



## Impact of use and appropriation of ICT in marginal populations Impacto del uso y apropiación de TIC en poblaciones marginadas

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**Abstract:** the globalizer's phenomena have certain economies integrated into local economic systems, producing technological marginality (MT): separation or social exclusion in relation to the use of tools and services that provide scientific and technological skills. Therefore, this article discusses the research that investigated in the period 2012-2015, about the influence of ICT (information and communications) in the life of the inhabitants and SMEs in the town of Ciudad Bolívar (Bogotá Colombia), in which is located the headquarters of the Faculty of technology of the University Francisco José de Caldas (UDFJC) taking into account indicators: digital divide, technological marginalization and inclusion. A methodology is also presented, considering the allowable error, the confidence level estimated, and character of the samples based on quantifying the impact of technology through scope, strategies, tools and statistics, using: Measurement Surveys Productive Sector; survey measuring basic needs at home, and needs assessment surveys in the environment; so that it can be replicated in subsequent studies gathering information to identify local baselines in technology and needs that may supplement and / or improve through ICT.

**Keywords:** ICT, digital inclusion, digital divide, accessibility, technological usability, marginal population.

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**Resumen:** Los fenómenos globalizadores han dejado de integrar ciertas economías al sistema económico local, produciendo marginalidad tecnológica (MT): separación o exclusión social en relación con el uso de herramientas y servicios que proporcionan habilidades científico-tecnológicas. Por lo anterior, el presente artículo aborda la investigación que indagó, en el periodo de 2012-2015, acerca de la influencia de las TIC (Tecnologías de la información y las comunicaciones) en la vida de los habitantes y pymes en la localidad de Ciudad Bolívar (Bogotá Colombia), en la cual se encuentra ubicada la sede de la Facultad Tecnológica de la Universidad Distrital Francisco José de Caldas (UDFJC) teniendo en cuenta indicadores de: Brecha digital, marginalidad tecnológica e inclusión. Se presenta igualmente una metodología propia, teniendo en cuenta el error permitido, el nivel de confianza estimado y el carácter de las muestras basados en cuantificar el impacto de la tecnología a través de los alcances, estrategias, herramientas y estadísticas, usando: encuestas de medición de Sector Productivo; encuesta medición de necesidades básicas en el hogar; y encuestas de evaluación de necesidades en el entorno; de manera que pueda replicarse en estudios posteriores donde se requiera recopilar información identificar líneas base locales en cuanto a tecnología y necesidades que se puedan suplir y/o mejorar a través de las TIC.

**Palabras clave:** TIC, Inclusión digital, Brecha digital, accesibilidad, usabilidad tecnológica, población marginal.

## 1. Introduction

The town of Ciudad Bolivar, the 19th of Bogota (Colombia), is the third largest town after Usme and Sumapaz, with about 12,998.46 hectares. The area is crisscrossed by streams Lima, Peña Colorada and Trumpet, flowing into the river Tunjuelo. It consists of 252 neighborhoods that are home to more than 700 thousand inhabitants, whose data technical households, technological usability, education, literacy and some labor market indicators are in Table 1, along with its geographical location, as in Figure 1.

Occupies, for the above context, inquire about how and with what tools Information

Technology and Communications (ICT) have been socially involved and measure whether such a society has been favored with the benefits they offer. Specifically, if the inclusion of these new technologies in social processes has allowed - such as the use of computers, the Internet and environments of technological learning -an increase in benefits or tangible consequences that brings use [3] where the indicator under investigation is the technological marginality (MT).

In accordance with the foregoing, it is appropriate to characterize the MT. A first aspect has to do with the digital divide, defined as the social and economic difference (both gender conditions, culture, geographical location,

STATE DATA SOCIO – TECHNOLOGICAL	
Households with computer, phone and internet	
Total households	169,545
Households with computer	49,782
Households with fixed telephone	101,705
Households with Internet	35,446
Literacy	
Men aged 15 years or more	6,169
Women aged 15 years or more	7,811
Number of educational institutions	
Public schools	66
Unofficial schools	106
Universities	1
Research centers	1
10 and more people who have cellular, computer or internet use	
They use computer	208,402
They have cell	361,478
Internet use	213,117
Main indicators of labor market	
Occupied	258,902
Vacated	33,494
Economically active population	292,396
Inactive population	191,304

Table 1: Data of the socio-technological State of Ciudad Bolívar. Source: [1].

