E-PROCUREMENT ADOPTION AMONG ITALIAN FIRMS BY USING DOMAIN NAMES

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Abstract: The digital divide can occur either as a "local" (within a given country) or "global" (between developing and industrialized countries) phenomenon. Our study intends to offer an important contribution by analyzing the digital divide in Italy and the factors contributing to this situation at the territorial level (i.e., macroareas: North, Center, South and at the provincial level) To do this, we used the registration of Internet domains under the ".it" ccTLD as proxy. In particular, we analyzed domain names registered by firms. The analysis produced interesting results: the distribution of domains registered by firms in Italian provinces is more concentrated than the distribution according to income and number of firms, suggesting a diffusive effect. Furthermore, when analyzing the factors that contribute to the presence of a digital divide at the regional level, regression analysis was performed using demographic, social, economic and infrastructure indicators. Results show that Italian regions that have good productive efficiency measured by added value per employee and a high educational level measured by number of firms specialized in the ICT service sale (provider/maintainer) and by number of employees devoted to research and development are the best candidates for utilization of the Internet.

1 INTRODUCTION

Internet growth has captured the imagination of users, policymakers, entrepreneurs, corporate managers, military strategists, social commentators, scholars and journalists (Guillèn & Suarèz, 2004). The Internet is seen by some researchers as a new technological means that will lead to a "smaller, more open world" (Tapscott & Caston, 1993). According to some researchers the Internet symbolizes "the triumph over time and space" the rise of the "netizen", and the crowing of the "customer as sovereign" (Gilder, 2000).

According to Coffman, Odlyzko (2001) the Internet is a means of communication that is expanding very rapidly. Studies carried out by the Network User Association (NUA Ltd) estimates the worldwide on-line population in 1999 and in 2002 and shows that in Europe the number of individuals on-line came to 190.91 million in 2002, compared to 47.15 million in 1999.

Companies as well as individuals also turn to the Internet to exploit its communication potential. Today, information infrastructures are reaching out to the individual consumer, and telematic networks reduce the cost of communications. This statement agrees with economics literature (Hoffman & Novak, 1996), which confirms that the Web is becoming a dynamic and personal means of communication.

According to other authors (Bassi, 2002) the spread of the Internet and the functions of electronic commerce will permit individual clients to choose from a wide array of products and reduce costs, selecting and buying goods directly from the source and allowing companies to sell while by passing traditional channels. Scandinavia, at 8.6%, leads the region with the highest percentage of on-line sales, usually computers and related products, travel, video and music, and books.

This situation could prove to be quite worrisome for traditional businesses, as emerges from a survey carried out by the Syndicate Agents Union and representatives of the Italian Commerce in November 2000.

However, companies must adopt entirely new forms of commercial activity so that online sales will be successful.

The advantages for businesses provided by the Internet are not only linked to the sale of products

and services (direct advantages) but can also be indirect (Hansons, 2000). For example, among the most important of these are reduced costs, image consolidation, greater customer loyalty, and a wider diffusion of products offered by the company. They are referred to as "indirect" since they do not lead directly to sales and do not generate immediate profits; however, they are important since they will probably be the greatest benefits offered to businesses by the Internet.

The gradual confirmation of the Internet as a means of communication also permits companies to access data and a variety of other information; for example, it is possible to rapidly obtain information about the market in which one operates by visiting websites specialized in economic information or areas that furnish updates on laws, price changes, the appearance of any new operators in the field, fairs, competitive bidding, and other news of interest to operators. One can also identify the competition and analyze them by means of information published on company websites, etc.

