

CONSUMPTION OF ADVANCED INTERNET SERVICES IN URBAN AREAS: A CASE STUDY OF MADRID

Rubén Camilo Lois González

Francisco José Armas Quinta

José Carlos Macía Arce

University of Santiago de Compostela (Spain)¹

1. ICT opportunities in urban areas

Mobile telephony was preceded by a series of advances in communications (telegraph, telephone, radio, television and fax) that improved transmission speed and contact costs (Davies, 2004). However, it was the advent of the Internet that has brought space-time relationships closer than ever. The classic concept of physical territory, displacement and distance, was replaced by the instantaneous transmission of information and the provision of advanced online services (Cairncross, 2001; Veltz, 1999, Ges, 1997). These recent technological advances in the means of communication are associated with contemporary globalization (Davies, 2004) and have brought about the formation of a large global network influenced by the flow of communication and economic, political, social and cultural interaction (Short and Kim, 1999).

In economic terms, ICT eliminates trade barriers and promotes the development of international business, factors leading to the reformulation of corporate strategies (Méndez, 1997). In spatial terms, through ICT global cities concentrate a large percentage of wealth and power, becoming the true economic and political references of modern states (Sassen, 2003; Veltz, 1999). Some authors such as Castells (2010), prefer to speak of regions and metropolitan areas.

In short, we are witnessing a global opening dominated by communication, as part of a large global network that obtains its greatest prominence in urban spaces. This situation offers new opportunities for citizens to communicate and interact using the Internet as a strategic tool. Citizens have the ability to access a variety of services and opportunities, communicating with other citizens, interacting with government,

¹ Research financed by the National Plan for R&D, reference CS02010-16298.

associations, companies and banks, empowering work and distance learning, and so on. (Armas et al, 2011; Muhammad, 2007; Rhee, 2007).

Moreover, the reality of business is also closely related to the benefits ICT and the Internet offer: computer advances have transformed the modus operandi of companies, information is managed in a more intelligent and, above all, more dynamic way, communication is instantaneous and can be performed remotely. In addition, companies have found the Internet to be a new medium with which to promote their products on the market and start buying and selling processes with suppliers and customers. Without doubt, very favourable circumstances that have changed the whole way of understanding the reality of business nowadays (Méndez, 1997).

However, citizen and business use of these advanced services is not equally distributed in urban spaces. The presence, use and diffusion of ICT presents contrasts between central cities and their immediate peripheries, focusing on the quality of its citizen's lifestyles. (Lois et al, 2010).

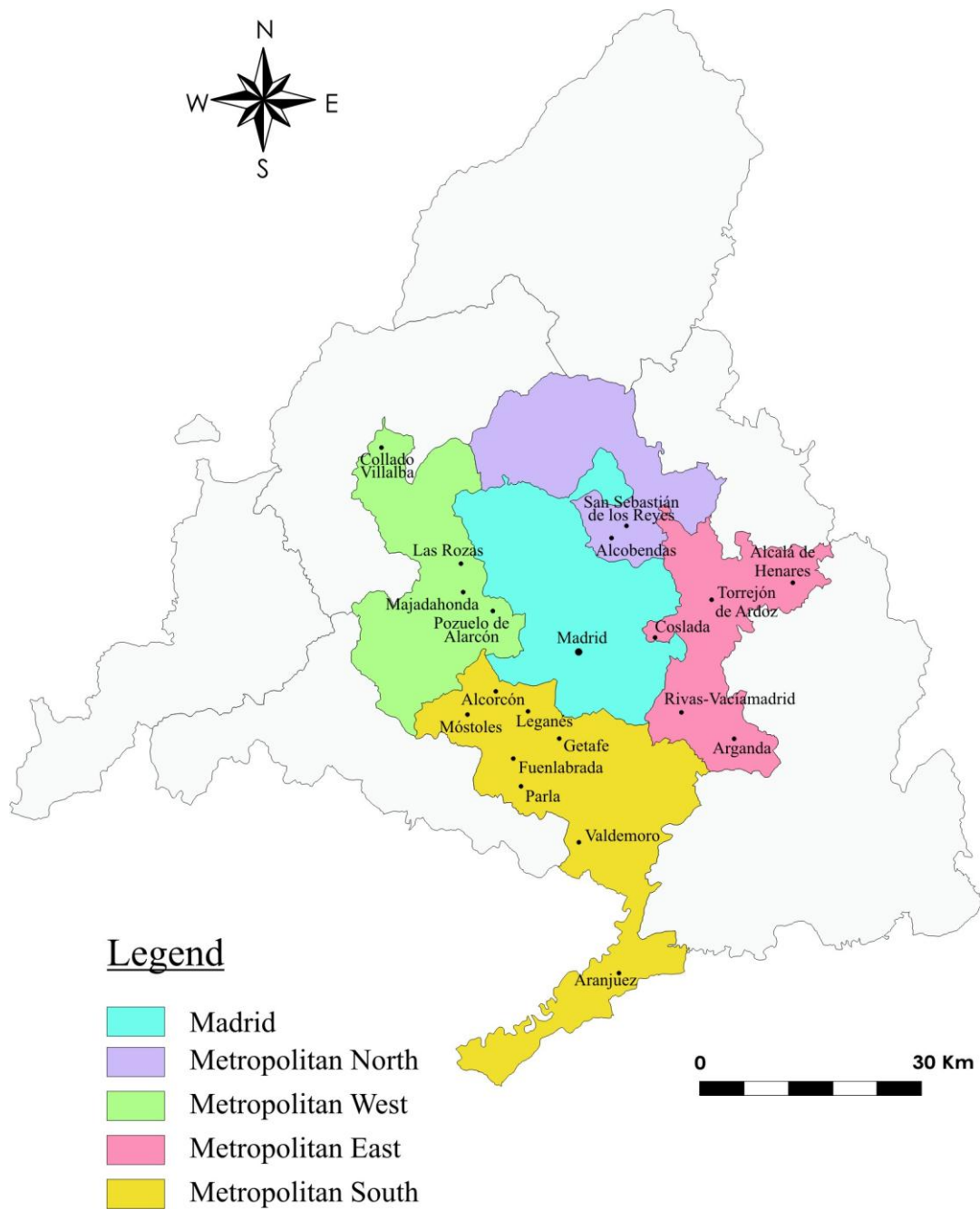
In recent decades, the city of Madrid has been consolidated as a major European urban reference. In this paper, ICT trends in the metropolitan area are researched, analysing the use of advanced Internet services in the public and business sectors.

