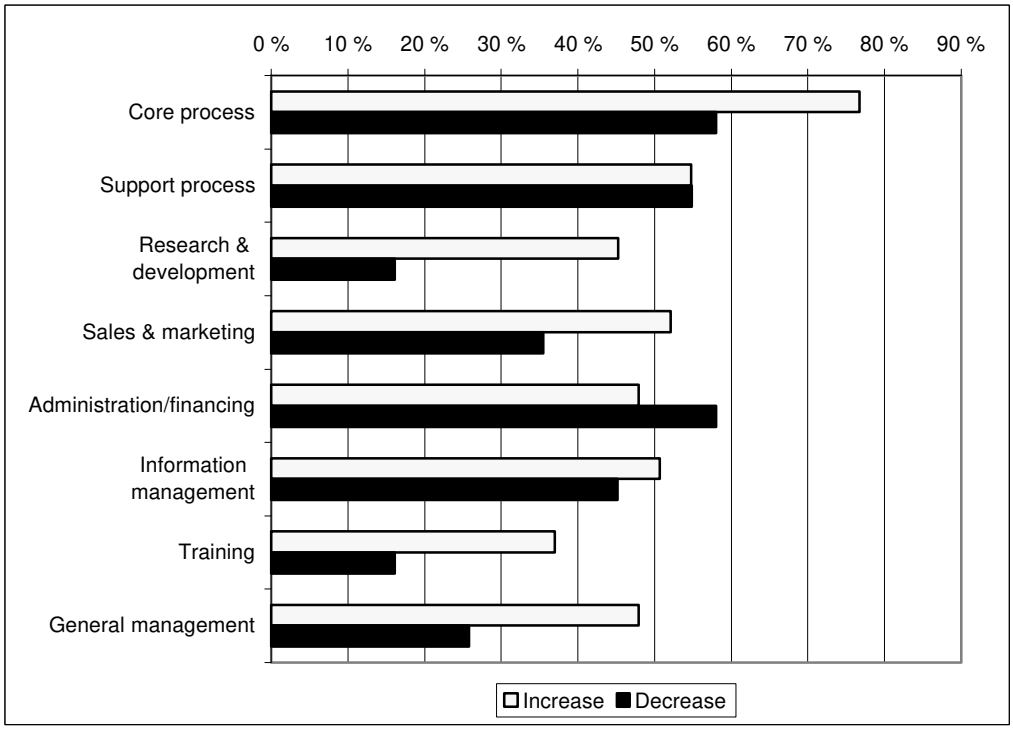
Figure 5.18. Employment change by use of telework



$\chi 2 = 26.7$, df= 4, p= 0.000***

Companies that relate employment changes to the application of modern ICTs see their core processes particularly affected (see Figure 5.19.). Nearly 80% of them associate the increase in employment and about 60% associate the decrease in employment in core processes with the application of ICT. In this group, at least every second company also associates the increase in employment in support processes, in sales and marketing and in information management, and the decrease in employment in support processes and administration/finance with the use of ICT. The decrease in employment in support processes and in administration/finance is more often associated with ICTs than the increase in employment in these areas. Concerning all other functions, the use of ICTs is more often associated rather with the growth than the decline in employment. Particularly, declining employment in training as well as research and development is hardly associated at all with the application of modern ICTs.

Figure 5.19. ICT-related employment change in different departments or functions



As can be seen Figures 5.20. and 5.21., among companies relating changes in employment to the use of modern ICT, the majority sees mainly male workers affected. This relates to both the increase and decrease in employment. Concerning the age, the majority of these companies associates the increase in employment with younger workers and the decrease in employment with other workers. The number of highly qualified workers was seldom reduced in these companies, but over half of the companies having increased employment had hired especially highly qualified workers. The increase and decrease in employment has more often affected permanent and full-time workers than temporary and part-time workers.

