Acceso y uso de tecnologías de la información y comunicación en México: factores determinantes

Access and use of information and communication technologies in Mexico: determining factors

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RESUMEN

La evolución e inserción de las tecnologías de la información y comunicación (TIC) han logrado ser un núcleo de transformación, donde la aplicación, generación y acumulación del conocimiento se incrementan de forma exponencial a nivel global, pero de manera desigual. El presente estudio analiza la brecha digital en México mediante la identificación de los determinantes de la disponibilidad y uso de las TIC. Se estimaron regresiones econométricas con datos de la Encuesta Nacional sobre Disponibilidad de Tecnologías de Información en Hogares (ENDUTIH) 2016. Los resultados indican que el acceso y uso de computadora, internet y teléfono móvil se relacionan con la edad, el nivel de escolaridad, el ingreso, la ocupación, las habilidades digitales y la ubicación geográfica. No obstante, en el uso es esencial la adquisición de habilidades digitales para un aprovechamiento óptimo de las TIC.

ABSTRACT

The evolution and insertion of Information and Communication Technologies (ICT) have managed to be a core of transformation, where the application, generation and accumulation of knowledge increase exponentially at a global level, but unevenly. The present study analyzes the digital divide in Mexico through the identification of the determinants of the availability and use of ICT. Econometric regressions were estimated with data from the National Survey on Availability of Information Technologies in Households (ENDUTIH) 2016. The results confirm that the access and use of computer, Internet and mobile phone is related to age, schooling level, income, occupation, digital skills and geographical location. However, in the use is an essential acquisition digital skill for optimal use of ICT.

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INTRODUCTION

ICTs play an essential role in the economy and the society of developing countries. They have a constructive role in the economic development, GDP growth, acquisition of employment skills, increased productivity and organizational restructuring, reduction of poverty and greater democratic participation of citizens (Torero and Von Braun, 2006, Grazzi and Vergara, 2011, Palvia *et al*., 2017).

At the global level, these technologies connect people, generate more goods trade and services worldwide and increase access to information and knowledge (Kilenthong and Odton, 2014, Nishijima et al., 2017). At a microeconomic level, the access and use of ICTs have positive effects on the labor market, improve the distribution of resources and favor economic growth (Kuhn and Mansour, 2011, Aker *et al*., 2016). However, these potential benefits imply disparities in the access and use that can amplify economic and social inequalities.

The foregoing has become evident in Mexico in recent years. According to the data from the National Survey on Availability of Information Technologies in Households (hereafter ENDUTIH, [Spanish acronym]) of the National Institute of Statistics and Geography (INEGI, 2016a, [Spanish acronym]) more than half of the households in the country do not have an Internet connection (53%); of 32,925,270 households only 45.6% have a computer, and of 122,273,473 inhabitants, 73.6% are mobile phone users. The foregoing figures show that there are groups of people lagging behind in the access and use of these technologies.

This study answers the following questions: What are the factors that determine the access and use of ICTs at home? Is there a disparity in the access and use of ICTs between urban and rural households? This last question responds to the fact that ICTs seem to be an urban phenomenon given the provision of infrastructure and greater possibilities of access in cities; however in recent years the penetration of these technologies has increased in homes located in rural areas. Thus, led by the information from the 2016 ENDUTIH, this research analyzes the digital divide in Mexico by identifying the factors that influence the access and use of ICTs (computer, Internet and mobile phone) in homes.

This research contributed in highlighting that in Mexico, there are few analyzes on the determinants of access and use of ICTs in homes given their recent incorporation into the academic literature (Gutiérrez and Gamboa, 2010, Grazzi and Vergara, 2011; Márquez *et al.*, 2016); second, addressing this issue constitutes an important contribution because one of the objectives of sustainable development is to reduce the digital divide in order to guarantee equitable access to information and knowledge. Third, the study aims at helping the design of public policies to reduce the digital divide in the country.

The rest of the document is organized as follows: the first section describes the origin and evolution of ICTs and the Information and Knowledge Society (SIC, [Spanish acronym]). The second section considers the literature review on the digital divide. The public policies of ICTs in Mexico are presented in the third section. The following

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describes the data and the methodology. The results are shown in the fifth section, followed by the conclusions.

