The Evolving Role of Public Policy in Promoting Information Technologies: The Case of Mexico

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Abstract--**Over the years, Information Technologies (ITs) have greatly stimulated economic growth and development. Being the Internet one of the most prominent IT technologies, its contribution to the advancement of education, learning and knowledge is of enormous importance. It is hardly surprising, therefore, that the commitment to the diffusion of the Internet has become a top issue for many developing nations. In the case of Mexico, Internet penetration has undergone a number of setbacks, mainly due to a misinterpretation of the factors causing the so-called digital divide. Hence, this paper aims to analyze the role that public policy plays in encouraging the diffusion of the Internet. Available data shows that Internet diffusion remains relatively low in spite of recent governmental initiatives devised to encourage connectivity. The main challenge for policy-makers is then to encourage the private investment in IT infrastructure in order to increase Internet diffusion.**

I. INTRODUCTION

In the last two decades, the incessant penetration of Information Technologies (ITs) has transformed the world economy. As a general-purpose technology, IT has impinged upon many activities, and thus altering the way they were performed. As a consequence, new jobs have emerged, some others have changed and many others have disappeared. This phenomenon has been dubbed as the "New Economy" [7]; [19].

In the middle of these changes, some countries have been better able to respond and benefit from these changes than others. In this regard, it is noteworthy that the relationship between ITs' technological progress, industrial innovation and economic growth is a relatively recent phenomenon that appears to have developed in the 1990s [7].

On the other hand, several studies have analyzed the effect of IT on economic growth and productivity. For example, the Organization for Economic Cooperation and Development (OECD) has declared that the Internet is now a fundamental infrastructure supporting the economy and is firmly in its second stage of development, having evolved from a data network connecting PCs with wires to a much broader network of new portable devices from mobile phones to tablet computers [19].

Three main effects of IT on economic growth have been identified. First, IT investment helps raise labor productivity by means of augmenting the capital-labor ratio (i.e., capital deepening). Second, rapid technical change in IT goods and services add to more rapid multifactor productivity (MFP) growth in the IT-producing sector. And third, greater use of IT may help the productive sector increase its overall efficiency [27].

From the set of technologies bundled under the IT epithet, the Internet is by far the most important, with a huge impact on the business and public sectors through services such as e-learning, e-commerce, e-government, etc. It is not surprising, therefore, that given the Internet's growing impact on the global economy many developing nations are seeking to encourage the diffusion of the Internet to spur economic growth. Although many governments have handled many approaches and actions to this goal, their interest has increasingly been expressed in the form of public policies, governmental initiatives and the instrumentation of institutional programs, most of them in coordination with international development bodies, such as the World Bank and the United Nations Conference on Trade and Development [27]; [31].

Yet, the widespread diffusion of new technologies, and especially of the Internet, is posing new challenges to policy-makers as well. Although ITs can help modern societies solve long standing economic and social problems, they still call for a number of pre-requisites to be fulfilled before the advantages of new technologies can be seen. First, there is the infrastructure issue, which is related to the necessity of having a physical network to support the Internet's operation, an area in which in many developing nations are very limited or simply do not have any. Second, there is the capability issue, which means that the benefits derived from the introduction and diffusion of ITs are fully harnessed when citizens have a better level of education and computing skills. And third, there is the technical change issue, which is related to the fact that ITs experience a continuous and permanent process of innovation which demands from users an equivalent continuous and permanent upgrading attitude, as we can now witness by the growing importance of social networks and new IT platforms such as Smartphones and tablets [28].

In spite of the necessity to cope simultaneously with all of these three structural conditions, most governmental initiatives have preferred to focus only on the infrastructure issue, as in the case of Thailand [25].

Since the lack of universal access to the Internet has represented the most critical issue for policy-makers, most public plans and programs regarding the promotion of ITs seem to have been devised bearing in mind the reduction of the so-called "digital divide[1]."