Our study analyzes the spread of the Internet among Italian firms utilizing as metrics the number of domain names registered under the ccTLD ".it". We took into consideration domain names, names that are associated to IP addresses in the net, because we believe it to be really important for a firm to have a domain name, as through this name an Italian firm can exploit the above mentioned direct and/or indirect advantages. Moreover, it is helpful for a firm to register a domain name not only to have its own web site, but also to benefit from the advantages related to on-line means of communications (for example e-mails, FTP and so on). As a matter of fact, on-line means of communications unlike traditional ones (for example call-center services or telemarketing) are more effective as they allow firms to reach, for example, several customers at the same time, and more flexible, as some of them allow customers to solve problems on their own (for example with the FAQs). In this way, a twenty-four hours a day access to resources is granted. On the contrary, traditional customer care methods require intensive work and a considerable engagement of resources to ensure prompt and accessible assistance.

Besides, the analysis of the Internet presence in various social activities and economic and political areas indicates a critical issue: the existence of a "digital divide" between those who possess the material and cultural conditions to exploit the new technologies, and those who do not, or those who lack the crucial ability to adapt to the rapid continual change that characterizes the Internet today (Warschauer, 2001; OECD, 2001, Kirkam et al. 2002; Norris, 2001; Rogers, 2001). Therefore, it is not surprising that the announcement of the Internet potential as "a liberty, productivity and communication instrument, goes hand in hand with the digital divide exposure" caused by the uneven Internet diffusion (Castells, 2001). The 1999 World Human Development Report written by the United Nations organization considers the number of Internet users one of the most widely used indicators that show the divide between rich and poor countries. Statistics compiled by the International Telecommunication Union indicate that by the end of 2002 Internet users represent in countries such as Africa, Central America and South America only 1% of the population while this percentage goes up of 50-60% in countries such as Iceland, United States, Scandinavia, Singapore or South Korea (ITU, 2003).

In this paper we are going to analyze the factors contributing to the existence of the digital divide in Italy, taking into consideration not only economic variables, but also educational, cultural, demographic and in the end, technological variables.

2 METHODS

Several metrics are available for measuring Internet diffusion. The most convenient are the so-called endogenous metrics which can be "obtained in an automatic or semiautomatic way from the Internet itself" (Diez-Picazo, 1999). These metrics have the undeniable advantage of accuracy, being based on automatic data collection and retrieval; in addition they allow good geographical characterization of the phenomenon being based on data that allow differentiation of users on a national, regional and provincial level. Among the endogenous metrics, according to literature, the most frequently used ones to evaluate Internet diffusion analysis are Internet hosts based on host count procedures (see studies published by Internet Software Consortium or by RIPE-NCC) and second-level domain names (Naldi, 1997; Zook, 1999; Bauer, Berne and Maitland, 2002). Despite the advantages offered by endogenous measures, there are also a few disadvantages, since in some cases they tend to underestimate and in others to overestimate the phenomenon being studied (Zook, 1999, 2000, 2001). Overestimation can occur when the number of hosts is used, often associated with IP addresses, while if we consider the number of registered

domains, more than one domain may be associated with the same registrant. Underestimation can occur because not all Internet users register a domain name under their own ccTLD, and in many countries the regulations allow foreign citizens to register under their own ccTLD (for example, Italy allows organizations and citizens of European Union countries to register under the ".it" ccTLD).

In the case of hosts, underestimation may be due to the growing presence of firewalls and private networks (Intranet) and the use of dynamic IP addresses, increasingly accompanied by new tools to access the Net (for example, mobile phones). In spite of these disadvantages, the numbers of hosts and Internet domains are the principal means utilized for analyzing Internet diffusion.

To measure Internet diffusion in Italy among firms, we used the endogenous measure of second-level domain names registered under the ".it" ccTLD, managed by the Institute of Informatics and Telematics of CNR, Pisa, using data that were extracted from the registrations databases, using automatic and semi-automatic procedures. We created a new database for analyzing Internet diffusion by initially consulting the WHOIS database (the latter contains information regarding the domain names registered under the ".it" ccTLD, applicants who have signed a contract with IIT-CNR and technical and administrative contacts) using an automatic procedure; for example in order to determine the type of applicant, the automatic procedure verified whether an ORG field (organization name) and a DESCR field (description of the organization registering the domain name) were present and if they were, depending on the values of these fields, classified it as a firm. If the ORG or DESCR fields were wrong, the LAR (is a Letter of Assumption of Responsibility through which the applicant assumes full civil and penal responsibility for the use of the domain name requested) database (semi-automatic procedure) was consulted. Finally, where LAR information was not accurate enough, the Italian Chamber of Commerce database was consulted.