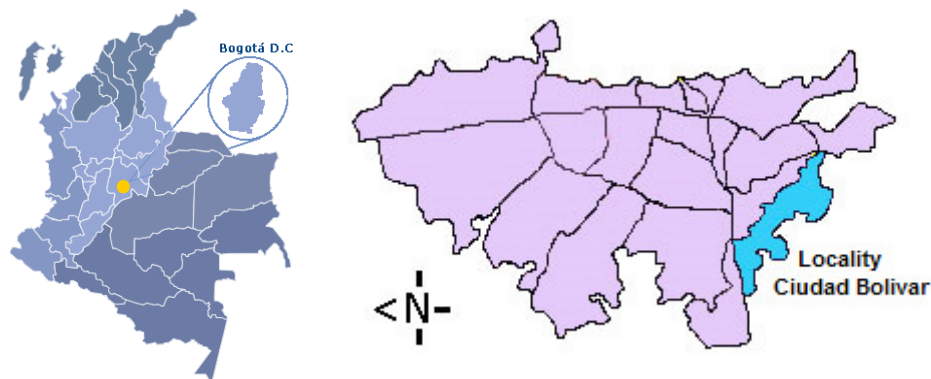


Figure 1: Geographical location of Bogota and the study area. Source: [2].

etc.) that exists for the acquisition and use of technological tools of Information and Communication; limiting access and economic and social application of the same, and therefore the ability of an industry to make use of such technology.

A second aspect is the digital inclusion, as a process that allows people to enjoy all the rights and all opportunities arising from ICT access and use; understanding that information and communications technology are useful for improving the quality of life of people and stimulate community development, along with improving their occupational skills. Digital Inclusion is understood, then, as the technological process of culture resulting in social cohesion where access to

information is assumed to be an essential element of building equity, derived from all support and ICT support.

Adding to the above, since 1995 the UDFJC has maintained a presence in the town of Ciudad Bolivar through the Faculty of Technology, whose offer undergraduate and active research groups are shown in Table 2. In particular, the area of telecommunications has developed through the research group GIDENUTAS, from 2008 to 2015, research and development in the field of digital inclusion, focused on training in the use and appropriation of ICT. They have also organized academic settings as the V international forum future of social ICT in the Americas region; structuring and implementation of e-learning courses for the center

TECHNOLOGICAL FACULTY			
NUMBER OF STUDENTS		7744	
<b>Undergraduate curriculum projects</b>			
<b>Civil engineering propaedeutic cycles</b>		<b>Telecommunications engineering propaedeutic cycles</b>	
<b>Technology in Civil Construction</b>		<b>Electronics technology</b>	
<b>Seed research</b>		<b>Control Engineering propaedeutic cycles</b>	
Investigation groups		<b>Seed research</b>	
VIVIENPO UDENS VIVIENPO	CAPTE GIDPAD Research Group pavements GIICUD	SIRO Siudat	DIGITI ROMA ORCA INTEGRA TELETECNO GIDENUTAS GIRMA UDINEX SCIBAS GRESFIMA
<b>Ingeniería de Producción por ciclos propedéuticos</b>			
<b>Tecnología Industrial</b>			
<b>Seed research</b>		<b>Investigation groups</b>	
El kibbutz Étymos CERES TECNOWORK	DEDALO ARMONICO GIDETCI LENTE EAFITI ISIS	<b>Mechanical Engineering propaedeutic cycles</b>	
<b>Engineering &amp; Power Distribution Networks by propaedeutics cycles</b>			
<b>Electrical engineering propaedeutic cycles</b>		<b>Mechanical technology</b>	
<b>Telematics Engineering by propaedeutic cycles</b>		<b>Seed research</b>	
<b>Electrical Technology</b>		<b>Investigation groups</b>	
<b>Seed research</b>		SIMEC PEMI Mar	
<b>Investigation groups</b>		DISING GIDETCI GIEAUD TRIBOLOGY AND ANALYSIS OF FAILURE LECME	
<b>Systematizing data</b>			
<b>Seed research</b>		<b>Investigation groups</b>	
SIAT SIEPOT SICE	GISPUD GIDETCI GIPUD ARMOS CEM GICE	PEGASUS GEHIRN Prograf S	IAFT METIS ORION IMAGINET FIZMAKO Grecia

Table 2: Curricular Projects UDFJC. Source: [5].

of excellence ITU Americas region; and measuring the baseline access use and appropriation of ICT by households in the village.