ICTs and the society of information and knowledge

ICTs are defined "as tools and processes to access, retrieve, store, organize, manipulate, produce, exchange and present information by means of electronic means" (Sunkel, 2006, p.8). These technologies began to spread as of the seventies and in the eighties there was a gradual and increasing growth in promoting ICTs, which was the basis of the information society promoted in the nineties (Crovi, 2008).

The term information society was coined at the end of the sixties by Masuda (1981) who established that in modern and advanced societies the generation and transmission of information are the main elements that generate wealth. On the other hand, knowledge society was created in the nineties by Drucker who stressed that knowledge is the main factor of wealth. This notion was added to information constituting the Society of Information and Knowledge (SIC [Spanish acronym]) (Crovi, 2008).

In the mid-nineties developed countries (G7) reiterated the liberalization of the telecommunication sector in order to generate a new model of development based on the use of technology and communication (Alva de la Selva, 2015). Given the relevance of the topic, two World Summits of the Information Society (CMSI, [Spanish acronym]) were held. The first was held in 2003 in Geneva, Switzerland, and its purpose was to prepare the foundations of the information Society for all. The second summit was held in 2005 in Tunis, where the Geneva Plan of Action, the search for solutions and the establishment of agreements in the fields of internet governance and financing mechanisms (ITU, 2003 and 2005) were launched.

Prior to the summits, representatives of the governments of Latin America and the Caribbean met as of 2000 to generate initial proposals and present a position at both meetings. In 2001, the representatives of the Latin American and Caribbean governments issued a declaration in which they established as their common objective "to reach 2005 as full members of the information society with efficiency, equity and sustainability, within the framework of the global economy based on the knowledge" (ECLAC, 2003, p.52). In the Latin-American context, ECLAC defined:

> the information society as an economic and social system where knowledge and information are fundamental sources of wellbeing and progress, that represents an opportunity for our countries and societies, if we understand that its development in a global and local context requires deep fundamental principles such as respect for human rights within the broader context of fundamental rights: democracy, protection of the environment, promotion of peace, the right to development, fundamental freedoms, economic progress and social equity (Katz and Hilbert, 2003, p.119).

Under this scenario, at the beginning of the 21st century, the information society was established as a step towards progress, where technology announced the arrival of a new, more progressive and democratic society driven by ICTs and telecommunications (Alva de la Selva, 2015). However, poverty, exclusion, unemployment, the precariousness of

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work, the unequal distribution of wealth and new inequalities emerged in the knowledge society and globalization (Reygadas, 2008).

The digital divide: a discussion of literature

The origin of the term 'digital divide' remains uncertain and ambiguous, but recent publications (Gunkel, 2003, Van Dijk, 2017) point out that it was used for the first time in an official report by the National Information and Telecommunications Administration of the Department of Commerce of the United States of America in the mid-1990s. Initially, the digital divide referred to inequality among those who had or did not have physical access to ICTs (Van Dijk, 2006).

The provision of infrastructure is essential (Crovi and López, 2011, Tirado-Morueta, 2017) when accessing ICTs physically. This type of access by itself does not generate development, since projects driven by a technological approach have failed, according to the vision that technology is an instrument that channels knowledge from outside, without links to the existing system of knowledge of the communities, their values and culture (Burch, 2007).

Research on the topic went beyond "material access or first level of gap", and addressed the skills needed for users (Hargittai, 2002). This author coined the term "second level of gap", which refers to the acquisition of skills for a productive use of ICTs. Thus, the digital divide was defined as "the gap between individuals, households, businesses and geographical areas at different socioeconomic levels in regard to their opportunities to access ICTs and their use for a wide variety of activities" (OECD, 2001, pp. 8-9). Regarding the use of ICTs, Selwyn (2004) defines said use as any type of contact with this type of technology, which may or may not be significant and may or may not have consequences at medium and long term. Crovi (2008) points out that this use refers to the daily use and the utility or benefit ICTs provide.