Approximately 900,000 domain names were analyzed and grouped into several categories (individuals, firms, universities, associations, public groups and other registrants). In this paper particular attention, as mentioned above, was paid to the registration of domain names by firms. To be able to register a domain name under the "it." ccTLD, firms must send to the Italian Registry a LAR. The five LARs currently available differ according to the type of applicant (individual ,association/foundation, public administration, professionals, companies).

From this research performed as on December 31, 2004, it was established that the number of domains registered by firms came to 411,339 of which 407,030 were registered by Italian firms and 4,309 by foreign firms. Furthermore, 1,944 domains registered by Italian firms were not classified since it was impossible to discover the province of origin.

3 RESULTS

To measure the digital divide among Italian regions (Italy is divided into 20 regions) we utilized as metrics the number of domain names registered by firms under the ccTLD ".it", the penetration rate calculated every 100 firms, the index calculated by Zook and the Gini index (Gini, 1960).

The Zook index "Domain name Specialization Ratio" is "a useful technique for comparing regions which indicates the extent to which a region is specialized in domain names compared to the United States as a whole" (Zook, 1999).

That index has been used by Mattew Zook to define the digital divide in the United States

utilizing as metrics the number of domains registered by the firms under the ccTLD ."com" (Zook, 1999, 2000, 2001) and it is calculated in the following way:

Domain name Specialization Ratio =

(Number of .it domains in a region / Number of firms in that region) divided by

(Number of .it domains in a country/ Number of firms in a country)

An index value greater than one indicates a higher specialization than the national average and an index value less than one indicates a lack of specialization.

The penetration rate formula is as follows:

Penetration rate = (Number of .it domains in a region* 100)/Number of firms in that region

Our research shows and as literature suggests, even if some regions have a high specialization rate compared to the national average (for example Lombardy, Trentino Alto Adige, Tuscany, Latium) the variance among the analyzed regions could be extreme (Zook, 1999).

As mentioned before, an additional measure that was adopted in order to verify the existence of digital divide in Italy is the Gini concentration index (Gini, 1960). The Gini index assumes values equal to 1 and 0. Value 0 indicates equidistribution and 1 signifies the maximum concentration. The aim of the so-called "statistical theory of concentration" is to provide tools and techniques for measuring the concentration in concrete situations or for comparing

the degree of concentration among heterogeneous situations.

The Gini index, calculated on the number of registered domains (that number should not be confused with the above mentioned penetration rate) confirms the above mentioned results. Only firms with head offices in some provinces of Italy register a high number of domains while firms with head offices in other provinces (especially in the South of Italy) shows scarcely significant percentages. The first ten provinces over 103 register nearly half of the domains compared to the national totality (43.74%).

The study also compares the number of domains registered by firms with head offices in provinces with an income perceived by the single province and the number of firms of a single province in order to verify if the distribution of the registered domains is similar to the number of the existing firms and income distribution. In other words we wanted to verify if the Italian areas that are the richest and the most industrialized are also the most inclined to use the Internet.

Table 1 shows that the Gini index, calculated on the number of the registered domains is higher than the index calculated according to income and number of firms; this to signify that in Italy the most industrialized and richest provinces not always come first in the registration of domain names.

Table 1: Gini concentration ratio.

Gini index	
No. of registered domains	0.543
Number of firms	0.468
Total income provinces	0.466

A first conclusion that comes from the observation of the above mentioned results, is that the Internet cannot be considered as a spreading phenomenon capable of closing the gap among Italian regions and provinces: domain names distribution proves to be more concentrated than income level and the number of firms, this to signify that the Internet is far from being an equalizer, it rather intensifies the differences among Italian areas.