[1] According to the OECD [19: 5], the term "digital divide" refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to

The ongoing instrumentation of IT policies has mostly attempted to level the playing field for developing countries citizens. In the case of Mexico, for example, an IT program called "e-Mexico" sought to shrink the Internet gap between urban and rural communities by establishing a number of telecenters in the smallest towns and villages [12]. Unfortunately, the initiative did not live up to its expectations because of the misunderstanding of structural factors determining the diffusion of the Internet, as well as the several infrastructural deficiencies regarding the telecommunication sector and the lack of highly qualified human resources, as we shall discuss below. In this context, the paper aims at analyzing the rationale for the Mexican government to support the diffusion of the Internet.

II. THE ORIGIN OF THE "DIGITAL DIVIDE" ISSUE

The digital divide debate begins with the proper accounting for the origin of the term itself. There are at least two versions of who coined the term. On the one hand, Rogers [22: 96] contends that the term "digital divide" was probably coined by Larry Irving, formerly Assistant Secretary of Commerce for Communications and Information during the Clinton administration. On the other hand, Hoffman and colleagues [10: 48] have identified Lloyd Morrisett, the former president of the Markle Foundation, as the mastermind behind the idea.

Over the years, the concept has evolved to rationalize a symptom appeared in the mid-nineties: the increasing differences in the use of ITs by individuals. Twenty years ago, it became clear that ITs played a key role in the transition from the previous industrial age toward the newer network age [2]. After the transition, we realized that we lived in a society in which the production, acquisition, and flow of knowledge were crucial to compete and in which global information networks drove the economy [19]; [27]; [31].

However, the ITs' apparent ability to help improving almost every economic activity rapidly aroused the suspicions of some analysts. For example, [11] and [16] argue that ITs were actually exacerbating social, economic and cultural differences, rather than ameliorating them. In this perspective, the Internet altered the way some important activities such as commerce, education, government, and communications used to be performed.

Nonetheless, not all perceptions of the Internet were negative. Lisa Servon, for example, argued that the Internet helped society to bridge the gap in some key areas such as education or health. In her view, the Internet could connect people to a wide range of opportunities, demonstrating its potential to serve as a tool of social change [23: 1].

The real trouble with the Internet is, however, that its diffusion, both within and between countries has been extremely uneven. According to [17], the debate on the digital divide has taken place along a spectrum that argues, on the one extreme, that the market alone will take care of any perceived disparities (see, for example, [24]) and, on the other extreme, that governments should implement policies that subsidize access to some extent (see, for example, [14]).

In any event, if the digital divide were to persist, the danger is that the Internet will finish affecting the construction of, and the response to social problems such as poverty and inequality, as [9] report as happening in Africa, for example.

Given these contrasting views, one can ask whether in fact there is a substantial policy issue regarding the digital divide, and if there is, what policies can bridge the gap, and even more important, how to address it.

III. THE DETERMINANTS OF THE DIGITAL DIVIDE

The analysis of the determinants of the digital divide has demonstrated to be very complex because the term "digital divide" tends to include both the imbalances in physical access to technology and the imbalances in resources and skills needed to interact in the digital world. In this respect, [6] argues that research on the digital divide has been mainly descriptive, starting from a too simple criterion of access and failing to consider the many origins and consequences of differences in Internet access. And because the term "digital divide" hints at several interpretations, it has tended to generate different perspectives upon its causes.

By inspecting the relevant literature on the digital divide issue, one can be able to detect two main streams of analysis. In the first group, there are scholars focused on analyzing the digital divide in the OECD area, to whom a set of recurrent factors seems to be causing the divide; whereas in the second a group there are analysts interested in studying ITs' impact on the developing world, who have pinpointed other factors as determinants of the divide.

One can then classify the factors affecting developing countries as "primary factors" because of the physical infrastructure needed to access the Internet, i.e., electricity power, telephone lines, personal computers, Internet Service Providers, etc.; whereas the factors affecting industrialized nations can be classified as "secondary factors" because of their order of preeminence. Both sets are reported in the two following tables.

access ITs and to their use of the Internet for a wide variety of activities. In this paper, we adopt this definition.