According to Van Dijk (2017), the most appropriate meaning to describe and explain all types of digital divide is the following: physical access preceded by motivation, attitude and expectation to obtain material access. The most important elements in the process are: i) motivational access related to the lack of interest and lack of attraction for the new technology, which can be explained by social, cultural, mental and psychological factors; ii) physical or material access linked to the availability of hardware, software, applications, networks, the use of ICTs and their applications; iii) access to digital literacy linked to the acquisition of digital skills; and iv) significant use opportunities (Dimaggio and Hargittai, 2001, Van Dijk and Hacker, 2003, Van Dijk, 2017).

According to Crovi (2008) and Alva de la Selva (2015) the digital divide is associated with the following dimensions: a) technological, related to the provision of infrastructure; b) economic, referring to the lack or availability of resources to access ICTs; c) digital skills, linked to the cognitive abilities that individuals must possess in order to take up ICTs; d) socio-cultural, associated with social attitudes towards ICTs; and e) policy, identifying public policies on access to ICTs and the will to generate participation around them.

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The digital divide has been analyzed from different theoretical perspectives such as sociology, economics, diffusion of innovation, public policy and technical design (Riggins and Dewan, 2005). Research on digital divide during 1999-2005 focused on the meaning of physical access, which is associated with demographic variables such as income, level of schooling, age, gender, race and their structures were sociological (social capital) and economic (diffusion of a technology in the market and the options of adaptation of consumers) (Van Dijk, 2006). Subsequently, the research delved into the consequences of access and use on behavior, relationships and social effects (Van Dijk, 2017).

ICTs are used by specific disadvantaged groups of people, who may be low-income people, with low levels of schooling, unemployed, senior citizens, residents of rural areas, with different capacities, women and girls (Cullen, 2001). The digital divide can have negative consequences on the less favored groups since skills in information technologies are increasingly important for the labor market and Internet is expected to become the main means of communication in commerce, education and entertainment (Fairlie, 2003).

The existing literature on the penetration of ICTs in the households of developing countries, and especially those in Latin America, is still at the early stages. The following is a series of analyzes based on econometric estimates that address the access and use of ICTs in developed and developing countries. In regard to developed countries, the studies indicate that the factors associated with the availability and use of Internet, computers and mobile phones are gender, income, cost, education, geographic location, ethnic origin and age (Chaudhuri *et al.*, 2005, Vicente and López, 2006, Ono and Zavodny, 2007, Noce and McKeown, 2008). Similarly, in developing countries, the variables associated with the access and use of ICTs are income, education, gender, age, household size, occupation, place of residence, ethnic origin and social networks (Gutiérrez and Gamboa, 2010, Grazzi and Vergara, 2011 and 2012, Kilenthong and Odton, 2014).

Public policies on ICTs in Mexico

An overview of ICTs access and use policies in Mexico is described in order to comply with international commitments regarding the SIC. In 2000, the National e-Mexico System was created as the coordinating agency of the different government agencies with the purpose of fostering projects that promote the use and exploitation of ICTs for the benefit of the population.

This system had three objectives: 1) connectivity, 2) digital content and services; and 3) social inclusion (Palacios et al., 2013). Until 2012, the Digital Agenda was implemented as a complementary strategy to broadband to reduce the digital divide in Mexico (Ministry of Communication and Transport, SCT [Spanish acronym] 2012). Subsequently, in 2013 the National Digital Strategy was presented as a plan of actions to promote the adoption and development of ICTs, and to thrust the country in the information and knowledge society, which is based on five objectives: a) governmental transformation; b) digital economy; c) quality education; d) universal and effective

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health; and e) citizen security. These objectives require the following conditions necessary to achieve the goals of the strategy: 1) connectivity; 2) inclusion and digital skills; 3) interoperability; 4) legal framework, and 5) open data (Government of the Republic, 2013).

That same year, Article 6 of the Political Constitution of the United Mexican States was reformed. Said article stipulates that the "State will guarantee the right of access to the information and communication technologies, as well as to the radio broadcasting and telecommunications services, including broadband and Internet "(Official Journal of the Federation, 2013, page 3). However, despite the implementation of public policies aimed at reducing the digital divide in the country, the truth is that there is a set of social groups such as older adults, people with low levels of schooling and indigenous groups that do not have the means to participate in the SIC, thus making the digital divide one of the pending challenges for Mexico.