2. The municipality of Madrid and its metropolitan area

The municipality of Madrid has a population of 3,273,049 inhabitants (INE, 2010) and its metropolitan area has 2,682,320 inhabitants (IE, 2010), a total of 5,955,369 inhabitants. To reach this figure, the arrival of more than a million immigrants during the first decade of the 21st century has been especially important, a factor that has transformed Madrid and its urban area into a multicultural area of reference in Europe (see Figure 1, Table 1). Undoubtedly, the arrival of immigrants has transformed the social and cultural life of Spain's capital, and has boosted the economy through the work of thousands of workers in the construction industry and services sector.

In the urban area of Madrid, outlying towns shape the complementary spaces and act as associated secondary centres for relatively specialized activities (Méndez, 2002). The specialization of cities, (shopping, leisure parks, business, industrial,

Figure 1. Statistic Zoning NUTS 4 of the Community of Madrid.



Source: Statistics Institute Community of Madrid.

Table 1. Total migration from abroad to the urban area of Madrid

Statistics Areas	2000	2001	2002	2003	2004	2005	2006	2007
Madrid Municipal	100,784	93,521	91,897	82,565	66,450	68,238	89,106	98,005
Metropolitan North	4,541	4,185	4,577	4,557	4,377	5,353	6,982	8,593
Metropolitan East	8,150	9,434	12,537	10,948	14,879	14,269	21,013	21,618
Metropolitan South	14,088	16,036	18,886	17,730	18,196	18,896	25,227	29,002
Metropolitan West	5,431	5,723	6,090	5,549	7,871	8,086	10,364	10,787

Source: Statistics Institute Community of Madrid

logistical, technological and science parks), causes some spatial segregation which results in noticeable differences in the distribution of per capita income. The specialization of cities, (shopping, leisure parks, business, industrial, logistical, technological and science parks), causes some spatial segregation which results in noticeable differences in the distribution of per capita income. Thus, the Northern Metropolitan area (Alcobendas, San Sebastian de los Reyes, Tres Cantos) has recorded the best values, € **49,965** per citizen, well above the values of the Southern Metropolitan area (€ **18,544**) and slightly higher than € **38,539** in the municipality of Madrid (IE 2010).

On the other hand, if we analyse the use of advanced ICT services in the metropolitan area of Madrid, the same internal differences are detected (Lois et al, 2011). At this point, it is necessary to ask what factors have led to these differences and how they are reflected in the urban area of Madrid.

3. Methodological Notes

To perform an analysis on society's as well as the business sector's consumption of advanced Internet services in the metropolitan area of Madrid, data from the National Institute of Statistics and the Statistics Institute of Community of Madrid was used. The purpose of this information was none other than to try to find behaviour patterns between the degree of diffusion of new technologies, the use of advanced Internet services and the socioeconomic characteristics of the population. The data on the society's use of new technologies was consulted in the Survey on Equipment and Use of Information Technologies and Communication in the Homes from the National Institute of Statistics, and the data refers to the use of advanced Internet services by companies

and various socioeconomic data from the metropolitan area of Madrid were taken from the Statistics Institute of the Community of Madrid.