Figure 5.20. ICT-related employment growth by types of affected workers

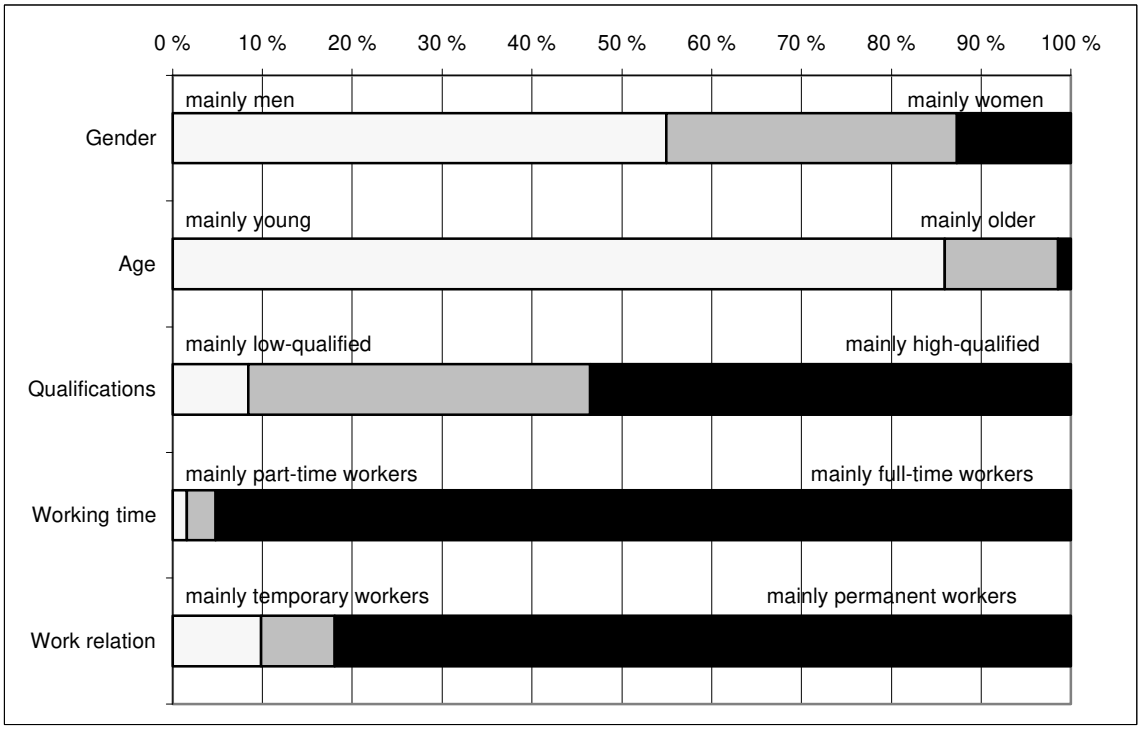
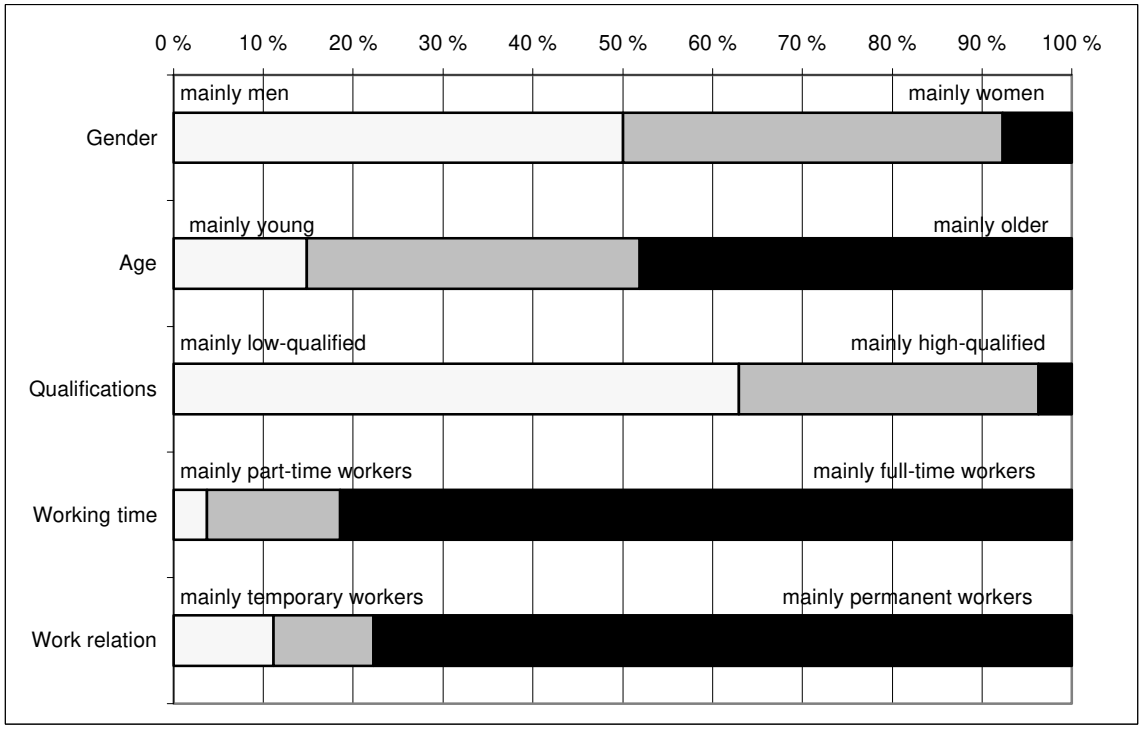