Data and methodology

Data from the ENDUTIH, 2016 (INEGI, 2016b) were used to provide answers to the following questions: what are the factors that determine the access and use of ICTs in households? Is there a disparity in the access and use of ICTs between urban and rural households, education level, sex, age and geographical location? There was a national, state and main cities geographical coverage of this survey. Its main objective was to generate statistical information that allowed knowing the access and use of the technologies of households and individuals of six years of age and older in Mexico.

For the purpose of this study, the states were grouped into five regions[i] (see Figure 1), based on the meso regions defined in the 2001-2006 National Development Plan as support for the regional development planning system. These regions are composed of several entities that integrate powerful projects which effects go beyond the limits of two or more federal entities (Official Journal of the Federation, 2001).

The econometric estimations included individuals between fourteen and 97 years of age, who are part of the household in the ENDUTIH, 2016. In this research, the household is the unit of reproduction and consumption which is made up of rational individuals and where decision-making regarding the optimal allocation of available resources is adjusted to the utility function of the household (Castaño, 1999). The ENDUTIH contains information on housing characteristics, socio-demographic data of its members, as well as detailed information on the use and availability of computer, Internet and mobile telephony:

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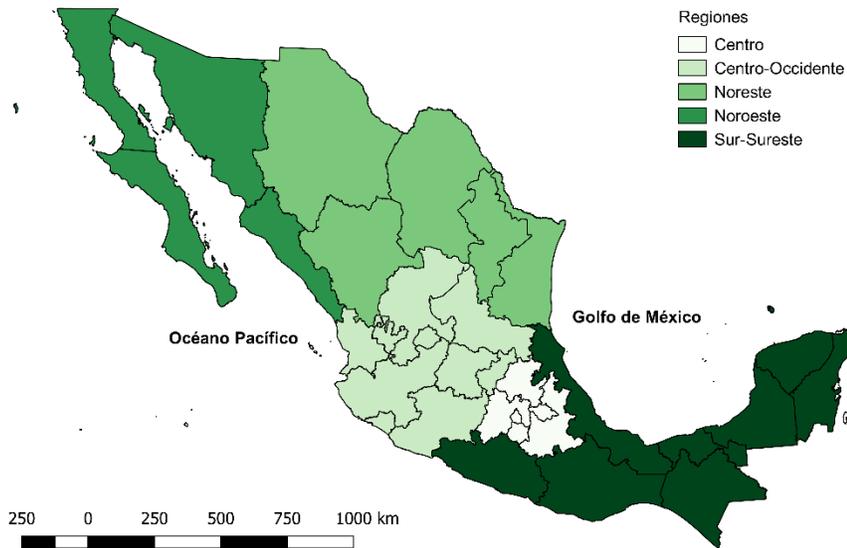
Figure 1. Mexico Geographic Regions.
Source: Developed by the author with INEGI data, 2010.

Model used in Estimating the Access and Use of ICTs

This section presents the specification of the logistic model of the decision to access and use ICTs in Mexican households. We followed Vicente and López (2006) linear utility function to model the household's decision to use the computer, Internet and mobile phone. The individual i will be a computer, Internet and mobile phone user, if the utility associated with the use of these technologies U_{il} is greater than the utility of not using them U_{io}. It is assumed that these utilities are linear functions of the attributes of the decision maker X, and a term of the additive error ε. Therefore, they can be expressed as:

$$U_{i0} = X_i\beta_0 + \varepsilon_{i0} \tag{1}$$

$$U_{i1} = X_i\beta_1 + \varepsilon_{i1} \tag{2}$$

A dichotomous variable Y is defined, where $Y_i = 1$ if the person i is a user of some of the technologies, if not, it is $Y_i = 0$. Then the probability that the person i is a user can be expressed as:

$$P(Y_i = 1) = P(U_{i1} > U_{i0}) = F[X_i(\beta_1 - \beta_0)] \tag{3}$$

Where F is the cumulative distribution function of the error term; assuming that this function is logistic, the model can be estimated by means of a logistic function. Therefore, it can be expressed as follows:

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$$P\ (Y_i = 1) = \frac{e^{X_i \beta}}{1 + e^{X_i \beta}} \qquad (4)$$

X_i is a group of variables at an individual, household and context level

Description of the variables used in the models

Next, the variables used in the models are described. Within the individual attributes, age was classified into four categories: i) 12 to 18; 2) 19 to 30; 3) 31 to 50; and 4) more than 50 years of age, which is the reference category. Gender is a binary variable where 1 is assigned for a woman and 0 for the contrary.