The need to compare the degree of new technology diffusion in society and business required all data to be related to identical territorial units but the sources consulted showed very different data. The Statistics Institute of the Community of Madrid offers socioeconomic data, such as income per capita, the education level of the population, or activity sectors of the working population, among others, following the regional division of NUTS4 from European Statistics Office. This organism also provides information about the use of information technology and communication and about e-commerce in businesses with more than ten employees within the same territorial basis in the Community of Madrid. However, the National Institute of Statistics provides data on the population's use of new technologies according to municipality population size. In order to extrapolate this data the number of inhabitants was accounted for in each NUTS4 of the Community of Madrid, according to municipality size and the demographic weight each territorial division had, grouping municipalities according to their size and the extent of ICT use in different parts of the community and thus approximately known (see figure 1).

In order to relate the advanced uses the population makes of the Net and the socioeconomic characteristics of the population, two indices have been developed. The first, called IP_i relates the number of Internet users income per capita for each territorial unit in the community of Madrid, in this case NUTS4, the degree of training in the population and the proportion of the population employed in the service sector, as well as indicating the propensity of a territory's population to use the Internet. The second index, called AS_i relates to the number of Internet users, users who use the Net to make purchases, those who use it for banking, and those who use it to contact the administration, and it measures the intensity in the use of advanced Internet services.

4. Advanced uses of the network in the metropolitan area of Madrid

Despite significant progress seen in the nineteen-eighties, in the network of networks, which saw its expansion throughout the world, it was not until the mid-nineties, when the World Wide Web was created that great leap forward in the process of Internet diffusion and, consequently, the Information Society took place. Before seeing the use for this application, the Internet's use was extremely complicated, since it

was very difficult to locate and retrieve information. The appearance of the first browsers and search engines facilitated this process, something which led to the creation of a worldwide communications network with a wealth of information and other services.

At first, most Internet users accessed the network primarily for simple tasks like finding information and communicating with others. Although the Net is becoming increasingly popular, now close to two billion users, there are still areas and sectors of the population living outside this technological revolution. Today many services are offered through the network, either by the government or the private sector, ranging from simple hotel bookings or the weekly shopping in a supermarket to multiple and varied administrative and financial procedures.

In the case of Spain, the availability of these services does not imply a breakthrough in the diffusion of new technologies, and the relevant statistics reflect that. At a European level, Spain has been bringing up the rear in Internet access, where fewer than 60% of the population between 16 and 74 (2009) use applications and network services. The number of Internet users in this country is almost ten percentage points below the average for the European Union of fifteen, and very far from the leading countries in the diffusion of the information society such as Sweden, where nine out of ten inhabitants use this network. Currently in Spain there are, in our opinion, two types of digital divides, the digital divide in access and the digital divide in Internet services. The first is that between those citizens who are users of the network and those who are not, either because they have no training or because they find it of no interest to them. These citizens are part of the group called "digital illiterates". The digital divide in Internet services is the one that separates users who use the Internet almost exclusively to access information and to communicate (either through email or through emerging social networks), from those who use it in a broader way, carrying out e-commerce, online training, online banking, and so on. In countries where the diffusion of new technologies is higher, the digital divide in access is reduced to a minimum, being relegated only to the elderly, and the digital divide in advanced services has far less presence.

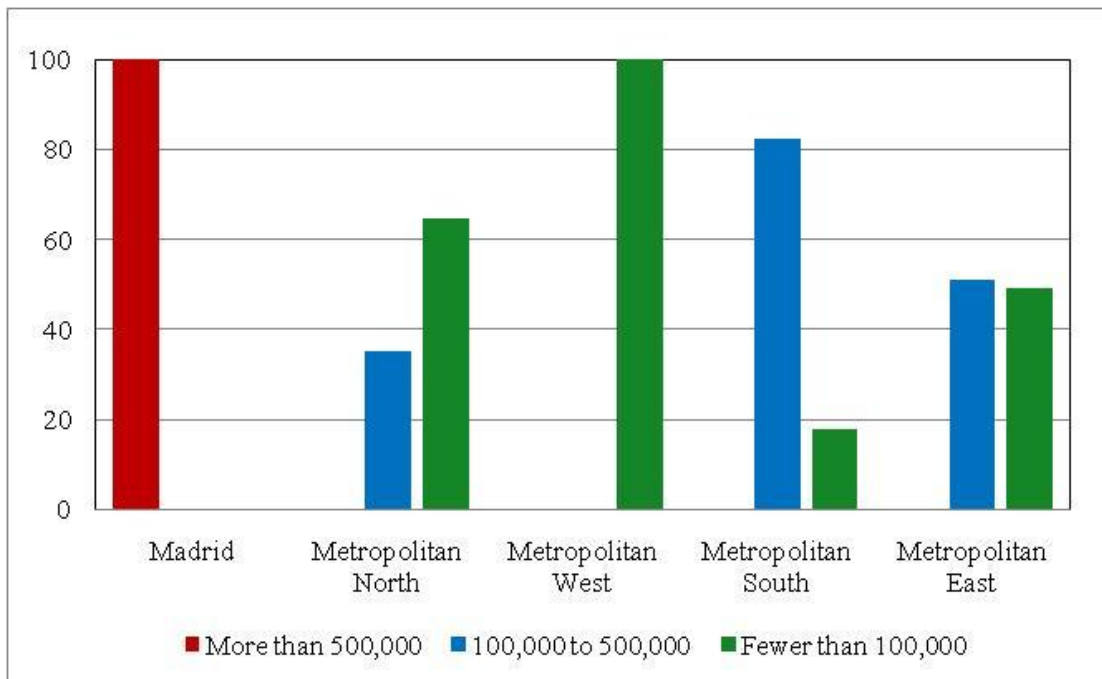
The urban areas have a privileged position in the process of new technology diffusion as they concentrate the most and best infrastructures that enable access to