3.1 Factors That Cause the Digital Divide

To identify the key factors contributing to the existence of the digital divide at a regional level (the survey has been conducted at a regional level and not at a provincial level as many variables were available only at a regional level) we identified five models:

Model 1: stepwise regression taking as dependent variable the penetration rate calculated every 100 firms and as independent variables economic indicators;
Model 2: stepwise regression taking as independent variables indicators that express the cultural liveliness of a given region;
Model 3: stepwise regression taking as independent variables indicators that express the educational attainment of a given region;
Model 4: stepwise regression that takes into consideration demographic indicators;
Model 5: stepwise regression that takes into consideration as independent variables indicators connected to the ICT.

In the stepwise regression the independent variables are inserted in the equation if the F probability is of <= 0.050 while they are removed from the equation if the F probability is of >= 0.100.
Nevertheless the models 1, 2, 3 ,4, 5 show the multicollinearity problem: the variables studied in each model could be correlated to the independent variables examined in the other models generating an evaluation distortion. For example the independent variable number of registered patents of model 1 could be correlated in a positive or negative way to the independent variable number of employees devoted to research and development of model 3.

3.1.1 Model 1

Model 1's purpose is to verify if the disadvantaged areas in terms of economic development are also disadvantaged in terms of Internet diffusion.
In this model the only significant variable that expresses the variance for the 64.4% of Internet diffusion among Italian regions is the added value per employee (see table 2). The rest of the variables analyzed in the model (see table 3) prove to be scantly significant as they do not reflect the literature (Chinn and Fairlie, 2004; Hargittai, 1999; Guillèn & Suarèz, 2001, Maitland & Bauer, 2001, Norris, 2001). Besides, although the above mentioned variables prove to be little significant in expressing variance at a regional level, the economic indicators such as total income, per capita income, number of registered patents every 100 firms and the percentage of big firms are positively correlated to the penetration rate. Table 3 indicates the above described trend.

Table 2: Coefficients (a) - F = 32.62 SIG. = 0.000 R^2 = 0.644.

Model		Non standardized coefficients		Standardized coefficients	t	Sig.
		B	Standard Error	Beta		
1	(Constant)	-13.383	3.909		-3.423	.003
	added value per employee.	.000	.000	.803	5.711	.000

a dependent variable: Penetration rate

Table 3: Pearson's correlation matrix.

	Penetration	added value per employee.	Percentage big firms	Total income	Per capita income	Registered patents every 100 firms
Penetration	1.000					
added value per employee.	0.803**	1.000				
Percentage big firms	0.539*	0.637**	1.000			
Total income	0.480*	0.510*	0.921**	1.000		
Per capita income	0.737**	0.828**	0.314	0.166	1.000	
Registered patents every 100 firms	0.702*	0.717**	0.701**	0.611**	0.478*	1.000

** the correlation is significant at the 0.01 level; * the correlation is significant at the 0.05 level

3.1.2 Model 2

Model 2 seems to confirm to a slight extent the combination between technological indicators and cultural indicators (Florida, 2002).
The results are shown in table 4.

Table 4: Coefficients (a) R^2 = 0.34 F = 9.442.

Model		Non standardized coefficients		Standardized coefficients	t	sig.
		B	Standard Error	Beta		
2	(Constant)	7.464	.663		11.266	.000
	spending in theatres and music	3.557E-05	.000	.587	3.073	.007

a dependent variable: Penetration rate

Although the model is rather plain, it expresses only the 34% of the ICT diffusion variance among Italian regions, the independent variable have a statistically significant positive effect in the ICT diffusion.
The H5 hypothesis is confirmed: the Internet is diffused in Italy among regions with a higher spending in theatres and music (Beta is equal to 0.587).

