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PRACTICES AND TRENDS OF TELEWORK IN THE PORTUGUESE INDUSTRY: THE RESULTS OF SURVEYS IN THE TEXTILE, METAL AND SOFTWARE SECTORS

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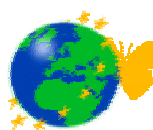
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Practices and trends of telework in the Portuguese industry: the results of surveys in the textile, metal and software sectors

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1 Introduction

The aim of the TeleRisk¹ Project on labour relations and professional risks within the context of teleworking in Portugal – supported by IDICT – Institute for Development and Inspection of Working Conditions (Ministry of Labour), is to study the practices and forms of teleworking in the manufacturing sectors in Portugal. The project chose also the software industry as a reference sector, even though it does not intend to exclude from the study any other sector of activity or the so-called “hybrid” forms of work. However, the latter must have some of the characteristics of telework. The project thus takes into account the so-called “traditional” sectors of activity, namely textile and machinery and metal engineering (machinery and equipment), not usually associated to this type of work. However, telework could include, in the so-called “traditional” sectors, other variations that are not found in technologically based sectors. One of the evaluation methods for the dynamics associated to telework consisted in carrying out surveys by means of questionnaires, aimed at employers in the sectors analysed. This paper presents some of the results of those surveys. It is important to mention that, being a preliminary analysis, it means that it does not pretend to have exhausted all the issues in the survey, but has meant that it shows the bigger tendencies, in terms of teleworking practices, of the Portuguese industry.

2 The concept of “Telework”

There are different definitions in the literature regarding the discussion of the concept of telework. However, there are some common elements within those definitions, from which it is possible to establish some kind of agreement.

Using those diverse theoretical contributions, we selected some ideas as points of reference. For the International Labour Organisation (ILO), telework is defined as “*all the work carried out from a certain place or away from offices or central locations, where the worker does not have personal contact with his/her colleagues, but may communicate with them using the new technologies*” (cf. Gbezo, 1995). Remote work usually refers to the work carried out away from the organisation in terms of space and time, being associated to the “computerisation of the office”. But, the term *telecommuting* is also used, and it refers to the fact of there being no need to travel to the usual work place. Within this context, commuting trips are questioned (home-work-home), since the technologies associated to computerisation of the office allow some of the workers to become potential teleworkers, carrying out their work at a distance, using their computer or other kinds of telecommunications (Olson, 1983).

For Huws *et al* (1990) as well, a pre-condition for the development of remote work, especially for telework, is the “computerisation of the office”. Ursula Huws refers to *elusive offices* (“not real” offices), which are organizations that control activities indirectly, by means of a network of contracts with small suppliers, with direct control of activities such as image projection, distribution or sales.

When expressions such as “office computerisation”, telecommuting and remote work are mentioned, some of the elements that make up the origin of the concept of telework are established.

The North-American author Jack Nilles, considered one of the founders of the concept of telework², defends that information technologies can substitute trips to work (commuting trips). The study made by Huws *et al* (1990), suggested that the definition of telework expressed by Nilles, based on substituting trips to work with telecommunications is not clear. The concept cannot be established only at the technological, organisational, contractual or location levels. In fact, telework is not a unidirectional or one-dimensional “phenomenon”, and cannot be defined only by one parameter.

“We define telework as work the location of which is independent of the location of the employer or contractor and can be changed according to the wishes of the individual teleworker and/or the organisation for which he or she is working. It is work that relies primarily or to large extent on the use of electronic equipment, the results of which work are communicated remotely to the employer or contractor. The remote communications link need not be a direct telecommunications link but could include the use of mail or courier services.” (Huws *et al*; 1990, p. 10)

Korte and Wynne (1996), in the TELDET³ project, started by trying to obtain a definition of the concept of telework. They used the definitions suggested by several authors (Olson, 1983; Gordon, 1987; Mullner, 1985; Maciejewski, 1987 and Huws *et al*, 1990) and put forward a definition of telework, based on the following elements:

- *Location of telework* – Location can follow three criteria:
 - Partial independence from location of company, employer, clients, etc.
 - Location chosen because it is near home of employee (temporary or permanent).
 - Location far from company, employer, client location, etc.
- *Use of ICT* – Two levels of usage of ICT can be defined:
 - Low level: telephone, computer, delivery of tasks and results by post (on diskette).
 - High level: telephone, fax, e-mail, PC or terminal connected occasionally or permanently to servers, delivery of tasks and results by means of telecommunications.
- *Types of organisation*
 - (a) Type of organisation of the company:
 - *(Re)location of activities*, that is, new geographical distribution between the activities of “*front office*” and “*back office*”. Teleworking means companies can re-think their organisation and their (re)location, in order to get benefits (low salaries, better working conditions, improved quality and efficiency).
 - *Outsourcing*, is an extension of (re)location and decentralisation of activities, but the department or service that is (re)located still belongs to the company.
 - *Micro-companies* or *one-man businesses*, do not demand large premises, since teleworkers work from home or share space in an office.
 - (b) The way the teleworkers are organised is related to the forms or types of telework.

In Portugal, the concept of telework has also been the subject of discussion in several scientific fields, mainly sociology, law and management. On the problem of (tele)work law (labour and legal implications) it is important to mention the study by Rui Fiolhais (1998), *Sobre as implicações jurídico-laborais do teletrabalho subordinado em Portugal* (On the labour and legal implications of dependent telework in Portugal). Also, the work carried out by APDT, the Portuguese association for the development of telework, namely the *Guia de boas práticas de teletrabalho* (Telework good practice guide) (by José Caramelo Gomes and Pedro Ortins Bettencourt) and *A Manual for the Tele-entrepreneur “The Office at Home”* (by Miguel Reynolds Brandão).