quality networks. Also, most of the qualified population are concentrated in these areas. Madrid, in the national context, is one of the most advanced regions in the process of Information Society diffusion, with a greater number of network users.

In order to study the Internet use in the metropolitan area of Madrid and especially the use of advanced services, the regional division used was NUTS4 from the European Statistics Office. Thus, the metropolitan area is divided into five regions: Madrid, Northern Metropolitan, Western Metropolitan, Southern Metropolitan and Eastern Metropolitan (see figure 1). The variables taken into account in the analysis were: Internet users, online buyers, Internet users wishing to communicate and seek information, and Internet users who access it in order to perform tasks related to electronic commerce, electronic banking and to interact with the administration. Similarly, these variables were crossed with other socioeconomic indicators, with the aim of trying to find behaviour patterns among the population, socioeconomic characteristics and the consumption of advanced network services on the Net.

In the metropolitan area of Madrid substantial differences were found in the number of Internet users depending on the size of the municipalities. In the smallest,

Figure 2: Population Distribution in the metropolitan area of Madrid, NUTS 4.



Source: Statistics Institute of the Community of Madrid, 2010.

Note: The percentages were calculated with respect to the population of each NUT 4

with fewer than 100,000 inhabitants, where the highest values were registered, exceeding almost fifteen percentage points with relation to those of 100,000 to 500,000 inhabitants. On carrying this data to different regions of the metropolitan area, it is found that the largest number of urban areas of this size are in the western and northern metropolitan areas. In the western metropolitan area all residents live in municipalities with fewer than 100,000 inhabitants, in the north six out of ten, and in the east half of the metropolitan population, so this is where the highest proportion of Internet users are (see figure 2). This indicator is directly related to per capita income, the population's level of training and the proportion of the population employed in the service sector. Thus, regions with more affluence, more educated and a higher proportion of the population employed in the service sector are in the northern and western metropolitan areas and in the municipality of Madrid. In order to relate all these variables, an IPI index was created to measure the propensity of the population of an area to use the Internet. The formula used was:

$$IPI = (\log R + (\log WS - \log KH)) / (\log R + (\log WS + \log KH))$$

Where **R** is the income per capita, **WS** is the proportion of population employed in the service sector, and **KH** is human capital measured as a percentage of the population with first-degree or less. The result of this index revealed that the propensity to use the Internet is higher in the northern, western metropolitan areas and in the municipality of Madrid, as shown in table 2.

Table 2: Propensity of Internet use in the metropolitan area of Madrid.

	Statistical areas (NUTS4)				
	Madrid (municipality)	Metropolitan North	Metropolitan East	Metropolitan South	Metropolitan West
IPI	0.63	0.65	0.61	0.60	0.68

Source: Own calculations compiled from the Statistics Institute of Madrid, 2009.

With regard to the uses of the Internet, the basic or traditional uses can be differentiated, these are searching for information and communication compared to advanced services, such as electronic commerce, electronic banking, distance learning