Figure 5.21. ICT-related employment reduction by types of affected workers



6. MANAGERS' STATEMENTS CONCERNING THE SOCIAL CONSEQUENCES OF MODERN ICTS

We asked managers to give their opinion on possible social consequences related to the widespread use of modern ICTs (Figure 6.1.). It is interesting to mention that the managers' opinions do not differ significantly concerning almost all statements whether we look at firm size or industry they come from. However, as will be shown later, managers from various regions have quite different views in this respect.

We will first discuss how managers assess the impact of modern ICTs concerning the development of the labour market and job opportunities for various groups of workers. Managers do not express great hope in that ICTs will provide an extensive number of new jobs. About 40% of them disagree with the statement that ICTs will create more jobs than destroy, while even less than 10% strongly agree with the statement. The argument that modern ICTs mainly create routine jobs for low-skilled workers, on the other hand, is opposed to by the majority of the managers. We can assume that the managers associate the creation of skilled jobs with the emergence of the information society in the first place.

A great majority of managers is convinced that ICTs increase disabled people's access to employment. Their opinion may be influenced by the fact that telehomework is becoming more common, which may give disabled people a better change to get jobs. The widely held view of ICTs threatening older workers' jobs is not shared by the majority of managers; however, a minority of them (45%) agrees with this statement. Only 40% of all managers are of the opinion that modern ICTs will offer better job opportunities for women. On the other hand, there is a minority of managers (about 35%) that does not associate the widespread use of modern ICTs with better job opportunities for women.

We will now discuss the managers' opinions on organisational consequences related to the introduction of modern ICTs. The argument that the benefits of modern ICTs do not come from the technology itself but from the organisation forms in which it is embedded is widely accepted by them; more than 80% agree with this statement. This means that the managers do not take the view of technological determinism; instead, they seem to interpret the introduction of modern ICTs

more as a strategy to support and enable the development of new and possibly more flexible organisation forms.

It seems that the majority of managers are of the opinion that major organisational changes related to the introduction of modern ICTs have already occurred. At least about 60% of them disagree with the statement that until now the implementation of ICTs has had few repercussions on the organisation of the company. On the other hand, the majority (58%) also holds that, in the near future, one can expect major organisational changes taking place in the companies due to the introduction of ICTs.