TABLE 1: SUMMARY OF PRIMARY FACTORS AFFECTING THE DIFFUSION OF THE INTERNET

Affecting Factor	Type and Direction of the Influence
1 GDP per capita	Positive: The more affluent the society, the more likely the citizens have access to the Internet
2 Market Competitiveness	Positive: the more competitive the economy, the lower the cost of accessing the Internet
3 Government Regulation	Negative: the more public rules and permits, the less provision of ICT services
4 Foreign Direct Investment	Positive: the more foreign investment, the more business opportunities to Internet services
5 Basic Skills in Computing	Positive: the more skilled the individual, the more likely he/she have access to the Internet
6 Literacy	Positive: the more educated the individual, the more likely he/she have access to the Internet

Sources: [17]; [21]; [30].

TABLE 2: SUMMARY OF SECONDARY FACTORS AFFECTING THE DIFFUSION OF THE INTERNET

Affecting Factor	Type and Direction of the Influence
1 Income	Positive: The more affluent the individual, the more likely he/she has access to the Internet
2 Ethnicity	For Whites: Positive; For Blacks: Negative
3 Geographic Location	For Urban Residents: Positive; For Rural Residents: Negative
4 Education	Positive: The more educated the individual, the more likely, he/she is a user
5 Age	An inverted U-shape: That is, the older the individual, the more likely he/she is a user (up to a certain age threshold: <45 years)
6 Gender	For Men: Positive; For Women: Negative

Sources: [5]; [11]; [22] ; [23]; [28].

According to the information provided in Tables 1 and 2, the determinants of the digital divide differ according to the type of society one is looking at. For developing countries, their traditional weaknesses in infrastructure seem to directly affect their citizens' access to the Internet, while for developed nations the obstacles appear more related to socio-demographic conditions. However, one needs to bear in mind that the mutual interaction of these factors produces a highly dynamic phenomenon. Therefore, the next section presents a simple model of the digital divide as a dynamic process and the implications of this for public programs.

IV. THE DIGITAL DIVIDE AS A DYNAMIC PHENOMENON

In analyzing the determinants of the digital divide, the first obstacle to tackle is the multifaceted concept of Internet access. Reference [29] argues that this concept is so freely used in everyday meanings that it ends being used in very different contexts because of a lack of uniformity in the concept itself. To some extent, the meaning of having a computer and a network connection is the most common one in the sphere of the IT adoption. However, this only refers to the second of four successive kinds of access, which [29] call "barriers" for the information and network society. According to these authors there are four (sequential) barriers:

1) Lack of any digital experience caused by individual (or collective) apathy, computer fear and unattractiveness of the new technology; 2) No possession of computers and network connections; 3) Lack of digital skills caused by insufficient user-friendliness and inadequate education or social support; and 4) Lack of significant usage opportunities.

These barriers correspond to an equal number of types of access, namely, psychological access, material access, skills access, usage access

In spite of the sequential order of these barriers, the lack of computers and networks (second in order) occupy a center place in several studies dealing with the digital divide. According to these views, low-income populations in developing countries should take advantage of cost reductions in IT hardware and software, affordable combinations of open-source and commercial software, donated computers and free networking, "if they are to make any discernible progress towards overcoming the digital divide that currently separates them from the developed countries" [15: 391]. Moreover, John Simons suggests that "for the poorest of the poor (in America), government might consider subsidizing public street-corner Internet kiosks, as it did with public telephones" [24: 291].

However, the real issue is not whether investing in ITs can help development, but whether the overall benefits of doing so outweigh those of investing in education or health, instead. Therefore, for developing societies the true value of the Internet needs to take into account the respective investment costs.