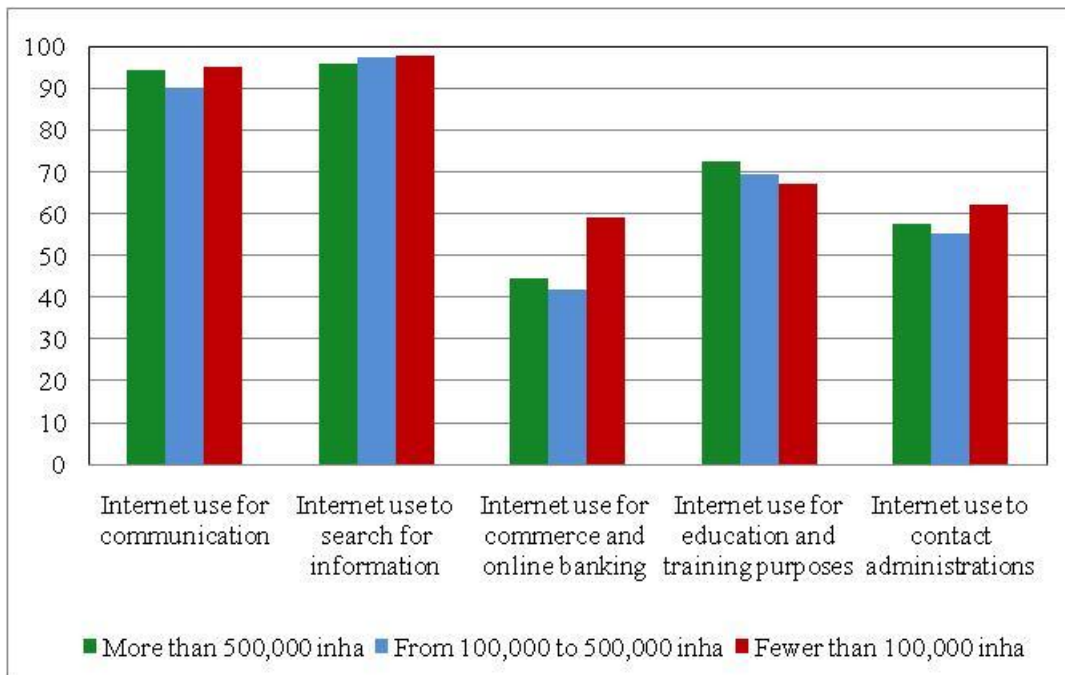
or contact with the administration. In the present case, at a territorial level, two different situations are revealed. On one hand is the behaviour pattern of the population using the basic web services, where most of the users use it, regardless of place of residence and therefore, without much influence from income, degree of training and population employment rate. The other is the use of advanced network services, and here again it demonstrates the spatial differences as cited above. Internet users living in smaller urban areas, fewer than 100,000 inhabitants, which correspond to the northern and western metropolitan areas exceed by seventeen percentage points those of medium size, which corresponds to the southern and eastern metropolitan areas in the use of electronic commerce and electronic banking. For services related to public administration, the same behaviour repeats itself but with less noticeable differences (see table 3 and figure 3).

Table 3: Use of Internet services by the population in the metropolitan area of Madrid.

	More than 500,000 inhab.	From 100,000 to 500,000 inhab.	Fewer than 100,000 inhab.
Internet users	70.9	56.3	71.2
Internet online shoppers	25.8	13.3	20.9
Internet use for communication	94.2	90.3	95.3
Internet use to search for information	95.9	97.6	98.0
Internet use for commerce and online banking	44.7	41.7	59.2
Internet use for education and training purposes	72.6	69.4	67.3
Internet use to contact Administrations	57.4	55.2	62.0

Source: Statistics of the Community of Madrid, 2009.

Figure 3: Use of Internet services by the population in the metropolitan area of Madrid.



Source: Own calculations compiled from the Statistics Institute of the Community of Madrid, 2009.

An index was created in order to link together the most common advanced services offered on the network, an index which measures the intensity of population use of these services, AS_i and relates the number of net users, internet users buying online, those who do online banking, and those who contact public administrations. The formula used was:

$$AS_i = 1 / m (V_i / U_i + B_i / U_i + A_i / U_i)$$

Where U_i is the number of Internet users, V_i is for the internet users who engage in electronic commerce, B_i is for the internet users of electronic banking, A_i is for the internet users who communicate with the public administration over the Internet, and m is the total number of net uses. The result of this index showed that the intensity of advanced Internet service use takes place in the small metropolitan areas, which correspond to the northern and western metropolitan areas (see table 4).

Table 4: Intensity of advanced Internet services use.

	More than 500,000 inhab.	From 100,000 to 500,000 inhab.	Fewer than 100,000 inhab.
AS_i	0.60	0.65	0.66

Source: Own calculations compiled from the Statistics Institute of Madrid, 2009.

The analysis of advanced Internet services consumption conducted in the metropolitan area of Madrid showed that it is more intense in smaller urban areas and they are predominantly located in the northern and eastern metropolitan areas. These differences are, as in e-commerce and electronic banking, more noticeable than those recorded in the number of net users. This may be due to smaller urban areas being well connected, having remarkable public service equipment and attracting qualified young people from large cities who are searching for smaller urban areas with lower housing costs.

5. Advanced Internet services in the business sector

In Spain there are about three million, three hundred thousand companies in which 95% are small businesses with fewer than ten employees, but they account for just over 26% of all employees. 60% of Spanish companies base their headquarters in four regions, Catalonia (18.5%), Madrid (15.3%), Andalusia (15.1%) and Valencia (10.7%). In the case of Madrid, its company structure follows the same pattern as that described for the rest of Spain, given that 95% of businesses located in this community are small businesses. The analysis of the consumption of advanced Internet services in the metropolitan business area of Madrid involves studying socioeconomic variables of the population, such as the level of training, the degree of utilization of new technologies, the employment sector of the population and so on, this in addition to the indicators in this respect

The diffusion of new technology equipment in companies with 10 or more workers in Madrid, as the statistics are only available for this group, is almost as if virtually every one of them has a computer and broadband Internet access, regardless of the sector and its size. Apart from these basic indicators, the use of computers connected

to the network by employees, if the companies have their own websites and applications given to the same were also taken into account.