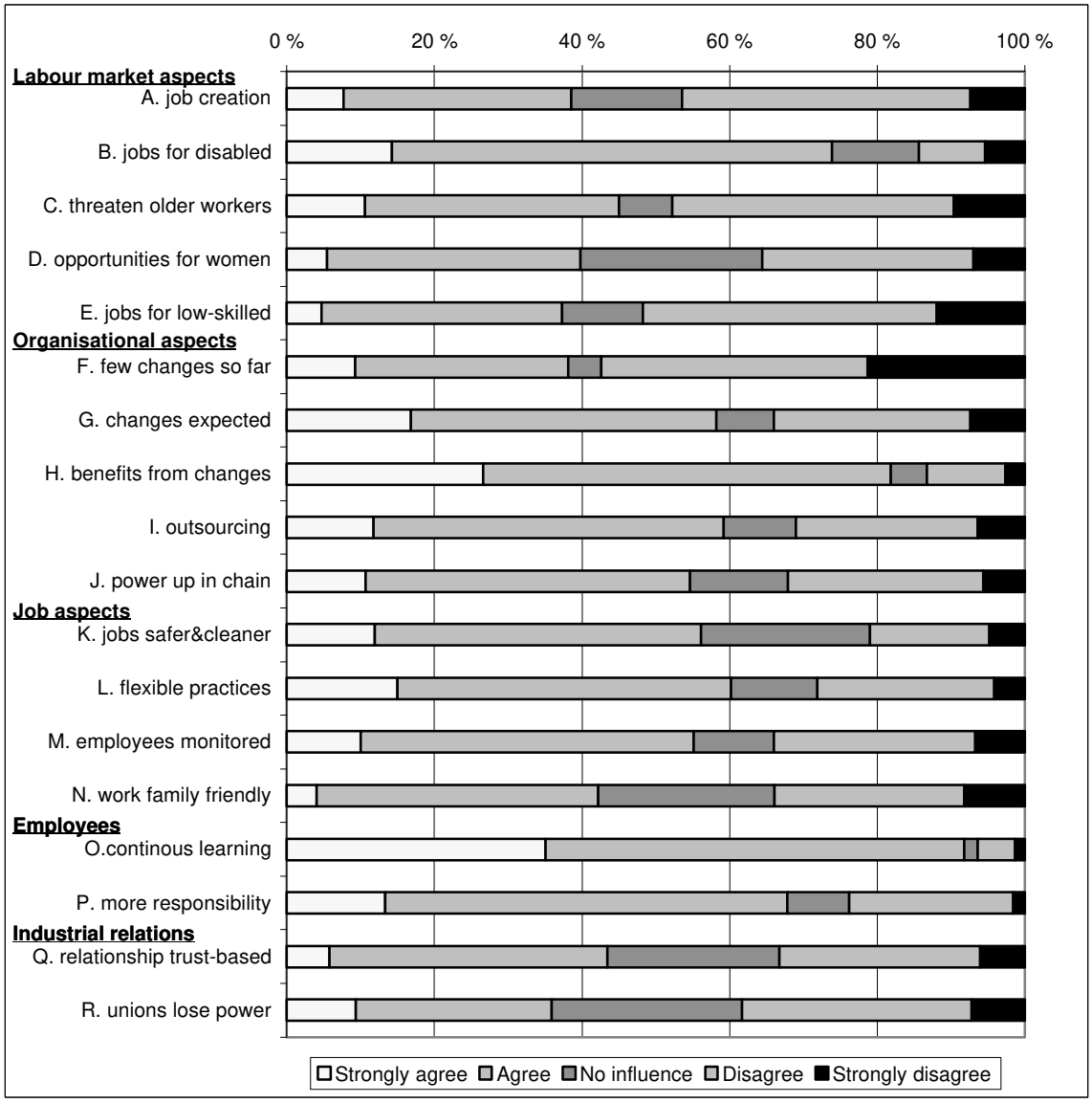
One type of the organisational changes often associated with the introduction of modern ICTs is the outsourcing and/or delocation of business functions and activities. A majority of the managers seem to share the view that outsourcing is supported by modern ICTs (59%). They also support the argument that ICTs give more power to large companies higher up the supply chain (55%).