Although, some analysts think that the problem of information inequality related to the Internet will be solved as soon as everyone can have a computer and a connection to the net, the first kind of access barrier (described above) is either neglected, or viewed as a temporary phenomenon that touches only old people, some categories of housewives, illiterates or unemployed. Yet, this barrier is much more pervasive than the public opinion thinks [28].

The problem of inadequate digital skills is viewed as a lesser evil, which is normally analyzed in terms of the skills of IT operation; and tends to be thought of as a function of the time elapsed to master the new technology [3].

Finally, differential opportunities from the usage of computers and network connections still need more theoretical analysis from scholars. This is because differential usage is presumed to be a citizens' free choice in a differentiating post-modern society [8]. Nonetheless, the lack of significant usage opportunities calls for deeper insights because of its importance to social and educational policies [28].

Drawing on the framework proposed by [29], Fig. 1 summarizes the digital divide as an evolving process which tends to gradually move from the first two barriers to the last

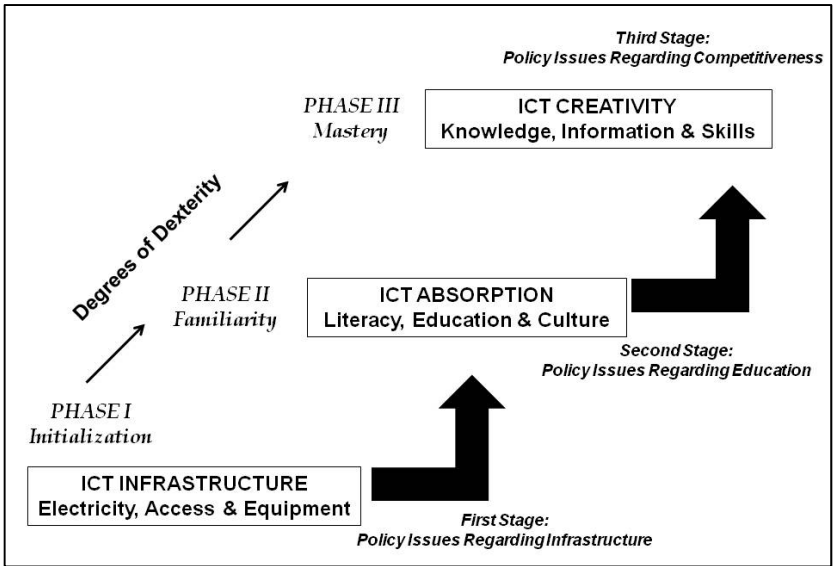

Fig. 1: Phases in the Adoption of ITs
Source: Author's elaboration based on [29].

two. According to this approach, once the mental and material access barriers are pulled down, the problems of structurally different skills and uses come to the fore, and then, it is the time to face the challenges these barriers posed on public policy. If solved, the would-be internaut will then be in possibility of finally mastering the new technology[2].

The phases shown in the Fig. 1 indicate the process required to learn the use of the Internet. In the first phase, electrical energy, internet access and appropriate electronic equipment (i.e., computers, tablets or Smartphones) are all complements and required. In the second phase, the level of literacy, education and culture help users to harness the Internet potential. In the third phase, accumulated knowledge and information enhance users' skills for empowering them in more creative applications within the realm of the Internet. Under this framework, public policy needs to play a dynamic role. In the earlier stages, policy-makers should focus on supporting infrastructure creation and operation; then, they should encourage education policies aimed at improving literacy skills in general, and digital ones in particular, finally, they should adopt broad policies aimed at supporting a competitive milieu for all citizens. Yet, many public policies hardly manage to overcome the first barrier, as we shall see in the case of Mexico.

V. THE INTERNET IN MEXICO

In Mexico, as in many other countries, the Internet was first adopted by universities and research centers, which also became the first nodes of the network. The main interest of these institutions was to establish a reliable Internet connection between Mexico and the United States, in the first place, and then with the rest of the world.

The diffusion of the Internet in Mexico can be described in four distinct phases: an introductory phase, a developmental phase, a concentrated phase (duopoly), and a competitive phase. The transition from one phase to the next was determined by special circumstances that help explain the current state of the Internet in Mexico.