In the Green Book for the Information Society (1997), approved by the Portuguese Parliament under the organisation of the Mission for the Information Society⁴ that defined a national strategy for the processes of modernisation that could lead to the information society. In this *Livro Verde para a Sociedade da Informação*, telework is considered as “*a flexible form of work, covering different areas of activity, where the workers can carry out their functions from a distance, from home or a place of work (telecentre) during a certain amount of their working hours. Telecommunications and information technologies will increasingly become indispensable tools for the*

performance of remote work, breaking geographical barriers and leading to information sharing within a widespread electronic environment.” (p. 45)

The study by FUNDETEC (1998)⁵, which was one of the first to be carried out on this subject in a more systematic way in Portugal, defines the concept, based on three different elements:

- Distance – The teleworker is in a location that is geographically different from where the work is carried out and/or delivered;
- Technology – Use of computers and telecommunications (networks, equipment and applications/services) as support for telework;
- Structure – Agreement amongst participants (worker, employing company, client) that sets up and regulates labour terms (how) and working conditions

Telework can, thus, have different shapes, taking into account certain variables and organisational environments. Several authors and empirical studies indicate different types of telework (Olson, 1983; Korte and Wynne, 1996; Di Martino, 2001). Therefore, according to the study of Di Martino one can find different types of telework depending on the work location:

- *At home*: telework in the place of residence.
- Location nearer home than the traditional work place: “*neighbourhood centres*”, telecottages, satellite offices.
- Alternative work place: telecentres, “*touchdown*” centres (temporary work places, used occasionally, for short periods of time, mainly by mobile workers)
- *Call centres*: Places where telephone operators use automatic distribution technologies and computer/telephone integration, generally supplying several services such as telemarketing, telebanking, support to clients, sales, etc.
- Several locations and several timetables: *Mobile or nomadic work*
- Crossing countries and continents: *across-border teleworking* (those involved are located in countries that share a common border), *offshore teleworking* (work is transferred to places with low costs or less regulated work environments, usually geographically more distant).

It is important to stress that combinations of forms of telework are starting to emerge, such as telework at home with mobile telework, which means organising work becomes more complex.

For this author, the different definitions and classifications of telework are useful, but based on static visions of this new form of work. Since telework is an “evolving” phenomenon, it is important to observe its dynamics, in terms of evolution, technological content and time intensity.

The diagram shows how telework has evolved from the type of telework at home towards a variety of forms associated to the flexibility of the work space/location: *on-line*, away with a computer, or far from the traditional work place. In terms of usage of working time, this new form could be used full time, part-time or occasionally.

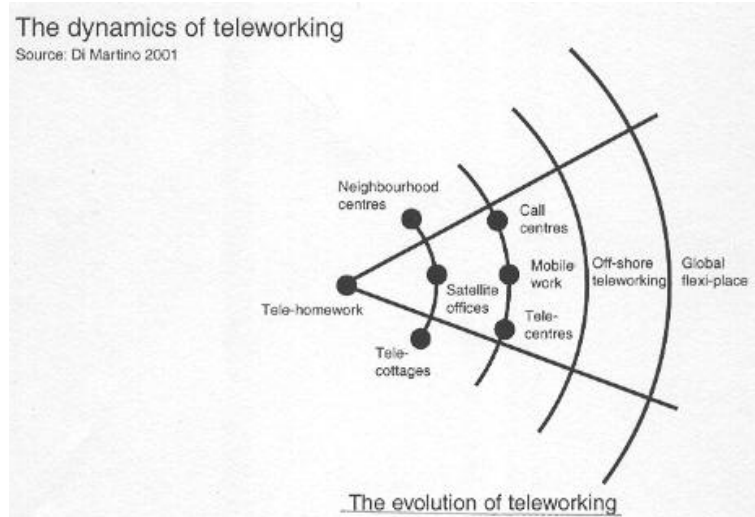


Figure 1 – Diagram of evolution of telework

The development of teleworking practices has followed a direction that does not necessarily imply teleworking at home (as many people still think...), but rather a progressive growth of forms of mobile telework. The geographical scattering of companies is translated into new needs and tendencies in the organisation of work, leading to the emergence of more flexible forms of organisation of workers, such as types of mobile work.

Some studies carried out in Portugal identify some organisational forms of telework. The FUNDETEC study (1998) takes into account the following: teleworker's home, teleworking centres, satellite offices, mobile telework, shared offices, *offshore* (across-borders or international telework). As for the types of telework, it could be: formal or informal, full-time, part-time, alternative (some days of the week) or occasional.

In her study for the Portuguese Ministry of Labour (IDICT), Sousa (1999)⁶ mentions four ways to implement telework: home, satellite centres, teleworking centres, remote working groups. According to this author, the most common type of telework, independently of its form of implementation, is alternating between the teleworker workplace and the company (called as "complementary telework").

Considering the variety of definitions surrounding the concept of telework, we think, as does Huws, that this concept has to be approached from different points of view. Therefore, we tried to think about them from as eclectic perspective as possible, in order to be able to understand the organisational, technological, legal and economic dimensions that we considered fundamental to put into perspective what can be considered telework.

3 Telework in the Textile and Shoe Manufacturing, Metal Engineering and Software Sectors.

3.1 Methodological Stages

The hypotheses we want to analyse in this paper are connected to specific fields of study, that is, sectors of economic activity. Therefore, we start from the principle that telework is not an intrinsic practice of the sectors related to the application, production and dissemination of information and communication technologies, such as the *software* sector. On the other hand, the so-called traditional sectors, such as textile, shoe manufacturing and metal engineering (machinery and metal equipment), can be subjected to new working practices due to the decentralisation of some stages in the production chain, resulting from an economic context affected by globalisation. In this sense, telework cuts across several sectors of activity, since, more than to a specific sector of activity, it is associated to certain functions or professions characterised by the processing, storage and dissemination of information.

The field of observation is limited to companies in the textile, shoe manufacturing, metal engineering and software sectors, in order to establish comparisons between an emerging sector of teleworking practices and so-called traditional sectors, also subject to those new forms of working.