Among other products, computer applications have been obtained with the ability to interact with Smartphones and / or Tablets; and the establishment of policies based on regional consensus on concepts such as penetration rates of ICT; measurement parameters Digital Divide; digital cities, their impact and social contribution; and Digital Inclusion, concerning forms of access to ICT and the reduction in the difference in purchase of technological tools among sectors with economic facilities versus those who lack these opportunities [4].

For these reasons, the issue on the characterization and use of ICT continues and awaiting academic contributions. Accordingly, this article describes the results of research to measure the impact on the use and appropriation of ICT use understanding as how the resources or technological tools in everyday activities are adopted; and ownership as the ratio of effective application of technology to facilitate daily needs.

Survey methodology aimed at 10,000 villagers classified Measurement Survey basic needs at home; surveys measuring Productive Sector; and needs assessment surveys in the environment. Items that involved ICT -related data were also determined, such as: percentage of inhabitants who have radio service broadcasting, television, fixed line penetration, mobile line penetration, penetration of computers and internet and computers without; in addition to the frequency of Internet use, access points, and objectives navigation.

In the productive sector surveys were categorized as follows: number of workers, computers in each company, computer use in the

company, type of internet access, internet capability, internet use, need to enhance learning in business, and number of fixed and mobile lines in the company .

The article is structured as follows: state of the art, materials and methods, results, discussion of results and conclusions.

## 2. State of the Art

This section describes the projects displayed from the year 2010, related to appropriation of ICT in Colombia.

Initially, Colnodo - an organization whose main objective is to facilitate communication, exchange of information and experiences between the Colombian organizations at local, national and international levels through electronic networks of low cost, addressed strategic programs such as digital inclusion and the strategic use of (ICT) for development. Thus the project “Strengthening women in using ICTs to combat violence against women and girls” emerged in order to strengthen capacities in the use of ICT by women from various sectors, and promotion campaigns and actions to combat gender violence through the use of ICT. With this project the realization of two feminist exchanges of technology, which is directly trained in the use of technologies to eliminate violence against women and girls was achieved; likewise, it made the delivery and monitoring of seed funds for seven proposals, through which organizations contributed to the prevention of violence against women and girls using technology [6].

Similarly, Colnodo developed the project “National ownership of ICTs through telecentres and other local centers access to ICT”; ie promote meeting places, learning and communication in the use of ICT as a means for

strengthening and management of initiatives aimed at improving the living conditions of communities, strengthening communication processes in indigenous communities nationwide and departmentally through partnerships with organizations located throughout the country. Thus, in 2010, 24,579 people were digitally literate, and 11 training tutorials were developed for vulnerable populations [7].

In late 2010 a “study of the impact of the use and appropriation of ICT in the Wayuu Community of Colombia, as a tool to safeguard and disseminate their cultural, tangible and intangible heritage” was held. The research, developed with support from the FRIDA Program, showed the Wayuu case which illustrates how modernity has impacted their traditional lifestyle, causing the vast majority of communities in rural areas to have migrated to the cities; as well as the precarious participation in local affairs. Given this reality the use of ICT was raised as an ally in safeguarding its cultural heritage, resulting in a model capable of replicating as experience in other indigenous communities in Latin America and the Caribbean. ICT tools and applications, then, accounted for protective measures: identification, documentation, research, preservation, promotion, enhancement and transmission; as well as opportunities for the commercialization of goods with cultural value, [8].