In general, managers are of the opinion that, due to applying ICTs, the quality of jobs will improve. About a half of all managers agree with the statement that the use of ICT makes jobs safer and cleaner, while only about 20% of them disagree. And strong disagreement is expressed by less than 5%. Managers are generally not convinced that modern ICTs will make jobs more family-friendly. In fact, most of them do not agree (63%) with this idea, whereas less than 30% express their doubts.

An overwhelming majority of the managers agrees with the statement that ICTs increase employees' need for continuous learning. The share of positive answers exceeds 90%, and more than 35% of them strongly agree with this argument. Furthermore, two out of three managers assume that modern ICTs will give workers more responsibility. The share of the managers disagreeing with this argument is about 25%. But they also admit that ICTs can and will be used to monitor employees more precisely and continuously. At least about 55% of managers agree with this view, whereas only about 35% express their disagreement. That ICTs will increase the need for more flexible work practices and labour contracts is the opinion of about 60% of all managers. Among them, a little less than 30% strongly support this argument. Still, the result is somewhat surprising because the view that modern ICTs will increase the need for more qualitative as well as quantitative flexibility is widely expressed in the literature.

Surprisingly, the managers see industrial relationships as less affected by the introduction of modern ICTs than is often argued in the literature. Only a minority of about 45% of all managers agrees with the statement that, due to ICTs, the relationships between managers and workers become more trust-based. The share of managers that see the power of trade unions reduced in the emerging information society is even lower (about 35%), while nearly 40% disagree with the statement.

Figure 6.1. Evaluation of statements



The statements are shortened in the figure. For complete statement clauses, see Appendix 4.

Major deviations from the general opinions expressed in the statements by regions are presented in Table 6.1. As it shows, managers in Flanders are more sceptical about the potential of modern ICTs in creating than destroying more jobs than managers in other regions. They are also more

sceptical about the potential of modern ICTs to increase disabled people's access to employment, which view their colleagues in the Stuttgart area and in Niederösterreich share. On the other hand, managers in Portugal, the Republic of Ireland and the West London area are more optimistic in this respect.

Managers in the Republic of Ireland and the West London area see the jobs of older people less often as threatened by modern ICTs than managers in other regions; their colleagues from Portugal and from the Stuttgart area and the Tampere region, on the other hand, seem to be less optimistic in this respect. Managers from the West London area together with their colleagues in the Stuttgart area and in Niederösterreich are also more optimistic, as the potential of modern ICTs to provide more job opportunities for women is discussed. This optimism is not so widespread among managers in Flanders and in the Tampere region. Whether the jobs created in the information economy are mainly of a routine nature, and therefore suitable for low-skilled workers in particular is disputed. Managers in the Republic of Ireland and the West London area share this view more often, whereas their colleagues in Flanders, the Stuttgart area and the Tampere region disagree with this statement more often.

Managers in Niederösterreich and in the Tampere region more often share the view that modern ICTs have so far not changed their business organisations significantly. Their colleagues in Portugal, the Republic of Ireland and the West London area, on the other hand, seem to assess that the organisational changes facilitated and supported by ICTs already taken place are rather far-reaching.

Managers in Lazio and in Portugal expect more often major organisational changes to emerge in the near future caused by the widespread use of modern ICTs than their counterparts in other regions. Their colleagues in the Tampere region, on the other hand, seem to expect less often dramatic changes in companies' organisation structures to emerge in the information society. There seems to be no differences in the managers' opinions on the statement that the benefits of ICTs come from organisation restructuring and not from the technology itself. Managers in Lazio, Niederösterreich, Portugal and the Stuttgart area more often share the view that the use of ICTs increases the externalisation and/or delocation of economic activities, whereas in the Republic of Ireland and the West London area managers agree with this statement less often. The statement that ICTs will give more power to larger organisations higher up the supply chain is assumed more often by managers

in the Republic of Ireland, Portugal and the West London area , whereas managers in the Tampere region seem to be less convinced about this statement.