During the introductory phase (1989-1993), the first Internet connections were established and the regional backbones were created. It is noteworthy that growth of the Internet during this period was spurred primarily by universities and similar academic users. The first direct connection to the Internet was established in 1989 at the main campus of the Monterrey Institute of Technology (ITESM). In the next few years, several regional networks were also established in major universities from Guadalajara (UdG), Mérida (UAY) and Puebla (UDLA). Because of technical reasons, no national backbone existed at that time, so regional users were unable to share information, provoking the duplication of services.

The developmental phase was lead by the combined efforts of government and academia. This phase lasted from 1994 to 1995. In 1994, the Mexico's government agreed to finance the first national backbone. This backbone linked the regional academic networks and provided direct connections to the United States [26].

The concentration (duopoly) phase (1996-98) emerged from the need of developing commercial applications for the Internet. Joint efforts from the industry, academia and government were needed during this phase. During this stage, the National Technology Network (RTN) was established by the National Council for Science and Technology

[2] According to [29], digital skills not only are related to the skill to operate computers and network connections, but also to the skill to search, select and process information from multiple sources.

(CONACyT) to support the development of Mexico's IT infrastructure [4]. Interestingly, RTN marketed the academic backbone for commercial applications. However, Mexico's former state-owned telecom company, TELMEX, began commercializing backbone connections and net services. After some few months, TELMEX swiftly captured the larger part of the market thanks to its dominancy.

The competitive phase was brought about by the desire for increased market efficiencies. The primary drivers of this phase were market demand, industry and governmental deregulation. This phase began in 1999 [26]. The first step towards this phase occurred in January 1997 when TELMEX was forced to compete with RTN and several new entrants in the growing market of Internet service providers [4].

Although some legal barriers to competition were removed during the duopoly phase, several factors impeded the development of a full-fledged competition in Mexico. The most significant of these is the large investments required to set up an operational infrastructure. This barrier quickly loomed impossible to surmount as the two established incumbents (TELMEX and the RTN) had already set up national backbones. Therefore, any potential entrant was forced to develop his or her own infrastructure before being able to compete. Still, with the help of foreign investment, some competing backbones sought the way to develop quickly. By 1999, Alestra and Avantel had established themselves as strong competitors in the larger markets, whereas smaller competitors were keen to enter the market as well [4]; [26].

As regards the speed of connection, the amount of bandwidth offered grew considerably during those years. However, the cost of access did not go down as quickly as desirable, and the quality of service did not increased either. As hinted above, since the 1990s, the Mexican telecommunications market has been dominated by TELMEX, which has 80 percent of the fixed line market and 70 percent of the mobile phone market. Insufficient competition has resulted in poor market penetration for fixed line, mobile and broadband markets.

The lack of competition has imposed significant costs on the Mexican economy. The sector is characterized by high tariffs that provoke poor market penetration rates and low infrastructure development. According to the OECD, the resulting welfare loss is estimated at US $129.2 billion (2005-2009) or 1.8% GDP per annum [20: 11]. Although there has been growth in mobile, fixed, broadband and satellite television markets, Mexico does not compare favorably with other countries that have developed more open and competitive markets and distributed ensuing benefits to consumers. Yet, new entrants have bundled offers (double- and triple-play) that provide an increasingly competitive response to TELMEX in urban areas.

Recently, Mexico has faced far more complex challenges. The largest of which is balancing the need for competitive efficiencies with the desire to provide services for a larger segment of the population. Before the competitive phase, TELMEX had a mandate to increase the level of service in poorer, rural areas of the nation. In doing so, the Internet services should have to be provided at lower profit levels or at a loss. Therefore, communication services had to be subsidized by the more profitable services offered in the larger, urban markets. Clearly, the entry of new competitors has increased rivalry in the larger markets, but it has also hampered TELMEX' ability to subsidize the less profitable markets, such as the rural towns of Mexico.