By mid-2012, an article entitled “The information and communications technology in environments rural learning as mechanisms of social inclusion” in which the importance of information and communications technology (ICT) are discussed and published in the teaching-learning process, carried out in rural communities, as strategies for social inclusion. Inclusion mechanisms were raised from the development of policies and projects aligned to the appropriation and use of ICT-orient-

ed educational processes that respond to the needs and the characteristics of community reality features. This meant generating better opportunities to enhance rural development; raising possibilities of insertion of the population in the labor market; as well as improving the quality of life, access to information, and reducing the digital divide. It can be concluded that, in rural settings, ICTs provide access to information and knowledge through the training process and learning mediated by them, enabling greater efficiency and effectiveness in training. In addition to the above, these learning processes are mediated by virtual environments and managed to reduce the digital divide that separates people living in the rural area of urban, plus the use and appropriation of ICT manages to include them socially, mitigating the problems marginalization and isolation that many of these communities face [9].

In late 2012, Colombia Digital Corporation (CCD) creates centers of public access to ICT. These centers have positioned over recent years as sites that make possible, at the local level, the participation of people in the use of the Web, but also in the transition of knowledge and expertise in various ways [10].

Furthermore, a project under the Government Program Bogotá Humana is the ICT For Government Digital Agenda, Smart City, and Knowledge Society and Entrepreneurship [11], the Bogotá project follows: ICT dynamization of knowledge and enterprise, whose aim was to promote the use and appropriation of information and communications technology, giving people greater opportunities for access to knowledge and leisure, economic and social development with entrepreneurship, help to overcome social exclusion, to close gaps between the various citizenships. To meet this objective, the High Council District of ICT gave life to the project Ciudad Bolívar Digital



Locality by Inter-administrative Cooperation Agreement 512 between the General Secretariat - Through the Office of the High Council District ICT - District Department of Education - Secretary of Economic Development - Department of Social Integration - Local mayor of Ciudad Bolívar - University Francisco José de Caldas - Bogota Telecommunications Company. The Digital City Ciudad Bolívar Project as a digital inclusion model focused on developing strategies to provide access, training, and appropriation of ICT through academic offerings were issued in 13 interactive portals located in the locality; among the most popular contents were: digital literacy, basic and advanced office, digital creativity, web 2.0 tools, and computers for children [12].

Finally, in the last five years, there have been projects focused on the inclusion of ICT among the most vulnerable population, since although poverty has declined over the past 4 years in Colombia, still there are great inequalities. 20% of the income of Colombia is in the hands of 1% of the population, while half of that income belongs to 10%. This concentration is much higher than exists in the United States [13]; in Colombia more than 70% of households are located at the base of the pyramid, that is, they live their daily lives on less than two dollars a day [14].

Therefore, from MINTIC the Vive Digital Plan 2010-2014 was created, whose main objective was to digitally include the poorest Colombians. Hence many initiatives, such as the Vive Digital Points that linked population strata 1 and 2 with technology, subsidies for computers up to 520,000 and Internet connections with an Internet plan 2 Mbps from \$6,400 per month were derived for 24 months for users of affordable housing and priority interest; with the aim of providing access to multiple opportunities for people to potentiate their skills [15].

With this project, Colombia achieved an unprecedented breakthrough in order to spread the Internet to reduce poverty and create jobs. The end of that four-year period had almost all the country's municipalities using high speed internet. The total number of beneficiaries at the end of the project: Household stratum 1 and 2: 118,316; Housing of priority interest: 25,388 in 146 construction projects; and public institutions: 894 [15]. Connections in households quadrupled. Internet was in all rural areas described in the plan, through Kiosks Digital Live 5524 [16]. The largest donation of computers and tablets are made to schools officials: 2 million units between computers and tablets [17]-Colombia has the lowest prices on the continent regarding computers [14].

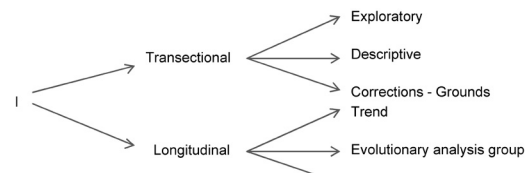


Figure 2. Non - experimental designs. Source: [19]

The Digital plan met and exceeded the goals: Increasing the % of internet users; public servant certificates in ICT; band connections, among other aspects of assessment [18]. Therefore, the second version was implemented, aiming to turn Colombia into a leading country in developing applications with social impacts aimed at boosting the progress of the poorest, thereby exporting 4,000 million people in the base of the pyramid in the world. Henceforth, the idea of a more transparent and efficient based on the use of ICT, with agriculture, justice, education, and health as priority sectors, government became a public policy goal.