From the spatial point of view and in relation to the use workers make of technology in these companies, some differences were seen between different regions in the metropolitan area. If in the whole autonomous region, half of workers use computers with Internet access, in the metropolitan area the highest values were recorded in companies located in the northern and western metropolitan areas, with values above 60% while the lowest values were in the southern and eastern metropolitan areas (see table 5). These differences were also detected depending on the size and sector of company and industry, higher values were recorded in large companies and the service sector.

Other key indicators taken into account were the presence of own website and the key reasons for that use, as this tool can be used as a platform for various advanced network services (electronic commerce, electronic banking or distance learning), or as a mere pamphlet presenting the company and its products. Despite widespread broadband access to the Internet, the case with web portals is different as 15% of companies do not have this tool. From the spatial point of view no major differences were detected, although the presence of company websites in Madrid, northern and western metropolitan areas of Madrid is slightly higher than in other metropolitan areas (see table 5). As for its use, almost all companies are presented by their websites, as well as their products, but only 20% practice e-commerce in the whole community of Madrid. Analyzing in detail what happens in the metropolitan area, the behaviour pattern is the same as that described in previous paragraphs; in the northern and western metropolitan areas there are a greater number of businesses selling on the net. There are also some differences in this indicator in terms of size. In the group of large companies over a quarter of them have sometimes bought online, while in small and medium enterprises just one in ten have done so.

Among the advanced Internet services companies can use, the diffusion of electronic commerce has been analysed by using two indicators: the companies that have made Internet sales and the proportion of e-commerce sales over total sales.

Table 5: Metropolitan area of Madrid. Diffusion of ICT in business.

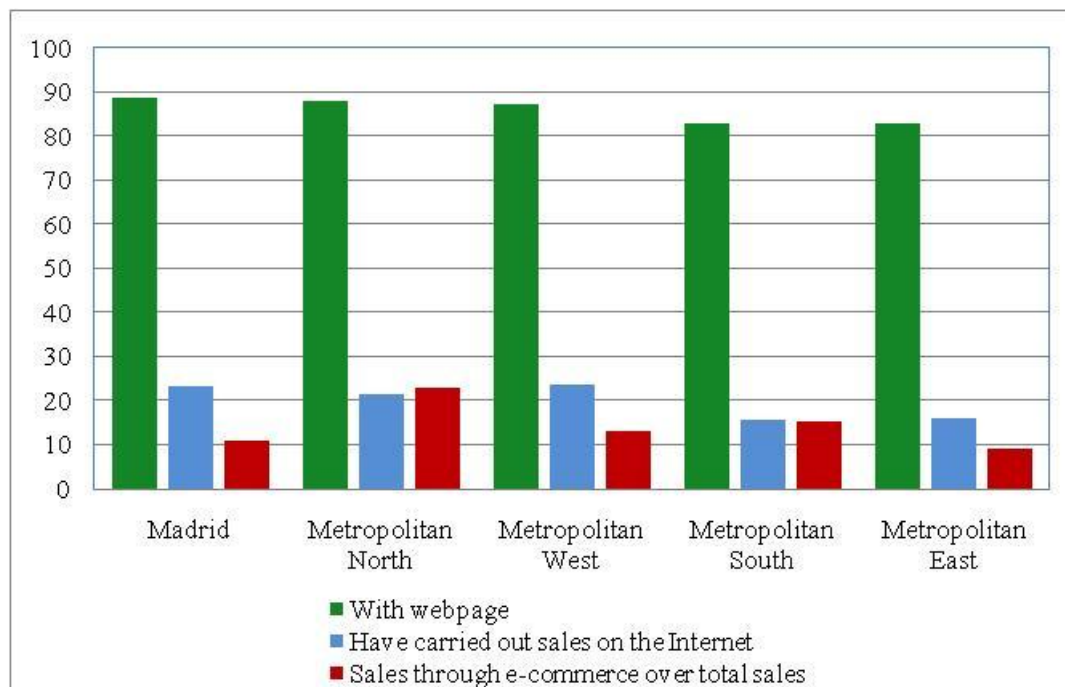
	Statistical areas				
	Madrid	Metropolitan North	Metropolitan East	Metropolitan South	Metropolitan West
Companies with Internet	98.9	97.8	98.7	98.8	99
Personal Internet use ¹	52.3	60.8	41.3	48.8	62.5
Companies with broadband	99.3	99.7	99.6	99.3	99.6
Companies with web page ²	88.5	87.8	83	82.6	87
Use web presentation ³	99	99.4	99.3	98.7	98.7
Companies making purchases on Internet ⁴	35.9	33.7	29.5	26.2	31.5
Companies that made payments online ⁵	72	65.6	65.5	60	70.6

- (1) The total of people
- (2) The total of enterprises with Internet connection
- (3) The total of companies with website
- (4) The total of enterprises with Internet connection
- (5) The total number of companies purchasing over the Internet

Note: Data referred to enterprises in the Community of Madrid with more than 10 workers excluding agriculture, livestock and public administration sectors.