Whether modern ICTs will make jobs safer and cleaner is obviously less clear. Managers in the Tampere region and the West London area agree more clearly with this statement than on average and less than their colleagues in Flanders and in the Stuttgart area. In Niederösterreich and the Republic of Ireland, they associate modern ICTs more often with flexible work practices, whereas their counterparts in Flanders are less often convinced that modern ICTs will initiate and support more flexibility in working life.

Whether the widespread use of ICTs will contribute to close and intensive control practices within companies is disputed as well. Managers in Niederösterreich and in the West London area seem to support this view more often, whereas their colleagues in Flanders and the Tampere region associate modern ICTs less often with intensive and continuous control of employees. The potential of modern ICTs to create a more family-friendly work situation is assessed more often positively by managers in Portugal and the West London area, whereas their colleagues in Flanders and in the Tampere region seem to be more sceptical in this respect.

There is widespread agreement among managers in all regions that the introduction of modern ICTs will increase the need for continuous learning. Here the share of positive assessments is the biggest in the Stuttgart area and in the Tampere region. A view according to which workers will get more responsibility due to modern ICTs, which is often expressed in the literature, is shared by managers from companies in Niederösterreich and the Tampere region in particular, whereas their colleagues in Lazio and in the West London area in general seem to be more sceptical in this respect.

The managers in Niederösterreich, in the Tampere region and in the West London area agree more often on the idea that due to ICTs the relationship between management and workers become more trust-based, whereas their colleagues in Flanders and in the Stuttgart area doubt this. A view according to which the unions will lose power in the emerging Information Society, also often expressed in the literature, is widespread among managers in Niederösterreich and in Portugal. On the other hand, their counterparts in Flanders and the West London area agree with this view less often.

Table 6.1. Major deviations in evaluation of statements by region

	Flanders	Lazio	Nieder-österr.	Portugal	Ireland	Stuttgart	Tampere	West London
	Labour market aspects							
	ICTs create more jobs than they destroy							
Agree (33%)	—				(+)			(+)
Disagree (33%)	(+)	—	+		—	(+)		
	ICTs increase the accessibility of employment for disabled people							
Agree (64%)	—		(—)	+	+	—	(+)	+
Disagree (12%)	+	(—)	+	(—)	(—)		(—)	
	ICTs threaten the jobs of older workers							
Agree (42%)				(+)	—	(+)	(+)	—
Disagree (44%)		—		(—)	+		—	+
	ICTs offer more job opportunities for women							
Agree (36%)	—		+			+	—	+
Disagree (32%)		(—)				(—)	+	
	ICTs create new routine jobs for low—skilled workers							
Agree (33%)	—				+	—	—	+
Disagree (46%)		—	+	—	—	+	+	—
	Organisational aspects							
	So far, the implementation of ICTs has had few repercussions on the organisation of companies							
Agree (36%)			+	(—)	(—)		+	(—)
Disagree (55%)		(—)	(—)	(—)	+	(+)	—	(+)
	In the near future, major organisational changes in the company will occur due to ICTs							
Agree (55%)	(—)	+		(+)			—	
Disagree (32%)		—	(+)	—			+	
	The benefits of ICTs come from organisation restructuring, not from the technology itself							
Agree (75%)	—						(+)	
Disagree (12%)			(+)					
	The use of ICTs increases externalisation and/or delocation of activities							
Agree (52%)	(—)	+	+	+	—	+		—
Disagree (27%)	(—)	—		—	+	—		+
	ICTs give more power to large organisations higher up the supply chain							
Agree (45%)		(—)		+	+		—	+
Disagree (27%)	(—)		+	(—)			+	
	Job aspects							
	ICTs make jobs safer and cleaner							
Agree (49%)	—		(—)	(+)		—	+	+
Disagree (18%)		—	+		(—)	+	(—)	(—)
	ICTs increase the need for flexible work practices and labour contracts							
Agree (54%)	—	(—)	+		+	(+)	(+)	(+)
Disagree (25%)	+	(—)		(—)			(—)	
	Employees are monitored more precisely and continuously through ICTs							
Agree (51%)	—		+				—	+
Disagree (31%)	+	—		—			+	(—)