### 3. Type of research:

In this case, research was non-experimental, and performed without deliberately manipu-

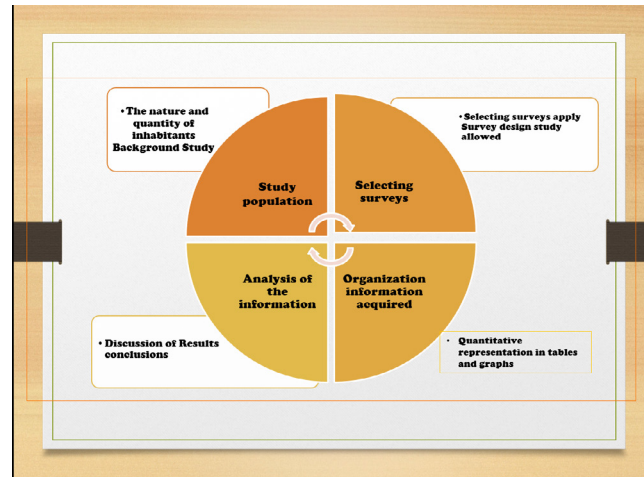


Figure 3: Methodological structure of the article. Source: Own.

lating independent variables; It was based on categories, concepts, variables, events, communities or contexts that have already occurred or occurred without the direct intervention of the researcher. Non-experimental designs are further divided by the number of times data are collected in: transectional and longitudinal, this research used the transeccional design, [19].

In transectional or cross-sectional, data are collected at a single time in a single time. Its purpose is to describe variables and analyze their impact and interaction in a given time, as shown in Figure 2.

#### 4. Materials and methods

In this section, understanding that research is descriptive and has a qualitative nature, a methodology that is structured according to Figure 3 is assumed.

**Study population:** for this phase, surveys for making information neighborhoods and quantity were developed to be performed by units of Zonal Planning (UZP) as shown in Table 3, as an urban subdivision of Bogota and the city of Bolivar City. With this, he made sure all the neighborhoods of each UZP were sampled.

For a population of 616,455 inhabitants in the town of Ciudad Bolivar, they took into account three aspects: The MPE, the estimated confidence level, and character of the sample:

$$\frac{\# \text{Indicadores}}{\# \text{Personas Encuestadas}} * 100\%$$

Equation 1. MPE. Source: [19].

This sample size guarantees a high probability of being able to characterize the population with optimal confidence indices, as with normal distributions, which denote larger samples to 30 units.

UZPs	Neighborhoods	AREA(Ha)
63 Mochuelo	5	207
64 Monte Blanco	8	634
65 Arborizadora	36	267
66 San Francisco	21	173
67 Lucero	77	518
68 El tesoro	60	211
69 Ismael Perdomo	91	503
70 Jerusalem	15	633
UPR Rio Tujuelito	13	140
Total Ciudad Bolivar	326	3285

Table 3. Ciudad Bolivar. Number and extent of neighborhoods according UZP. 2008. Source: [21].

The questions that were applied in the surveys were made and reviewed by expert opinion research group GIDENUTAS.



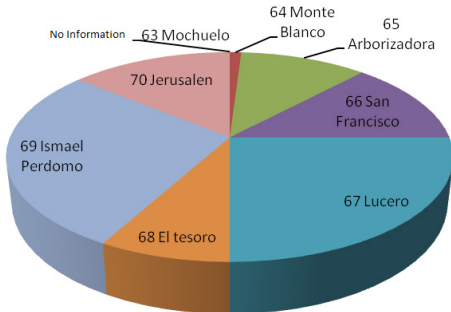


Figure 4: Surveys UZP. Source: [20]

### 4.1 Class Selection survey:

As meeting the objective of gathering relevant information to identify the base of the town line in terms of technology and main needs that may supplement and / or improve through ICT was a need to address the people and their various daily activities.