Education wise, five levels were established: 1) Without education as a reference category; 2) Primary; 3) Junior High School; 4) Senior High school; 5) University; 6) Master's Degree; and 7) Ph.D. People's occupations were classified into five groups: i) self-employed workers as the base category; ii) day laborers; iii) worker; iv) entrepreneurs or employers who hire workers; and v) workers without payment.

The number of potential ICT users (over six years of age who attend school) was included in the household variables. We estimated the average education of the members of the household over 18 years of age. The wealth index was calculated through Principal Component Analysis (PCA).[ii] Within the characteristics of the context, 1 was assigned if the household was located in a rural area and, 0 for the contrary.

Regional location variables were also included in order to capture the differences between geographical regions (South-Southeast, Center, Center-West, Northwest and Northeast), where the first mentioned was considered as the reference region. *Logit* regressions were estimated to model physical access and the use of ICTs, since the dependent variable is binary (0 and 1). Access refers to the availability of ICTs in the home and their use by the members of the household. To test whether the proposed models fit well with the data, the Hosmer-Lemeshow´s goodness-of-fit test was applied at a significance level of 0.05. The results obtained indicate that the model specification was adequate (Cameron and Trivedi, 2009).

Results

Description of the Current Situation of Access and Use of ICTs in Mexico

Based on the 2016 ENDUTIH, we present a set of descriptive statistics that gives a general overview of the current situation of access and use of ICTs in Mexico. Figure 2 shows that in 2001-2016 the use of wireline and/or mobile telephony, Internet and computer in homes has increased; the use of mobile phone went from 40.3% to 90.1%; the use of computer from 11.8% to 47% and the Internet from 6.2% to 45.6%. In 2014, there was a fall in the availability of mobile phones as a consequence of the lack of laws that would boost the sector, followed by the tax rate on profits and the high cost of mobile telephony (Martínez, 2014).

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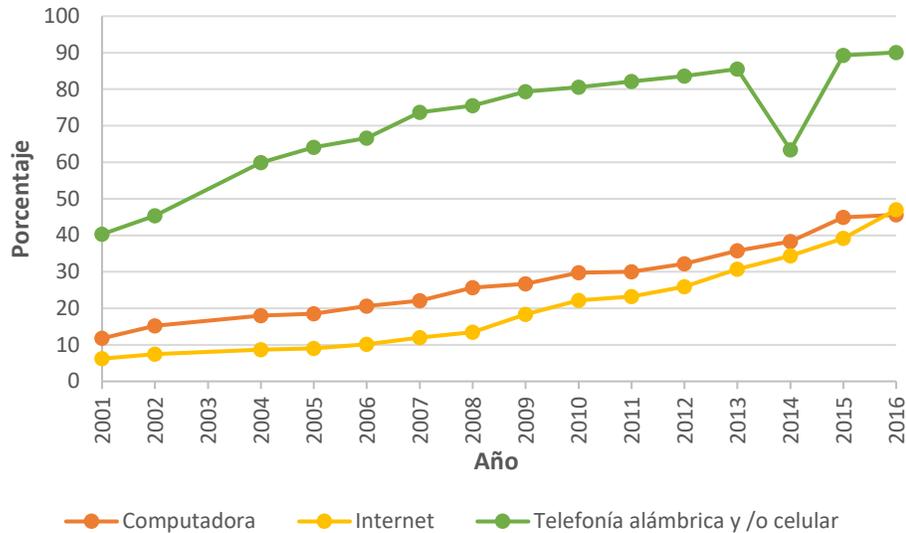
Figure 2. Availability of ICTs in homes according to type of equipment from 2001 to 2016.
Source: Developed by the author with INEGI data, 2016b.