Source: Statistics Institute of the Community of Madrid, 2006.

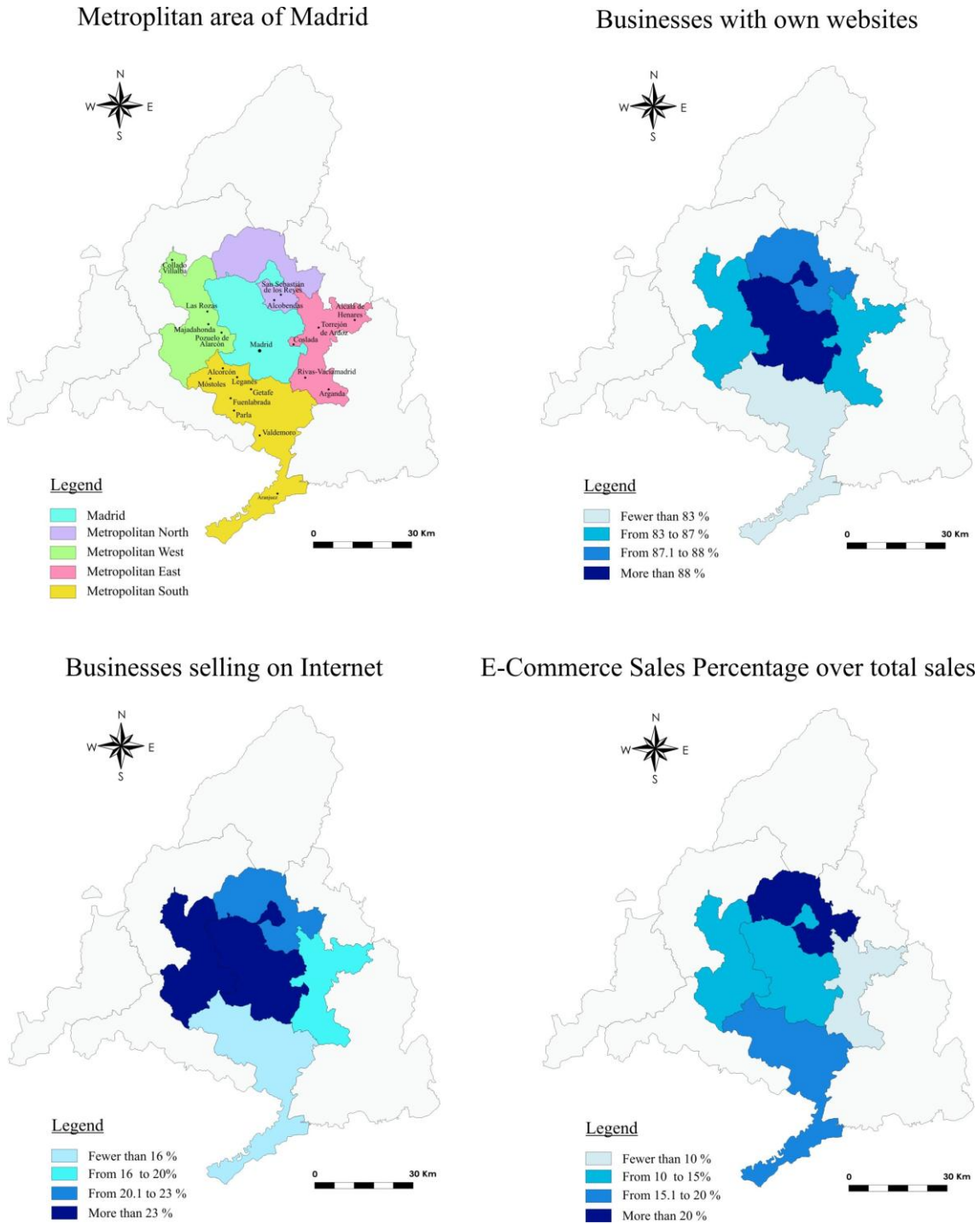
Figure 4: Consumption of advanced Internet services in the business sector.



Data relating to the companies of the Community of Madrid with more than 10 workers excluding the agriculture, livestock and public administration sectors.

Source: Statistics Institute of the Community of Madrid, 2006.