The surveys were based on the analysis of different experimental designs [19], as well as how to apply them. The validity experimental concept and its implementation were also met. Accordingly, the following surveys were chosen by category:

	% OF PENETRATION SERVICE
L line fixed	16.1 %
Mobile Line	84%
Computers	6.8 %
Computers without internet	3%
Computers with internet	3.8 %
B and wide fixed	16%
N any type of internet connection	81%

Table 4. Penetration of services. Source: Own.

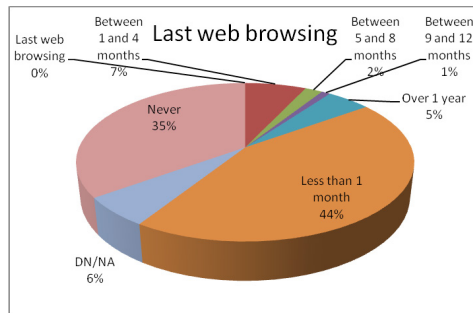


Figure 5. Last internet browsing. Source: [20].

SERVICE	USE	DOES NOT USE	USE IN THE LAST MONTH
USE OF COMPUTER	16.1%	33%	46%
NAVIGATION IN INTERNET	84%	35%	44%

Table 5. Uses. Source: own Preparation

### 4.1.1 Survey measuring basic needs at home:

This type of survey is focused on people living in the area, and have been protagonists in the development of the town, including its problems and new developments at the social level; besides knowing more about their personal and family needs.

### 4.1.2 Measuring ICT Survey in productive sector.

This survey is directly related to the application of ICT in SMEs of the town and its impact; if there is a need to use or see an improvement in the development of the productive sector to use new technologies.

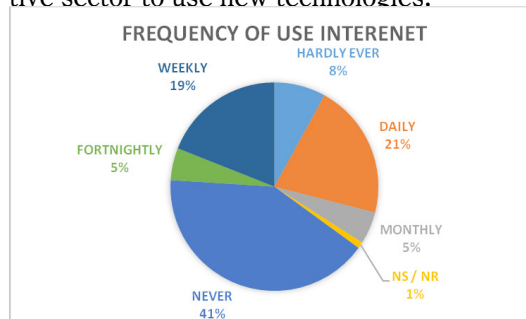


Figure 6. Frequency of use internet. Source: [20]

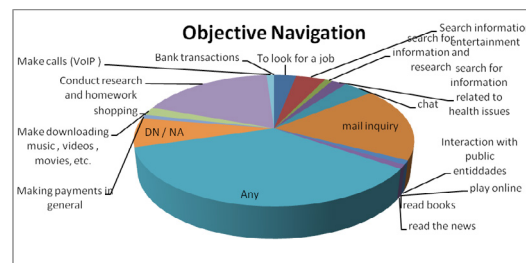


Figure 7. Objective of internet usage. Source: [20].

The study was initiated for the development of surveys, taking information from the neighborhoods and the number of surveys to be made by UZP, in order to Ensure That All Were the neighborhoods of each sampled. It is taken as the overall methodology dividing number of surveys of the number of neighborhoods UZPs to calculate the amount of surveys by quarter (Figure 4).

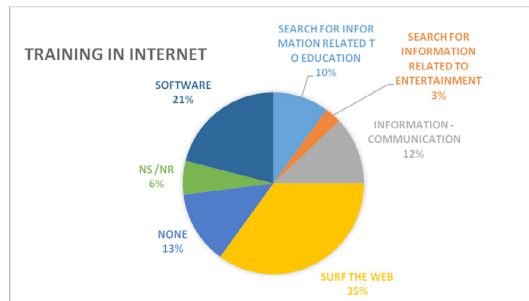


Figure 8. Intention of training through the internet. Source: [20]

## 5. Results

After the 10000 surveys to the inhabitants of the town of Ciudad Bolivar, the information was tabulated to get the following results.

As shown in table 4, the greatest percentage of penetration is mobile line, and the largest number of households have more than one mobile phone line in the home, however, given that the average number of inhabitants per household is close to 5, it follows that only 6 per cent of households each member has at least one mobile by person.