Hence, the national government, seeking to address the challenge of the lack of IT services for the poorer citizens, launched the e-Mexico project in 2001 [12]. In its origins, the initiative managed a $400 million budget to provide Internet access to most of Mexico's population, especially for the most remote and inaccessible villages. However, the program almost immediately began to suffer from the lack of an efficient infrastructure, capable managers and skilled human resources to operate the network and the equipment. In June 2013, a new competition bill was sent to lower house. The competition bill gave the government new powers to fight monopolistic practices. Table 3 depicts how events evolved after the enactment of the competition bill.

TABLE 3: MAIN EVENTS IN THE MEXICAN TELECOMMUNICATIONS SECTOR, 2013-2016

Date	Events
March 26, 2013	Lower house passes key telecoms reform
June 6, 2013	AT&T sells off 7% holding in TELMEX
February 24, 2014	New competition bill is sent to lower house. The bill gives the government new powers to fight monopolistic practices
April 2, 2014	Government's by-laws for telecoms reform prove controversial. Reforms meet criticism from the political opposition.
July 10, 2014	Mexican Senate finally passes telecoms byelaws. Leftist parties complain that the telecoms bill waters down regulators' power and is not tough enough on monopolies
July 11, 2014	TELMEX announces asset sale to bring down market share. The firm was looking to divest its assets, in an attempt to circumvent the threat of tougher telecoms regulation.
November 4, 2015	Telecoms reform begins to show results. The reform is responsible for a pronounced drop in telephony prices, but benefits to broadcasting sector are less clear
January 6, 2016	Mexico completes digital switchover. Digital broadcasting will allow more efficient use of the spectrum, but TV handouts have been criticized.

Source: Economist Intelligence Unit, data available at http://country.eiu.com/articleListIndustry.aspx?subtopic=Telecommunications&topic=Industry&Country=Mexico [accessed on March 31, 2016].

VI. PUBLIC POLICIES FOR THE ADOPTION OF INTERNET IN MEXICO

According to the elements discussed above, the nature of the digital divide revolves around three factors: access to hardware and bandwidth, skills training, and the availability of appropriate content (local, linguistic, and cultural). As the world moves into the knowledge economy, lack of access to the Internet becomes increasingly associated with the persistence of economic underdevelopment and poverty [27].

Nonetheless, the digital divide has posed a major challenge to Mexican policy-makers because of their need to ensure that ITs actually help citizens to ameliorate their misery. In the current situation, this is not happening because the lack of Internet access is directing many people (especially the less educated) to the margins of society, and thus leaving them unable to contribute to and benefit from the wealth of new opportunities that the digitally rich enjoy [18].

The current landscape of Internet adoption in Mexico looks highly skewed in spite of the several public initiatives devised to promote the technology. To begin with, Internet access remains highly concentrated in the richer and more developed states, such as Nuevo León, Distrito Federal (Mexico City), Baja California, Estado de México and Jalisco. Secondly, two of the poorest states in Mexico (Oaxaca and Chiapas) have a very low rate of Internet adoption (lower than 20 percent), and the country, as a whole, keeps almost two thirds of its households without having an Internet connection. These figures are depicted in Table 4.

TABLE 4: MEXICAN HOUSEHOLDS WITH INTERNET ACCESS, 2014 (ORDERED BY % OF STATE HOUSEHOLDS)