Figure 5: Metropolitan area of Madrid. Advanced Internet services in the business sector.



Source: Own calculations compiled from the Statistics Institute of the Community of Madrid, 2009.

Taking into account the metropolitan area of Madrid, the firms located in Madrid, in the western and northern metropolitan areas they have the highest percentage of sales made through e-commerce over total sales, and in these regions there is a higher proportion of companies that make sales via the Net. In this respect there is a difference of more than eight percentage points between the southern and western metropolitan areas in the percentage of businesses selling over the Internet (see figures 4 and 5).

These differences detected in the use of new technologies and especially in the use of advanced network services are related to the sector where the population is employed and has a good level of education. In the metropolitan area of Madrid, the southern and eastern areas are where more negative data has been recorded in respect to the diffusion of new technology in both business and society as well as the educational level and income per capita. It is also in these two regions where the proportion of the population employed in the service sector is lower in comparison to the population employed in the construction and industry sectors. The opposite case is recorded in the northern and western metropolitan regions where the diffusion of new technologies is greater in these two sectors.

6. Conclusion

After analyzing society and business sector consumption of advanced Internet services in Madrid, especially in the various regions of the metropolitan area, it can be concluded that there is a direct relationship between the use of information technologies and communication, and some socioeconomic indicators such as income per capita, the skill level of the population and its employment rate. The evolution of Net users has grown considerably in the last ten years, especially in Madrid, and it is one of the most advanced regions in the process of information society diffusion in Spain. The number of services offered by the Network also experienced a remarkable boom, especially the most advanced and those that require greater technological demands, although users of these services are still scarce.

In the metropolitan area of Madrid, significant differences across regions were observed. The northern and western metropolitan areas recorded a higher proportion of network users and, in turn, an increased number of Internet users make use of advanced Internet services such as banking and electronic commerce, distance learning or public administration contacts. These regions are, in turn, those with the highest per capita

incomes in the metropolitan area, as well as having a higher level of education and higher values in the proportion of the population employed in the service sector. The business sector repeats the same trend as companies that are located in these two regions and the Madrid municipality report the highest number of e-commerce sales over the total recorded sales, and it is where more companies carry out e-commerce in relative values. There is, therefore, considerable spatial differentiation in the use of advanced Internet services between the northern and western metropolitan areas and the southern and eastern metropolitan areas. This situation is related to differences in income, educational level and occupation of its population.

Bibliography

ARMAS QUINTA, FJ; MACIA ARCE, JC (2011). "Telework and rational use of public and private transport in the urban area of Madrid" in XVIII Congress of the AGE [in editing], Alicante.

CAIRNCROSS, F. (2001). *The death of distance 2.0. How the communications revolution our lives WillChang*. London: Texera.

CASTELLS, M. (2010). "Globalisation, networking, urbanization: reflections on the spatial dynamics on the information age" in *UrbanStudies*,47 (13), pp. 2737-2745.

DAVIES, WKD (2004). "Globalization: A Spatial Perspective" in JA MATTHEWS, HERBERT, DT (Ed.) in *Unifying Geography. Common Heritage, SharedFuture*. London: Routledge, pp. 192.

GES, M. (1997). "Telematic culture and territory" in *TheFactory*, No. 2. Available at: <http://www.lafactoriaweb.com>.

INSTITUTE OF STATISTICS OF THE COMMUNITY OF MADRID. Available at: <http://www.madrid.org/iestadis/>.

NATIONAL INSTITUTE OF STATISTICS. Disponible en Internet: <http://www.ine.es>.

LOIS GONZÁLEZ, RC; MACÍA ARCE, JC; ARMAS QUINTÁ, FJ (2010): "ICT inequalities in the Spanish urban system" In *Journal of Urban and Regional Analysis*, vol. 2, nº2, pp. 19-32.

MÉNDEZ, R. (2002): “La evolución de los mercados de trabajo metropolitanos: realidades y mitos a partir del ejemplo de Madrid” en *Scripta Nova*, vol. VI, nº 119.

MÉNDEZ, R. (1997): *Geografía económica. La lógica espacial del capitalismo global*. Barcelona: Ariel.

MUHAMMAD, S.; OTTENS, H.; ETTEMA, D.; DE JONG, T. (2007): “Telecommuting and residential locational preferences: a case study of the Netherlands” In *Journal of Housing and the Built Environment*, vol. 22, pp. 339-358.

RHEE, H. (2007): “Home-based telecommuting and commuting behavior” In *Journal of Urban Economics*, vol. 63, pp. 198-216.

SASSEN, S. (2003). *Los espectros de la globalización*. Buenos Aires: Fondo de Cultura Económica, 276 p.

SHORT, R.; KIM, J. (1999). Yeong Hyun. *Globalization and the City*. Harlow, Essex: Longman.

VELTZ, P. (1999). *Mundialización, Ciudades y Territorios*. Barcelona: Ariel.