According to the information obtained, there is a significant percentage of people who have never used or interacted with a computer (Table 5), 35 % of the surveyed population never surfed the internet (figure 5), which is worrying, as computers are an essential tool in work and in daily life, bringing us closer to the ICT; the most frequent Internet access, according to the people who have accessed in

Use of internet access in the company		
Activity	% of use	
Search for opportunities	0.97%	
Training	1.94%	
Shopping Cart	3.88%	
Entertainment	8.74%	
Exploring new markets	1.94%	
Payments tax obligations	1.94%	
Production	9.71%	
Relationship with suppliers	4.85%	
Sales	57.28%	
Another	8.74%	Accounting
		Sending information
		Protection of the service
		Internet cafe

Table 6. Use of access to the Internet Source: [20].

the locality, is from an Internet cafe, only 17% have access in the home, and only 40% of the population uses the internet regularly from daily to weekly, 41 per cent of the population never used (figure 6).

Figure 7 shows that the main objective of browsing on the Internet is to perform tasks and consular email.

The results show that for 12% of the respondents, the Internet is not a useful tool, while for the 39% if it is therefore 81% of the population is interested in being trained on issues of the Internet. The main topic of training is navigating the internet (figure 8).

## 6. Business Analysis

The majority of the business area of the town is engaged in trade with a 73.29%, followed by the 20.82% with the loan of some services and a low percentage of 2.66% devoted to industrial production; there are various types of productive sectors, such as tents, food, betting, communications, sweets, ice cream

parlors, bags, seams, internet cafes, bakeries, hairdressers, coal production, recycling, restaurants, miscellaneous and delicatessen stores, uniforms. The use of computers in this sector is very low, as only 14% of companies have computers.

The use that people give to the computer in the company is very low and discriminated for activities such as accounting, administrative management, communication, production, highlighting other activities and especially supports sales with 57,28% of use in this area (Table 6). About 58% of companies consider that the Internet can improve the productivity of the same.

54% of companies do not have people trained in office automation in your organization, only 16% have personnel trained in computer maintenance.

## 7. Discussion and Conclusions

For the measurement of the impact of ICT in a local environment with MT; it is important to know and identify the capacities and needs of the population so as to make the selection design of surveys and their subsequent methodology to use.

The methodology used not only motivates the population study to your active learning through ICT but that allows to generate structures of appropriation accessibility, interaction and digital participation creating social and community actors, individual and collective, serving as a bridge to create opportunities for human development and improvement in the quality of life of their inhabitants.

From the results we can infer that the monthly income of the majority of the population is below the two minimum wages, even less and until a minimum wage is 50%.

The % penetration of computers is just 6.8%, of which 3.8% have access to the Internet; the greater amount of people who access the services of the Internet do so from Internet cafes, however, there is a large percentage of people who have never used a computer or accessed the Internet, close to 35%, the main use of the Internet is to make tasks or enter the email.

Only 13% of the districts do not have an Internet cafe, which enables these sites, future, tend to improve access to ICTS and the penetration of services of Ciudad Bolívar.

The cost of the time from the internet in general, is less than or equal to \$1000, and the minute to cell phone is less than or equal to \$200.

Only 14% of businesses have computers; its use is varied, especially in sales, design, and use of internet cafes; likewise, near the 11 per cent account with access to the Internet, of whom the majority are by ADSL that they are mostly with higher capacities to Mega of speed.

With regard to the use of the Internet, it has been measured to support employers in sales, production and entertainment; however, despite low Internet penetration, respondents believe that could improve their productivity, i.e.: would be willing to use; on the other hand, around 54% of businesses have a person trained in topics of office automation, which would enhance a quick insertion in the Internet.

In summary: the use and appropriation of ICTS generates employment opportunities, training, the generation of knowledge among other contributions, for Smes.

In this regard, there is a need for more government projects and institutions to encourage the use and appropriation of ICTS ensure greater competitiveness, for jobs of higher quality and better pay, in addition to contributing to the decline of the social divide. Access to networks and education are essential for integration into the Information Society.

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