According to the data provided, most households do not have computer equipment due to the lack of economic resources (59.99%), followed by the lack of interest (15.09%). Of the households that do not have a computer, 16.39% do not possess digital skills or do not know its utility. The foregoing indicates that although the main barrier in the access and use of ICTs is economic, there is also an opportunity to improve digital literacy in regard to the use and benefits that these tools can generate in the economy as a whole. Likewise, 74.25% of the households that do possess a computer choose their home as the main site of use of this technology, and 62.41% consider that the main way to learn how to use a computer is on their own.

Similarly, the main reason why households that do have access to a computer are not connected to the Internet is the lack of economic resources (53.87%), followed by those households that consider that they do not need it (19.9). %). Of those who have no connection to the network, 13.42% do not have digital skills or do not know their utility. The latter makes clear that investing in acquiring digital skills is an opportunity. Of the households connected to the Internet, 85.45% said they use the Internet mainly at home, 45.62% access the Internet anywhere with a mobile connection. 90.57% of the users of the network indicate that they use it to send instant messages. Lastly, 91.05% use a smartphone as a wireless connection to the Internet.

As for mobile telephony, 69.59% of users have a smartphone (*Smartphone*), and 76.76% have prepaid airtime recharge service. The previous figures show that the lack of economic resources is the leading cause for the population to lag behind in accessing and using ICTs. However, in addition to income, there are other limitations such as the

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level of schooling, limited digital literacy and the lack of coverage in infrastructure especially in the rural areas of the country.

Table 1. Descriptive Statistics

Variable	Mean	Std. Dev.
Computer availability	0.49	0.50
Internet availability	0.54	0.50
Mobile telephony availability	0.91	0.29
Use of computer	0.44	0.50
Use of Internet	0.59	0.49
Use of mobile telephony	0.86	0.35
Age	44.78	13.97
Age squared	2200.4	1335.8
Average of schooling years	10.27	4.33
Woman (yes=1)	0.27	0.44
Age (14-18 years of age)	0.002	0.05
Age (19-30)	0.18	0.38
Age (31-50)	0.48	0.50
Age(> 50)	0.34	0.47
Elementary school	0.23	0.42
Junior High School	0.26	0.44
Senior High School	0.22	0.41
University studies	0.22	0.42
Postgraduate studies	0.03	0.17
Student (yes=1)	0.03	0.18
Number of potential users	0.66	0.92
Employee (yes=1)	0.95	0.22
Type of employment (day laborer) (yes=1)	0.05	0.21
Type of employment (worker) (yes=1)	0.65	0.48
Type of employment (entrepreneur) (yes=1)	0.03	0.17
Type of employment (worker without wages) (yes=1)	0.01	0.10
Have digital skills (yes=1)	0.46	0.50
Rural (yes=1)	0.62	0.49
South-Southeast Region	0.10	0.31
Central Region	0.24	0.43

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Central-Central-western Region	0.16	0.37
Northwestern Region	0.23	0.42
Northeastern Region	0.16	0.36
Total of the sample	36,334	

Source: ENDUTIH, 2016.

Table 1 provides descriptive statistics of the variables included in the econometric models. The data indicate that Mexican households are largely headed by men (73%). In regard to age, the majority of heads of households are concentrated in the range of 31 to 50 years of age. In regard to schooling, the vast majority of the population of households has junior high school studies. Lastly, only 46% of individuals are made fundamental digital skills available to reduce the digital divide.

Determinants of the availability of ICTs in homes

Table 2 contains the results of the logistic models. It includes the estimated parameters, the z statistic and the marginal effects evaluated in the average values of the explanatory variables. The results of the regressions indicate that the variables associated with the availability of ICTs in Mexico are age, average years of schooling of the household, number of users in the household, place of residence and geographical location.

Women are less likely to have a computer then men. However, they present more possibilities in accessing the Internet. Age is a positive and growing factor; however, after reaching a certain point, it decreases. This result tallies the study Fuchs and Horak (2008) conducted in African countries which suggests that older people adapt less to new technologies than younger people. Another of our findings that is consistent with the work of Grazzi and Vergara (2012) on Paraguay is that the larger the number of household members attending school, the greater the probability of having a computer at home. This confirms that computers are used for educational purposes.