The tool for observation and knowledge of the various possible configurations was the survey using questionnaires, as it means a “picture” that can be obtained of the global panorama of possible teleworking practices and/or the conditions for their implementation and development in companies. The survey using questionnaires is subdivided into four central types of analysis. In other words it consists of questions that focus on characterising the company, the clients, sub-contracted entities and the workers themselves. Initially, the questionnaire was subjected to a pre-test, so that some of the questions could be adjusted. Once the questionnaire was finalised and all corrections made, it was sent by mail.

The sampling process was complex and carried out in different phases (multi-stage sample), starting from the general, that is, all the Portuguese companies in the sectors to be studied (universe), to the specific, in other words, the “real” sample. That process was based on the survey of the Department of Statistics of the Ministry of Labour on the employed labour force (data referring to the year 1999), which means, was based on a large list of companies.

Of the different types of random samples it was decided to use a stratified sample, in as much as it meant that firms could be divided into groups or sub-sectors of activity. Initially was large sectors (subsections of the Classification of Economical Activities, or CAE in the Portuguese version) related to textiles, shoe manufacturing, metal engineering (machinery and metal equipment) and software and, then, to sub-sectors of activity (CAE with three digits). However, for the metal engineering sector this process became difficult since in terms of CAE it is a very heterogeneous and vast sector. Therefore, it was decided to use a database belonging to the Bank of Portugal (1999) concerning the investment in the various sub sectors of activity. This way, the basic criterion for choosing the sub-sectors in the metal engineering sector was investment, as it was required that the sample consisted of companies with technological innovation and possible teleworking practices and/or conditions for their implementation and

development. As from the start the companies with large investments are normally those that gather the conditions required by teleworking practices, such as investment in ICT. After defining the sub sectors of activity related to the textile, shoe manufacturing, metal engineering and software sectors, a sub-sample of companies with more than 20 employees was selected randomly for each level, forming a total sample of 338 firms. Of the 1023 questionnaires sent by post with the aim to reach the desired sample of 338 firms, 149 questionnaires were obtained. Considering the reduced amount of replies (15%), the variability in each level and the large difference between sample and universe, the data will not be extrapolated to the population but to the desired sample, so that there is no bias. It will just not be so accurate.

3.2 Company characterisation

The sector of activity is a variable of central characterisation in every study, as some comparisons can be made using it as a starting point. However, other characterisation indicators are also studied.

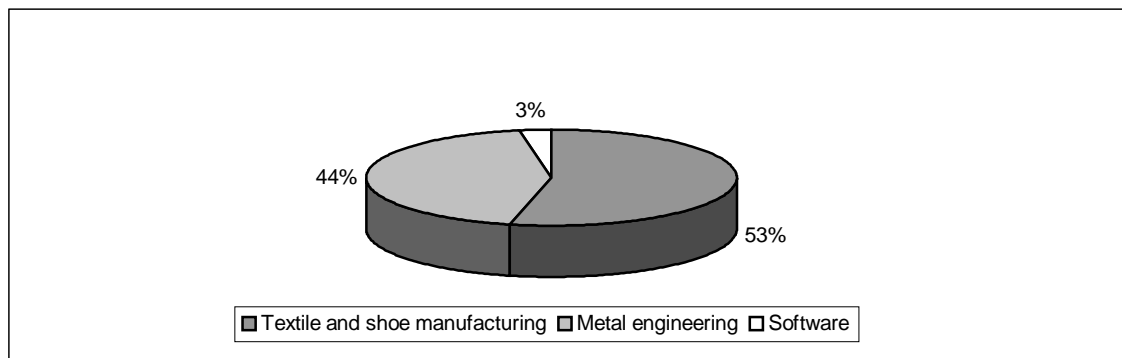


Figure 2 – Percentage of firms in the textile, shoe manufacturing, metal engineering and software sectors

Of the 149 firms in the sample, most belong to the textile and shoe manufacturing sectors (53%), a large part belongs to the metal engineering (machinery and equipment) sector (44%) and a very small percentage belongs to the computer and software sector (3%)⁷. The differences in percentages of the amount of companies in each sector will be taken into consideration, as it is a variable present in all studies.

As for the size of the companies in each sector of activity, most of them are SMEs, with no differences between sectors. On the other hand, in what concerns legal matters, the firms are mostly private limited companies, even though public limited companies were the majority in the software sector.

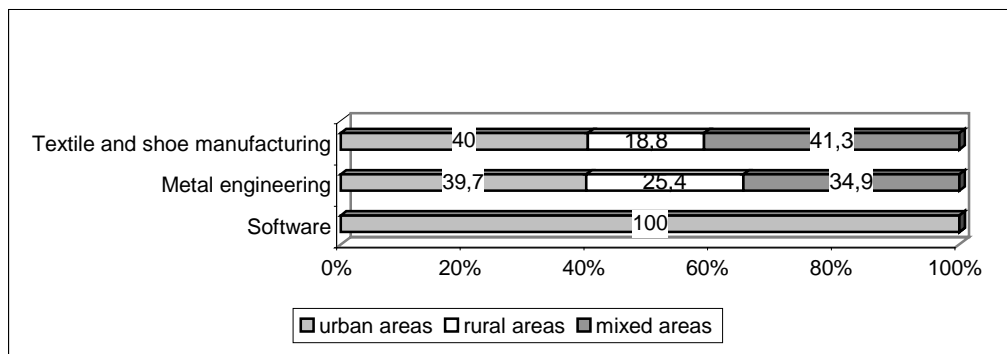


Figure 3 - Geographic location of the firms in the different sectors of activity

In terms of geographic location most of the firms are located in urban areas, especially those in the software sector, as all the companies in the sample for that sector are in urban areas. However, in the textile and shoe manufacturing sector, apart from 40% of the companies which were also found in urban areas, 41.3% of the firms are in mixed areas. The same happens in the case of the metal engineering sector, as in spite of the fact that 39.7% of the firms are located in urban areas, a similar percentage, 34.9% is found in mixed areas.