3.1.3 Model 3

Table 5 shows that the educational attainment plays an important role in the ICT diffusion among firms, the model expresses the 93.4% of the Internet variance diffusion among Italian regions: regions with a number of employees devoted to research and development and with a higher number of Providers/Maintainers (the Providers/Maintainers are the companies registering a domain name for somebody else, offering connection to the Internet services, managing electronic mail and so on - in practice they are the companies specialized in the ICT services) are more inclined to utilize the new technology.

Table 5: Coefficients (a) - R^2 = 0.938 F = 56.58 Sig. = 0.000.

Model		Non standardized coefficients		Standardized coefficients	t	Sig.
		B	Standard Error	Beta		
3	(Constant)	8.422	1.015		8.294	.000
	Providers/Maintainers every 1000 firms	29.844	3.663	.702	8.148	.000
	graduates in technical scientific subjects	-.086	.015	-.430	-5.849	.000
	number of graduates every 1000 inhabitants	-.033	.011	-.232	-2.884	.011
	number of employees devoted to research and development	.442	.175	.195	2.518	.024

a dependent variable: Penetration rate

Besides, a result that according to us is worth mentioning, is that the number of graduate people, unlike the other variables expressing the educational attainment level at a regional level, cannot be considered as a factor that affects Internet diffusion among firms, the beta tanking into consideration the number of graduates every 1000 inhabitants proves to be negative and significantly different from zero (the beta is equal to -0.232 at a significance level 0.01) (see table 5). This means that regions with a high level of educational attainment calculated in terms of graduates, register a lower penetration rate. This trend is explained by the fact that in less industrialized areas and where job opportunities are scanty, 19 years old youngsters continue their studies and tend to graduate with the hope of finding a job more easily (usually they find jobs in the North or in the Centre of Italy anyway) while in the northern and central regions that are more industrialized and where there are wider job opportunities young individuals tend not to continue

their studies and start working usually right after secondary-school diploma.

3.1.4 Model 4

Model 4 shows that there exist a linear relation between the demographic indicator and the registered penetration rate (that model expresses the variance of the 68% of the Internet diffusion).
Regions with a high jobless rate are less inclined to utilize the new technology, the correlation between the penetration rate and the jobless rate proves to be negative and significantly different from zero, the beta is equal to -0754 (see table 6).

Table 6: Coefficients (a) – R^2 = 0.680 F = 18.079 Sig. 0.000.

Model		Non standardized coefficients		Standardized coefficients	t	Sig.
		B	Standard Error.	Beta		
4	(Constant)	10.239	.719		14.231	.000
	Jobless rate	-.263	.048	-.754	-5.488	.000
	Residing population	4.154E-07	.000	.375	2.731	.014

a. dependent variable: Penetration rate

3.1.5 Model 5

As it could be expected even model 5's hypothesis are confirmed: the infrastructure supply is a good magnitude to measure the existence of the digital divide: the technological indicator has also a statistically significant positive effect on the ICT diffusion (see table 7), in addition the correlation between the penetration rate and the indicator that expresses infrastructures in ICT proves to be positive and significant to a 0.001 level, (the beta is equal to 0.673) this means that some regions with a high investment in IT register also a high penetration rate.

Table 7: Coefficients (a) – R^2 = 0.45 F= 14.878 Sig. = 0.001.

Model		Non standardized coefficients		Standardized coefficients	t	Sig.
		B	Standard Error.	Beta		
5	Constant	4.705	1.162		4.047	.001
	Ratio of IT expenditure in each region and number of firm in that region	1.077	.279	.673	3.857	.001

a. dependent variable: Penetration rate

Besides, even the above mentioned model expresses a variance of only 45% of ICT diffusion among Italian regions.
A first conclusion is that even if in Italy, as literature suggest (Guillén and Suaréz, 2001; Kiiski and Pohjola, 2002; Chinn and Fairlie, 2004), infrastructures play an important role in determining the digital divide; economic indicators and indicators related to the educational attainment are also important to explain the differences about Internet use among Italian regions.