Likewise, the level of schooling is essential for making these technologies available at home. A similar result was found by Grazzi and Vergara (2011) in their analysis of Latin American countries. The wealth index as *proxy* variable of the income increases the possibilities of having a computer and the Internet in the family. In regard to the above, Grazzi and Vergara (2012), Gutiérrez and Gamboa (2010) and Vicente and López (2006) in their research on Paraguay, Latin America and Europe, respectively, agree that education and income are central elements in having access to these technologies.

In regard to the difference between urban and rural areas, households in rural areas are less likely to have access to ICTs. Kilenthong and Odton (2014) found a similar result in their study on Thailand. This indicates that, on the one hand, IT companies do not find rural areas attractive enough to offer their services and, on the other hand, that the government does not have a universal access policy, hence the lack of infrastructure in these areas.

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Lastly, in terms of geographical location, if we consider the South-Southeast region as reference, we observe that the Northwest and Northeast regions are where there is a greater availability of these technologies. Ruiz-Ochoa (2015) reached the same conclusion in his work on Mexico. This evidence reveals that a set of federal and state public policies that promote access to ICTs has been established in the states near the border with the United States of America.

Table 2. Determinants of the availability of information and communication technologies in households in Mexico, 2016

Variables	Computer	Internet	Mobile Telephony
		Marginal Effects	
Woman	-3.85	1.35	0.19
	(-5.14)***	(1.93)**	(0.88)
Age	1.22	1.03	0.31
	(8.06)***	(7.59)***	(8.27)***
Age squared	-0.01	-0.01	-0.004
	(-6.49)***	(-7.42)***	(-11.11)***
Average education level in the household	9.02	6.66	1.19
	(82.88)***	(73.39)***	(43.68)***
Student	3.79	3.38	-0.24
	(1.90)*	(1.78)*	(-0.27)
Number of users	16.19	7.62	1.00
	(39.22)***	(21.78)***	(6.83)***
Work	0.86	-0.61	0.09
	(0.54)	(-0.44)	(0.25)
Wealth index	0.54	0.62	0.11
	(2.56)**	(3.21)***	(1.88)*
Rural	-4.78	-8.08	-0.58
	(-4.48)***	(-8.08)***	(-1.84)*
Central region	2.66	-9.70	-0.77
	(2.58)**	(-10.25)***	(-2.50)**
Central-western region	6.71	-1.39	0.30
	(7.18)***	(-1.60)	(1.16)
Northwestern region	10.68	11.28	2.50
	(10.34)***	(12.20)***	(10.11)***

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Northeastern region	3.75	1.78	0.94
	(3.84)***	(1.99)**	(3.59)***
Wald Chi2	8501.12	6941.38	3874.13
Log likelihood ratio	-17835.56	-20048.54	-8669.17
Size of sample	36334	36334	36334

Notes: *** significant at 1%, ** significant at 5%; * significant at 10%. The reference region is the south-southeast.

Determinants of the Use of ICT in Households

The level of schooling, digital skills and age are among the factors associated with the use of the computer, Internet and mobile phone. The first two are considered fundamental elements in the use of the computer and the Internet. In education, at a higher level of schooling, the probability of using ICTs is higher, especially for people with higher education (undergraduate and postgraduate studies). These results are consistent with those found by Sujarwoto and Tampubolon (2016) for Indonesia. Their study shows that education and digital skills contribute to the use of digital technologies.

Women are more likely to use computers, the Internet and mobile phones in comparison to men; this suggests that women use these technologies in their work activities. The opposite occurs in Gray *et al*. (2016) study on Latin American countries men use the Internet to a greater extent than women by accessing social networks more specifically and gathering political information.

19-30 and 31-50 age cohort groups are more likely to use these technologies in comparison to people over 50. Birba and Diagne (2012), and Grzybowski (2015) came up with a similar finding in their study on African countries. In regard to the type of employment, while considering self-employment as a reference category, we found that day laborers are less likely to use this type of technology, the opposite occurs with people who acknowledge themselves as entrepreneurs or employers.

On the other hand, a greater number of users (students) of computer and Internet in the household increases. Grazzi and Vergara (2012) made the same observation in their work on Paraguay. In regard to the geographical context, residing in rural areas reduces the probability of using ICTs, since in most cases they are isolated places, far from urban areas and with low or no connectivity whatsoever; this evidence is consistent with Sujarwoto and Tampubolon (2016) Indonesian research. Lastly, looking at the geographical regions, and considering the South-Southeast as the reference region, we observe that the Northwest region presents a greater use of ICTs, which makes it evident that in the states of this area of the country, public policies have been implemented to promote the use of ICTs.