Most of the companies in the different sectors do not have other units or establishments. However, of the 22 firms that stated they had other units or establishments, 59.1% are in the metal engineering sector and 36.4% in the textile and shoe manufacturing sector. In which case, it is in these so-called traditional sectors that there is a decentralisation of the companies units.

The business network has similar characteristics in each of the sectors of activity, without any significant differences. Even though the metal engineering sector is over represented and the software sector under represented, it can be concluded that the firms in the different sectors of activity are mainly SMEs and private limited companies, except the software companies which are mainly public limited companies. In geographical terms, the companies are located in urban areas, even though the firms in the so-called traditional sectors (textile, shoe manufacturing and machinery and equipment) also tend to be found in mixed spaces. It is still in the so-called traditional sectors that there is a decentralisation of production activities.

The characterisation of businesses network is similar in the so-called traditional sectors, not too different from the metal engineering sector.

4 Indicators of forms of telework

The concept of telework has been the subject of several thoughts and discussions by different authors, as mentioned before. However, putting this concept into practice requires a wide perspective that comprises the variety of situations and the different dynamics associated to this form of work, because, as mentioned by Di Martino (2001) we are facing a phenomenon in constant movement and evolution. According to the same author, it is therefore important to observe the dynamics of telework in terms of space/work place, time intensity and technological content.

For Korte e Wynne (1996), besides the location of the work place, and the use of information and communication technologies, other important indicators are types of organisation, that is, the way the workers are organised and the way the company is

organised, such as: (re)location of activities, that is, geographic distribution between “front office” and “back office” activities, outsourcing, micro-firms or one-man businesses.

Apart from these, other authors study the model of analysis of this phenomenon, in as much as putting into practice the concept of telework revolves around different factors and analysis indicators from which it is possible to identify the practices and dynamics of telework.

4.1 Networks of clients, sub-contracted entities and mobile workers

The way the organisation of the company is set up with respect to the relationship it establishes externally, namely with its clients and sub-contracted entities emerges as an “indirect”, but important indicator of the dynamics of telework.

Within a context of globalisation and de-centralisation of activities, the workers need to move away from the company or even to work at the premises of the clients or sub-contracted entities, that is in a geographically distant location, resorting to computers and telecommunications in order to be “connected” and in touch with the company, which may be, occasionally, a part-time situation or a full-time situation.

Table 1 – Average of clients and sub-contracted entities according to sector of activity

Sectors of Activity	Clients		Sub-contracted Entities	
	Average	N	Average	N
Textile/Shoe Manuf.	3 [11; 20[	80	2 [2; 5[	69
Metal engineering	4 [plus 20[	65	2 [2, 5[	59
Software	4 [plus 20[	4	3 [6; 10[	3
Total	4 [plus 20[	149	2 [2; 5[	131

The 149 companies in the sample have on average more than 20 clients, showing a wide network of clients from the start. However, the metal engineering and software sectors are those with a wider network of clients. The textile and shoe manufacturing sector is the one that has on average a more limited client base, between 11 and 20 clients, even though in terms of percentage, 63.8% of the companies in this sector declare they have more than 20 clients.

As for the sub-contracted entities, the 131 companies that answered that question sub-contract on average between 2 and 5 entities, namely the companies in the textile and shoe manufacturing sector and those in the metal engineering sector. On the other hand, the software sector is the one that has more sub-contracted entities, on average 6 to 10.

Comparing the different sectors, with respect to the network of clients and sub-contracted entities, it can be concluded that this network tends to be wider in the software sector, followed by the metal engineering sector, with a more limited network in the case of the textile sector. Taking into account the client network and sub-contracted entities as an important indicator of the development of telework practices, in as much as it might imply commuting or work mobility to a location different from the usual work place, as well as communication at a distance using information and communication technologies, it is in the software and metal engineering sectors that teleworking practices will emerge, due to the vastness of the network of strategic players.

The existence of mobile workers is in itself a “direct” indicator of telework, due to the mobility associated to the activity of these workers, which is carried out in different locations, at any moment and supported by ICT.

Table 2 – Existence of mobile work according to sector of activity (N and %)

Sectors of Activity	Mobile Work		Total
	Yes	No	
Textile/Shoe Manuf.	51 65.4%	27 34.6%	78 100%
Metal engineering	52 80%	13 20%	65 100%
Software	4 100%	0 0%	4 100%
Total	107 69.7%	40 30.3%	147 100%

Of the 147 companies that answered this question, 69.7% mentioned they had mobile workers. It should be noted that all the companies in the software sector that are part of the sample declare they have mobile workers in their companies. In the metal engineering sector, the percentage of companies with mobile workers is also significant, about 80%, whereas in the textile and shoe manufacturing sector that percentage is smaller, that is, 65.4% of companies.

Table 3 – Average number of mobile workers per sector of activity

Sectors of Activity	Average	N
Textile/Shoe Manufacturing	1 [Up to 5%[	50
Metal engineering	2 [6% to 20%[	52
Software	4 [More than 50%[	4
Total	2 [6% to 20%[	106

The average number of mobile workers in the 106 companies that replied to this question is 6% to 20%. However, there are differences between the sectors. On average, the software sector has more mobile workers, over 50% of the total number of workers, a fact observed in the 4 companies in the sample. On the other hand, the metal engineering sector has 6% to 20% of mobile workers, even though 61.5% of the companies say they have up to 5% of workers working as such. In the textile and shoe manufacturing sector, only 5% of workers are mobile workers, a situation found in about 90% of the companies.

Taking the existence of mobile work and the percentage of those workers who commute as a starting point, it can again be concluded that it is in the software and metal engineering sectors that the dynamics of telework tend to emerge, or that the potential for telework is present in those sectors.