	Flanders	Lazio	Nieder-österr.	Portugal	Ireland	Stuttgart	Tampere	West London
	Due to the use of ICTs work becomes more family friendly							
Agree (37%)	—	(—)	(—)	+	(+)	(—)	—	+
Disagree (30%)			+	—			+	—
	Employees							
	ICTs increase the need for continuous learning*							
Agree (89%)		—				(+)	(+)	
Disagree (6%)								(+)
	Due to ICTs employees get more responsibility							
Agree (64%)	(—)	—	+			(+)	+	—
Disagree (22%)			(—)		(+)		—	+
	Industrial relations							
	Due to ICTs relationships between management and workers are becoming more trust—based							
Agree (38%)	—	(—)	+			—	+	+
Disagree (29%)			+				(—)	
	In information society the unions lose power							
Agree (28%)	—		+				+	—
Disagree (30%)			(+)	(—)	+			

The above percentages in parenthesis indicate how many of the managers agree or disagree with each statement in general.

(—) means that the share of managers in a region that agree or disagree with a specific statement is at least 5% smaller than the average
— means that the share of managers in a region that agree or disagree with a specific statement is at least 10% smaller than the average
(+) means that the share of managers in a region that agree or disagree with a specific statement is at least 5% bigger than the average
+ means that the share of managers in a region that agree or disagree with a specific statement is at least 10% bigger than the average

7. CONCLUSIONS

According to our first results, it is quite obvious that the companies in the eight European regions follow different paths into information economy. The differences start with the companies' orientation in implementing new ICTs. Companies in the Republic of Ireland, Niederösterreich and the West London area aim to use ICTs more often as a control device, whereas companies in Portugal and the Tampere region tend to emphasise the co-ordination and communication aspects of ICTs. In these two regions, companies understand and use ICTs as organisation technology and as network technology.

In Flanders, Lazio and Niederösterreich, companies have implemented relatively less advanced computer hardware and software applications as well communication technologies. On the other hand, companies in Portugal and in the Stuttgart area have automated their production processes quite extensively, and in the Stuttgart area the use of automated data connection (EDI) is widespread. These two regions are the most advanced users of ICTs. Companies in the Republic of Ireland, the Tampere region and the West London area have applied more communication technologies than companies in other regions.

The share of companies having restructured their organisation is the highest in Portugal, in the Stuttgart area and in the Tampere region. While companies in Flanders, Lazio and Portugal have focused on internal restructuring, external changes are more common in companies in Niederösterreich and the Stuttgart area. Companies in the Tampere region in particular have applied a systemic approach towards renewing their internal and external organisation concurrently.

Relationships between the applied ICT systems and forms of organisational restructuring are less obvious. We can, however, identify a more general trend: if companies apply less advanced ICT system, they are also active in changing their organisation structure. External changes, on the other hand, are linked with a more extensive application of communication technologies.

It might be possible that different regional strategies of applying ICTs and renewing organisation structures are related to regional differences in company type, market positions and the location of

customers. But all these background variables need to be investigated separately in the further analysis.

Social consequences associated with the use of ICTs seem to differ from region to region. It is quite obvious that ICTs are only one factor affecting skill needs or employment, for example. Surprisingly, we could not find a clear relation between the extensive application of communication technologies and the increasing demand for communication skills. Although companies in the West London area and the Republic of Ireland have applied communication technologies more than companies in other regions, they are not the first to stress the increasing importance of these skills and competencies. Instead, work process skills and entrepreneurship seem to be more important to them. In the Stuttgart area, the Tampere region and Portugal, communications skills and entrepreneurship are valued clearly higher than elsewhere.

About half of the companies have had changes in their employment during the past five years. But in the majority of cases the implementation or use of modern ICTs is not seen as a causal factor, neither in case of an increase nor a decrease in employment. Companies in Portugal, the West London area, the Republic of Ireland and Lazio seem to be more convinced that employment changes are caused by modern ICTs in particular.

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