State	Households	As % of the State	As% of the Country
Nuevo León	758,800	55.6	2.4
Distrito Federal	1,352,927	55.0	4.3
Baja California	488,882	51.7	1.6
Quintana Roo	202,835	47.3	0.6
Sonora	356,710	46.0	1.1
Baja California Sur	98,447	45.9	0.3
Colima	91,838	45.3	0.3
Chihuahua	462,309	42.9	1.5
Jalisco	865,507	42.4	2.8
Aguascalientes	124,246	39.4	0.4
Tamaulipas	382,183	38.5	1.2
Morelos	196,950	38.4	0.6
Sinaloa	298,781	38.3	1.0
Nayarit	122,574	35.9	0.4
Coahuila	284,727	35.2	0.9
Estado de México	1,444,333	35.2	4.6
Querétaro	167,559	32.4	0.5
Durango	142,807	30.4	0.5
Yucatán	169,427	30.2	0.5
Tabasco	178,481	29.2	0.6
Guanajuato	383,474	27.5	1.2
San Luis Potosí	192,660	27.3	0.6
Campeche	63,518	27.2	0.2
Zacatecas	107,357	26.1	0.3
Hidalgo	200,263	25.7	0.6
Tlaxcala	79,648	25.5	0.3
Puebla	369,772	24.1	1.2
Michoacán	276,215	23.7	0.9
Veracruz	470,714	21.8	1.5
Guerrero	188,112	20.8	0.6
Oaxaca	151,806	14.6	0.5
Chiapas	124,605	10.0	0.4
Total Mexico	10,798,467	34.4	34.4
Total Households In Mexico	31,397,520		

Source: [13], data available at http://bit.ly/1HxtzPT [accessed on January 20, 2016]

Universal access initiatives are a significant public policy tool because they pursue specific objectives and solutions for broad social problems ranging from economic underdevelopment, to social capital building, the promotion of individual rights and social justice, and community-building, and over the years, Mexico has pursued several initiatives aimed at encouraging Internet adoption.

In the case of e-Mexico, the objective was to extend modest subsidies to development projects linked to human rights through community telecenters. However, one of the first critiques to this initiative surged from the conservation of traditional economic "system" imperatives, such as the creation of new license commitments for Microsoft, rather than promoting competitive bids through government-led investments into local open source programming ventures[3]. Moreover, the structure and settings of the Community Telecenters were designed and assisted by the telecommunications monopoly TELMEX.

However, as [17] notes, one of the main shortcomings of the initiative was that the telecenter model for access was not so successful in closing the digital divide, due in large part to the small population that was both in need and also served by each telecenters. An additional drawback was that most telecenters did not provide training in the cognitive skills needed to attain a meaningful access to IT.

The trouble with the Internet in Mexico is that its penetration rate has been rather slow. For example, in 2005 was only 16 percent, whereas in 2001, when the e-Mexico initiative was launched, the proportion of households with an Internet connection was a meager 5 percent.

Because of the large differentials in Internet access among the Mexican population, the country's digital divide keeps stagnant in the majority of small towns and villages where most people are rural and poorer. It is worth mentioning that, by mid-2014, around a third of the Mexican population uses the Internet regularly, still too far away from the Scandinavian nations, which have rates of 90 percent [20].

A study [12] conducted on the habits of the telecenters' rural users found that behavioral, infrastructure, and language problems were not solved by Internet access because marginalized societal strata were almost absent. Another problem faced by the telecenters was that TELMEX only

[3] For some early critiques on the e-Mexico program, see a report in Spanish from *La Jornada* newspaper on May 19 2004 (available online at http://www.jornada.unam.mx/2004/05/19/022n1pol.php) [retrieved on January 22 2016].