4.2 Location and geographical scattering

The areas where the clients or sub-contracted entities are found, and to where mobile workers commute, are factors from which it is possible to “design”, at a spatial level, the location of the network of these strategic players to encourage teleworking practices and subsequently, the location of the work place.

Within a teleworking context, the location of the work place may take different forms, apart from being temporary or permanent it could be distant or partially independent from the location of the company, clients, sub-contracted entities, etc.

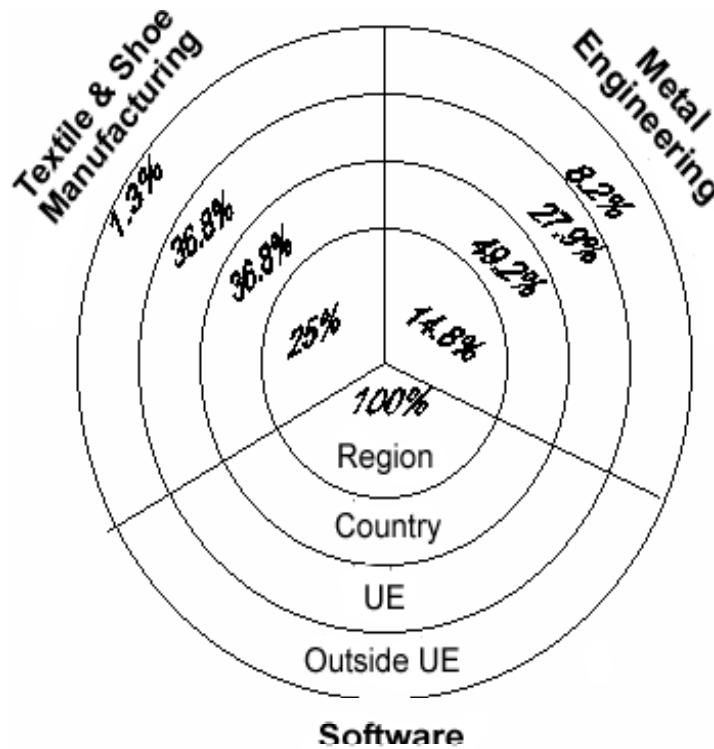


Figure 4 – Location of clients by sector of activity

The clients of the companies surveyed are found mainly in other regions of the country, but there are differences amongst the various sectors of activity. In the textile and shoe manufacturing sector, the clients of 36.8% of the companies are in other regions of the country, but equally, 36.8% of the companies have clients in other EU countries. Similarly, in the metal engineering sector, the clients of most companies are located in other regions of the country (49.2%) and those of a significant percentage of the companies in this sector are in other EU countries.

Apart from this tendency, it was also found that there is a very small percentage of companies in these so-called traditional sectors that have clients outside the EU.

It is also interesting to note that the clients of all the companies in the software business are found in the same region as the company itself.

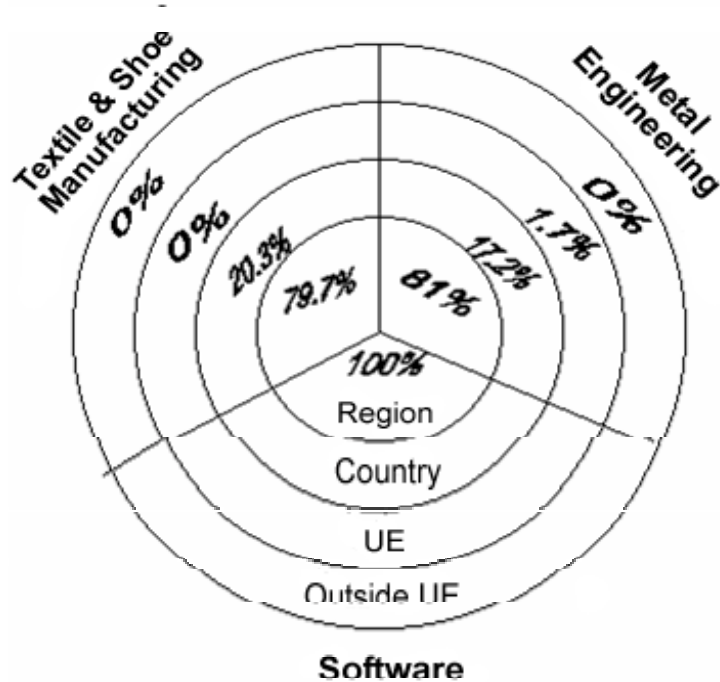


Figure 5 – Location of sub-contracted entities according to sector of activity

In each of the sectors being analysed most of the companies subcontract services to firms located in the same area as the company, noticeably in the software sector where this is the case of all the companies in the sample.

In the other sectors, there is a significant percentage of companies that also subcontract to firms located in other regions of the country. The only sector where there is subcontracting to firms located in other EU countries is the metal engineering sector (1.7% of companies).

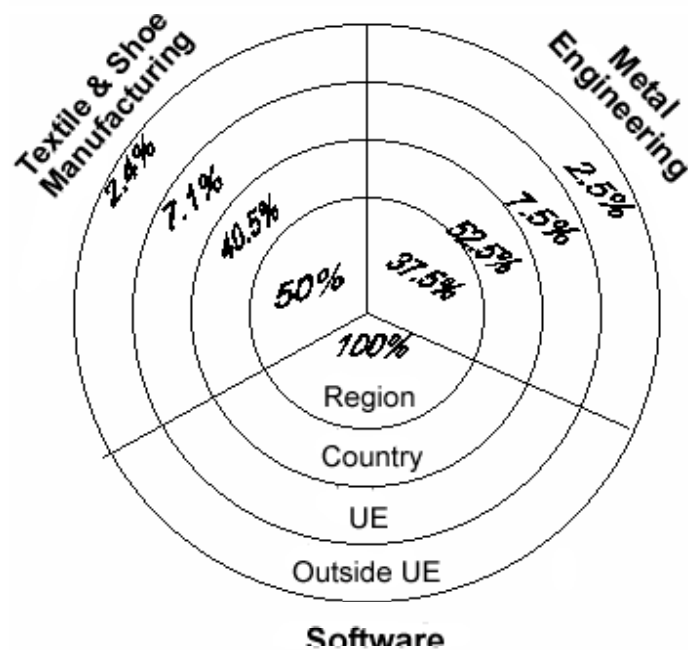


Figure 6 – Areas of commuting of mobile workers by sector of activity

In the textile and shoemaking sector, the mobile workers of most companies move around essentially within the area of the company (50%). However, the workers of a relevant percentage of companies also commute to other regions of the country (40.5%). In the case of the metal engineering sector, the workers that commute from most companies do it to other regions of the country (52.5%), even though in a significant percentage of companies they commute mainly within the area where the company is located (37.5%).