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Table 3. Determinants of the Use of Information and Communication
Technologies in Mexican Households, 2016

Variables	Computer	Internet	Mobile telephony
		Marginal effects	
Woman	1.83	4.60	1.40
	(1.68)*	(4.22)***	(5.25)***
12 to 18 years of age	8.04	17.18	4.99
	(0.71)	(2.69)***	(4.28)***
19 to 30	4.39	10.74	5.95
	(2.84)***	(7.76)***	(21.04)***
31 to 50	7.31	11.04	5.62
	(6.28)***	(9.61)***	(18.90)***
Elementary school	20.40	15.80	5.22
	(3.79)***	(4.88)***	(15.46)***
Junior High School	37.39	27.36	9.12
	(7.67)***	(9.80)***	(26.02)***
Señor High School	51.59	36.58	11.68
	(13.00)***	(17.07)***	(34.94)***
University	66.85	48.06	14.90
	(25.20)***	(29.62)***	(42.90)***
Postgraduate studies	65.08	38.44	8.63
	(73.61)***	(60.42)***	(42.70)***
Student	21.33	11.88	1.17
	(6.28)***	(3.93)***	(1.27)
Number of users	1.70	1.34	
	(2.91)***	(2.29)**	
Employee	5.65	3.99	1.93
	(2.75)***	(1.77)*	(3.40)***
Day laborer	-20.95	-20.45	-8.39
	(-8.22)***	(-6.45)***	(-9.88)***
Worker	0.25	0.31	3.47
	0.22	(0.27)	(10.96)***
Entrepreneur	8.75	10.89	4.68
	(2.57)**	(3.68)***	(9.12)***
Worker without pay	-3.58	-5.00	-2.70

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	(-0.84)	(-0.96)	(-2.17)**
Digital skills	77.05	80.79	
	(170.76)***	(189.55)***	
Rural	-4.34	-3.84	-1.43
	(-2.81)***	(-2.36)**	(-3.51)***
Central Region	-3.27	-8.01	-1.22
	(-2.24)**	(-4.98)***	(-3.06)***
Central-Western Region	0.89	-1.47	-0.23
	0.63	-1.02	(-0.66)
Northwestern Region	7.11	7.84	4.39
	(4.48)***	(5.57)***	(14.31)***
Northeastern Region	0.82	2.38	0.57
	0.56	(1.64)*	(1.60)
Wald Chi2	13613.29	12347.55	5056.81
Log Likelihood ratio	-8456.82	-8226.48	-11225.62
Simple Size	36107	36107	36107

Notes: *** significant at 1%, ** significant at 5%; * significant at 10%. South-Southeast being the reference region.

Conclusions

First, the following data answer the question about the factors that determine the use and access of ICTs in Mexican households: higher levels of schooling, the availability of digital skills and income reduce the digital divide, while said divide increases with age (senior adults), low-skilled occupations (day laborers and workers) and geographical location (south-southeast region of the country). Second, when asked if there is a difference between urban and rural households, the results show that rural residents have less access and use of these technologies.

The findings of this study suggest the presence of economic, social and technological inequalities in a country as heterogeneous as Mexico. Hence the need to establish regional public policies aimed at reducing the digital divide. Education wise, it is necessary to increase the levels of schooling, as well as to implement training courses for the acquisition of digital skills for people in an unfavorable situation such as low levels of schooling, seniors and women.

It is also necessary to provide rural areas with technological infrastructure. These areas have very low levels of coverage, since companies, wishing to make profits, only invest in areas with sufficient demand for ICTs. However, it is necessary to highlight that in addition to the above, it is necessary to solve structural problems such as inequality, poverty, marginalization, among others, with the purpose of offering the population more and better opportunities so they may participate in the information and knowledge

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society. This study was limited by the lack of availability of information related to cultural and social factors such as ethnic origin, social networks, among other variables involved in the phenomenon of the digital divide. Any future research will need a more in-depth approach.

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