4 CONCLUSIONS

In our paper we wanted to analyze the factors that cause the existence of the digital divide in Italy. The econometric analysis shows that the indicators related to education, in particular the number of firms specialized in the ICT services sale, substantially contributes to the existence of the digital divide among firms that have their head offices in a given region and, as economic literature suggests (De Arcangelis et al., 2002), also the number of employees devoted to research and development becomes a crucial element.
Another key factor that causes the existence of the digital divide in Italy, according to the results obtained by other researches (Kiiski and Pohjola, 2002) is determined by economic indicators. Especially in Italy the added value per employee is a variable that significantly expresses Internet diffusion among Italian firms variance.
Although the technological indicator, calculated according to investments in IT among Italian regions, is an important factor contributing to the existence of the digital divide in Italy, it does not express significantly the variance of Internet diffusion at a regional level. This result disagree with some researchers. For example Chen, Boase e Wellman 2002, and UCLA, 2000, 2003 finds that, in addition to income, access costs are strong predictors of Internet use.
Finally, according to the results obtained we want to highlight that in Italy in disagreement with other researchers (U.S. Department of Commerce, 1999 and Chinn and Fairlie, 2004) even if the variable showing the educational attainment at a regional level (i.e. the number of graduates calculated every 1000 individuals), has also a statistically significant effect in the ICT diffusion, the correlation between this variable and the penetration rate registered by firms in a given region prove to be highly negative. This means that the regions with a high number of graduates, in proportion to the residing population, are the less inclined regions to utilize the new technology.
However, the results obtained in this chapter illustrates the factors contributing to the existence of the digital divide at a regional level, utilizing as

metrics the number of domains registered by firms. It is obvious that economic indicators and other types of indicators related to education compared to the number of graduates in Italy, such as the number of employees devoted to research and development or the providers/maintainers number are the best elements contributing to the existence of the digital divide among firms.

On this matter, in a future research, it would be desirable to analyze Internet diffusion in Italy among individuals and to compare the results obtained with the analysis carried out in this chapter.

In conclusion, the digital divide in Italy depends on the educational attainment level, on regions that are productively efficient (that efficiency is calculated in terms of added value per employee) and with a low unempolyment rate.

Besides, in this chapter not only we identified the factors contributing to the existence of the digital divide, but also, analyzing data, we observed the presence of a serious issue: Italian regions with a low economic development and regions with a wide jobless rate appear to be underdeveloped even from a technological point of view. The difference between those who use the Internet and those who do not is another factor that contributes to the widening of the gap that makes geographical areas uneven (Northern and Central areas of Italy not only are more industrialized, richer with a high productive efficiency and in the forefront compared to Southern ones, but are also the areas that have higher penetration rates). In the first instance the Internet could be a pervasive phenomenon justified by the decentralized, non-hierarchical, immaterial nature of the Internet technology (Negroponte, 1995), which in principle should not have strong barriers to overcome as it happens in manufacturing (for example if a new manufacturing company decides to enter a highly competitive sector of the market, barriers could be represented by big companies with strong contractual powers or by high investments costs required to enter the market). This to mean that everyone in Italy could use the Internet to exploit its potentials, considering its low access costs. Besides Internet is a resource that if used by an individual, this does not reduce the possibilities of being used by someone else (immaterial nature), but on the contrary it brings benefit not only to that individual but also to all the users (net externality, Metcalfe law) (Hansons, 2000). Data show that this effect does not take place at a provincial level at all. Domains are even more concentrated than the number of firms and income. A ranking of provinces by penetration rate, shows that the distribution of Internet follows large differences in the level of income: even if some provinces have a high number of firms and high income, not always they are also the first in terms of registered penetration rate.

Before drawing conclusions, these data should be compared to those on the use of domains by individuals, and this comparison is currently in progress. Our preliminary conclusion is that, far from being an “equalizer”, Internet technology follows and possibly sharpens existing differences in economic opportunities within industrialized countries like Italy.

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