On the other hand, in the software sector, the mobile workers of all companies in the sample commute only within the area where the company is located.

An important conclusion reached from the analysis of the diagram is that mobile work across borders (in EU countries and outside the EU) is practically non-existent, even though there are some indications of this kind of work in the textile and shoe manufacturing sector, as well as in the metal engineering sector.

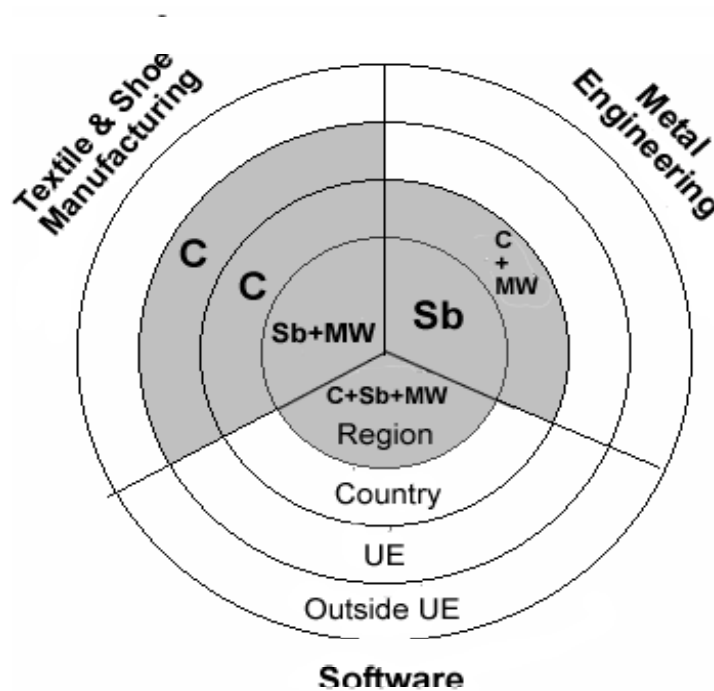


Figure 7 – Geographical location of clients (C), sub-contracted (Sb) entities and mobile workers (MW) according to sector of activity

The diagram shows the geographical scattering of the whole network of strategic players in the dynamics of telework development.

The companies in the textile and shoe manufacturing sector tend to have clients located in other regions of the country and other EU countries, whereas they tend to sub-contract services to entities located in the same region as the company and the workers also tend to commute within the area of the company.

The clients of the companies in the metal engineering sector are also located in other regions of the country, and it is to other regions of the country that mobile workers tend to commute, whereas at the level of sub-contracting they look for entities within the same region as the company.

On the other hand, in the software sector, there is no geographical scattering of the strategic players that encourage teleworking practices, but a geographical concentration, as all those players are found within the same region as the company.

Taking into account the geographical location of the different players in the network, it is the textile and shoe manufacturing, as well as the metal engineering sectors that present conditions that show a need for teleworking practices and the possibility of developing them, due to a geographical scattering of the strategic players. Teleworking practices are a way to reduce physical distances and allow the development of work in a network, as well as part-time work in parallel and together with the company.

4.3 Information and communication technological support

Information and communications technological support is a central factor generally named by the authors that study the phenomenon of telework.

Information and communication technologies (ICT) are important indicators in the analysis of types of telework, as those technologies give a new push to organisations, contributing to the development of teleworking practices. To this end, the development of the virtual organisation tends to build a platform of work organisation that favours certain dynamics associated to telework, as people in remote places can be part of, work or collaborate with a company located anywhere else.

Therefore, the importance of ICTs as a means of communication with the clients, with sub-contracted entities and with mobile workers is in itself an indicator of the development of teleworking practices and dynamics.

The different ICTs were put into four groups: channels (simple telephone line, modem/ISDN, dedicated lines); terminals (fax, fixed computer, portable computer, mobile phone); protocols (FTP, electronic mail, voice mail, normal mail, chat, video conferencing); media (intranet/LAN/Ethernet, infra-structure for sharing data/information, infra-structure to support collaboration process, access services for clients and suppliers, services for worker access).

Table 4 – Importance of information and communication channels as support for communication with clients, with sub-contracted entities and with mobile workers

Sectors of Activity	Clients		Sub-contracted entities		Mobile Workers	
	Average	N	Average	N	Average	N
Textile and Shoe Manufacturing	2 (Important)	67	3 (Less important)	55	3 (Less important)	35
Metal engineering	2 (Important)	44	2 (Important)	48	3 (Less important)	39
Software	3 (Less important)	2	2 (Important)	3	2 (Important)	4
Total	2 (Important)	113	2 (Important)	106	3 (Less important)	78

Information and communication channels (simple telephone line, modem/ISDN, dedicated lines) as a means of communication with clients and sub-contracted entities are on average considered important, whereas, in communications with mobile workers those channels are not so important. However, there are some differences between the sectors of activity.

Therefore, in the textile and shoe manufacturing sector, information and communication channels are only important for communication with clients. On the other hand, in the case of the companies in the metal engineering sector, this type of channels, apart from

being important for communication with the clients, are also important for communication with sub-contracted entities (for example, in cases where is needed further design, scheduling or planning activities, specially when CAD systems are used, or JIT techniques are needed, for example).

As opposed to this, in the software sector, information and communication channels are not very important for communication with clients, but considered important for communication with sub-contracted entities and with mobile workers.

Table 5 – Importance of information and communication terminals as a means of communication with clients, sub-contracted entities and mobile workers.

Sectors of Activity	Clients		Sub-contracted Entities		Mobile Workers	
	Average	N	Average	N	Average	N
Textile and Shoe Manufacturing	2 (Important)	71	2 (Important)	54	3 (Less important)	35
Metal engineering	2 (Important)	51	2 (Important)	50	3 (Less important)	41
Software	2 (Important)	4	2 (Important)	3	2 (Important)	3
Total	2 (Important)	126	2 (Important)	107	3 (Less important)	79

Information and communication terminals (fax, fixed computer, portable computer, mobile phone) are also considered an important tool in relationships with clients and sub-contracted entities, whereas in the case of mobile workers they are not considered very important. This is the case even at the level of the so-called traditional sectors.

However, in the software sector, terminals are important for communication with the different strategic players that play a part in stimulating teleworking practices.

Table 6 – Importance of information protocols in information and communication as means of communication with clients, sub-contracted entities and mobile workers

Sectors of Activity	Clients		Sub-contracted Entities		Mobile Workers	
	Average	N	Average	N	Average	N
Textile and Shoe Manufacturing	3 (Less important)	48	3 (Less important)	51	4 (No importance)	31
Metal engineering	3 (Less important)	32	3 (Less important)	40	3 (Less important)	36
Software	2 (Important)	3	3 (Less important)	3	3 (Less important)	4
Total	3 (Less important)	83	3 (Less important)	94	3 (Less important)	71

In general, information and communication protocols (FTP, electronic mail, voice mail, normal mail, chat, video conferencing) as a means of communication with the different strategic players are on average considered not very important. In the textile and shoe manufacturing sector this type of tool is even considered not at all important in communicating with mobile workers. On the other hand, in the software sector, these protocols are considered an important means of communication with clients.

Table 7 – Importance of information and communication media as a means of communication with clients, sub-contracted entities and mobile workers

Sectors of Activity	Clients		Sub-contracted Entities		Mobile Workers	
	Average	N	Average	N	Average	N
Textile and Shoe Manufacturing	3 (Less important)	65	3 (Less important)	53	4 (No importance)	35
Metal engineering	3 (Less important)	48	3 (Less important)	47	3 (Less important)	38
Software	2 (Important)	4	2 (Important)	3	2 (Important)	4
Total	3 (Less important)	117	3 (Less important)	103	3 (Less important)	77

Finally, information and communication media (intranet/LAN/Ethernet, infra-structure for sharing of data/information, infra-structure to support collaboration process, services for client and supplier access, services for worker access) are equally not very important for communicating with clients, sub-contracted entities and mobile workers.

In the metal engineering sector (metal equipment), this type of media is not very important in communicating with the different players, and the same is true at the level of companies in the textile and shoe manufacturing sector, who consider information and communication media not at all important as a means of communication with mobile workers.

On the other hand, the companies in the software sector consider this type of tool as important for their communications with clients, as well as communication with sub-contracted entities and mobile workers.

Table 8 – Important ICTs for communications with clients, sub-contracted entities and mobile workers according to sector of activity

Sectors of Activity	Clients	Sub-contracted Entities	Mobile Workers
Textile/Shoe Manufacturing	✓ Channels ✓ Terminals	✓ Terminals	
Metal engineering	✓ Channels ✓ Terminals	✓ Channels ✓ Terminals	✓ Channels
Software	✓ Terminals ✓ Protocols ✓ Means	✓ Channels ✓ Terminals ✓ Means	✓ Terminals ✓ Means

In the case of companies in the textile and shoe manufacturing sector ICTs do not play an important role in communications with mobile workers, and in communications with the other players very few play an important role (channels and terminals), as in this sector the network of strategic players in the stimulation of telework is limited, even though geographically that network is relatively scattered.

In the metal engineering sector, information and communication channels and terminals are considered the main tools for the relationships established with the different players, and only communication channels are mentioned in the case of mobile workers.

Due to its specific characteristics, the software sector is the one that shows a larger diversity of ICTs, some of which highly developed. Terminals and information media are essential tools in the relationships with the whole network of strategic players. The importance of protocols in communicating with clients is also worth mentioning. On the other hand, channels are only important in the relationship with sub-contracted entities, whereas for the so-called traditional sectors it is an essential tool.

4.4 Types of telework

The building process of types of telework started from the specific, that is, the various indicators, towards the general, that is, the aggregation of such indicators into three large analytical groups. These groups from which it is possible to determine tendencies in ways of teleworking are: network of strategic players (clients, sub-contracted entities and mobile workers), the geographic dimension of that network and communication technological support.

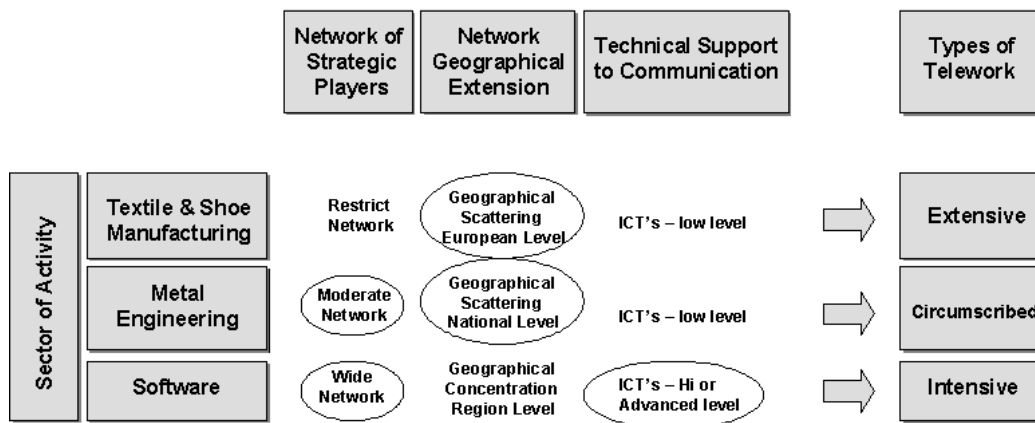


Figure 8 – Types of telework according to sector of activity

Teleworking practices are more visible in the software sector, as it is a sector that due to its characteristics is more open to this type of new ways to work. The network of strategic players is wide, even though at a geographical level these players are concentrated in the same area as the company. However, there is a high usage of ICT, with some innovation, such as protocols and information and communication media.

On the other hand, in the so-called traditional sectors, teleworking practices and dynamics are better hidden or covered up.

In the textile and shoe manufacturing sector the network of strategic players is limited, but they are geographically scattered in the same area as the company, throughout the country and even in the EU. In spite of the scattering and geographical distance of the different players in the network, the use of ICT is low, basically limited to information and communication channels and terminals.

Based on the three large study groups, the textile and shoe manufacturing and software sectors are the ones that seem to be at the two extremes, showing different teleworking practices.

In the metal engineering sector the network of strategic players is not so wide and heavy, being stronger than in the textile and shoe manufacturing sector in terms of quantity of clients and mobile workers. However, the network is limited to a national level. As in the textile and shoe manufacturing sector, it is still at an insufficient level, also limited to information and communication channels and terminals.

Considering the characteristics of each sector in relation to each group under study, an attempt was made to identify the types of telework, taking as the group (or groups) as the criterion noticeable in each sector due to its characteristics. In the software sector there is a greater tendency to develop telework practices, due to the vast network of strategic players, as well as to the solid use of ICT, hence the characterisation of this type of telework as *intensive*.

On the other hand, in the textile and shoe manufacturing sector teleworking practices and dynamics are weaker, but there is certain visible tendency towards the new forms of work, mainly due to the dimension of the network of strategic players, so that the types of telework are characterised as *extensive*.

In the metal engineering sector, the prevailing factor in teleworking practices is the reasonable network of strategic players and its dimension at a national level, that is, the network of players limited to the country, which means that the types of telework are *circumscribed*.

5 Conclusion

We thought that telework can be defined as a new form of work that is carried out from a location away from the central work place, and where the worker does not have personal contact with his/her colleagues, but can communicate with them by means of the new information and communication technologies.

Apart from that, telework has evolved from one type of work at home to a variety of forms associated with the flexibility of space/work place. At a technological level, the content varies according to the type of telework: on-line, away with a computer, or far from the traditional work place. At the level of usage of time, telework can be carried out in full-time, part-time or occasionally.

According to a Portuguese study mentioned earlier (Sousa, 1999), the most common type of telework, independently from how it is implemented, is the system where the work place of the teleworker is alternated with the company (complementary telework). In the study for which we presented some results, we started from the hypothesis that telework is not an appropriate practice only for sectors related to the application, production and dissemination of information and communication technologies, such as the software sector.

The so-called traditional sectors, such as textile and shoe manufacturing, and metal engineering, can also be subjected to these new work practices due to the decentralisation of some stages in the production chain, resulting from an economic context influenced by globalisation.

Therefore, it seems that teleworking practices will tend to emerge in the software and metal engineering sectors, mainly due to the size of the network of strategic players. In fact, 69.7% of the companies that replied to the survey mentioned they had mobile workers. Taking into account mobile work and the percentage of workers that commute, it can be concluded that telework has a bigger probability of emerging in the software and metal engineering sectors.

The only sector where there is sub-contracting to entities in other European Union countries is the metal engineering sector. However, mobile work across-borders (in the EU or outside the EU) is practically inexistent in all sectors.

Taking into account the geographic location of the different players in the networks where the companies are involved, the textile and shoe manufacturing as well as the metal engineering sectors seem to show conditions indicating the need for, and development of teleworking practices due to the geographical scattering of the strategic players.

Finally, in the software sector, teleworking practices are more visible than in the other sectors studied. In the so-called traditional sectors, teleworking practices and dynamics are more hidden or covered up. In these sectors the use of information and communication technologies is relatively low, limited to information and

communication channels and terminals. However, modernisation processes in these sectors let us foresee that there is the possibility of a quick spreading of the capability to use these new forms of working within a relatively short period of time.

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¹ Apart from the authors, Cláudia Teixeira Gomes and José João Sampaio also participated in this project.

² Jack Nilles was a researcher at the *Aerospace Corporation* in South California. He designed space ships for the Department of Defence and for NASA. In 1972, Nilles left *Aerospace* for the University as Director for Development of Interdisciplinary Programmes. In 1973, he set up a team of co-researchers in the areas of Engineering, Management and Communications and put forward a proposal, to the National Foundation of Science, entitled “Development of a policy of relationship between telecommunications and transport”. The project was developed in an insurance company, and the final report was published in 1974, and the book in 1976, entitled “The telecommunications – transportation trade off: options for tomorrow”, which spread the idea of “telecommuting” and “telework”.

³ The objective of the TELDET project, carried out at a European level at the beginning of the 90s, was to analyse the implementation and conditions of telework in the different countries of the European Community.

⁴ This Mission was composed by a representant of each Minister of the Portuguese Government, and the management team was organised at the Ministry of Science and Technology (1996-2001).

⁵ FUNDETEC (1998), *Study of Telework in Portugal*, Lisboa.

⁶ Sousa (1999) in her study *O Teletrabalho em Portugal – Difusão e Condicionante*, shares the concept that, in general, telework has been considered a new form of work, supported by ICTs and carried out away from the usual work place.

⁷ In absolute numbers: Textile and Shoe Manufacturing (80 companies); Metal Engineering (65 companies); Software (4 companies)