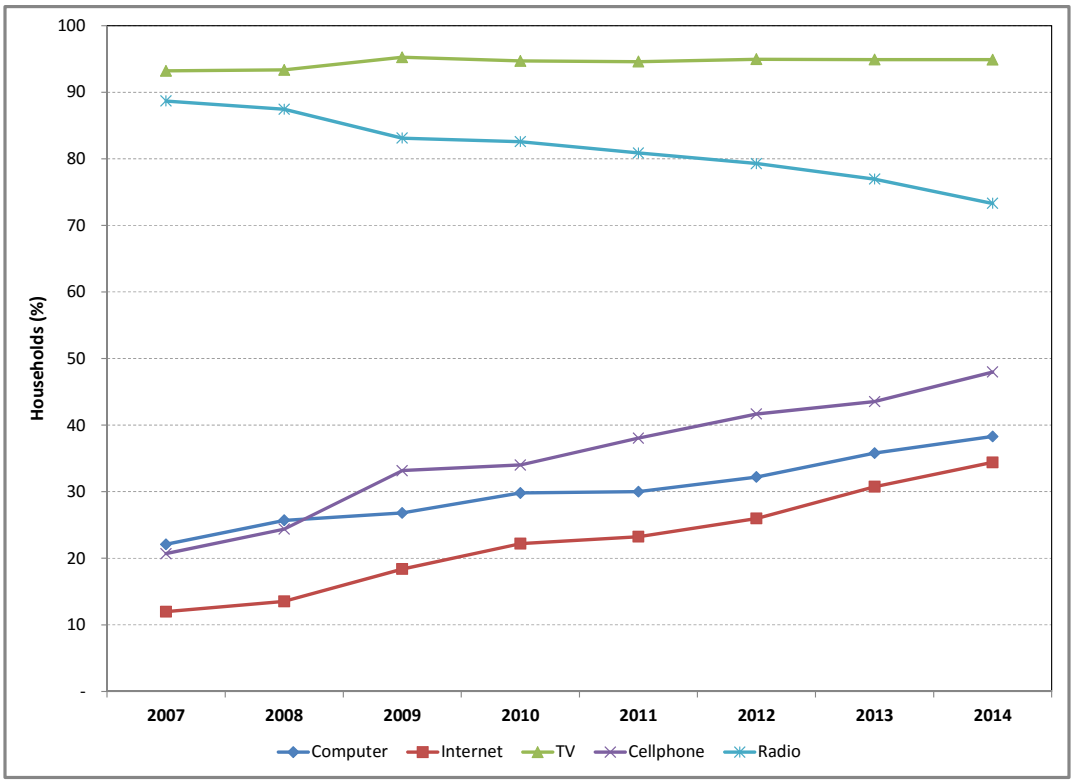

Fig. 2: IT devices penetration in Mexican households, 2007-2014 (as % of households)
Source: INEGI, 2014, data available at http://bit.ly/1aAGP98 [accessed on January 24, 2016]

offered a minimally necessary build-out of rural payphones and cable networks. Moreover, since 2004, the country has been experiencing a declining use of telephone landlines [18]. As a result, Internet penetration in Mexico has struggled to pass the 40% mark, even though more than 45 percent of Mexican households already possess Internet-ready mobile phones, as Fig. 2 shows.

From Fig. 2, one can observe how the digital gap is still considerable, although has been shrinking, as the use of cellphones grows. Interestingly, most Mexican households have a TV set and a radio but two thirds lack a computer with an Internet connection, apparently electricity is not a concern since almost all households can watch TV.

As regards the role played by the IT sector, [1] conducted an extensive survey of business leaders in the Mexican software services industry in order to study the situation of this sector. Their goal was to elucidate conceptual models of the industry, which is less developed in Mexico than in other middle-developed nations such as Ireland, Brazil, and India, and to analyze empirical findings to ascertain what is distinctive about the Mexican versus U.S. software industry. Their main findings are: 1) Mexico's industry is quite small relative to the U.S.; 2) programming is by far the largest service provided by the industry; 3) lack of specialization of services; 4) imbalances exist in the human resources of the firms (companies have been understaffed leading to poor quality results or delays in projects or overstaffed leading to cost overruns and financial losses); 5) wide pricing differentials exist across the industry for the same service; and 6) software firms need to improve performance measurement.

Currently, the digital agenda has occupied an even lower level of importance, given the priority of the regime to fight the growing narcotics trade and its side effects in the increasing social insecurity as criminality rates have soared.

To some extent, the failure to bridge the digital divide in Mexico is driving the government toward a situation where most citizens seem less-and-less capable of participating in the economic and social affairs that are increasingly technology-dependent. So, empirical evidence seems to confirm that the Mexican government has become accustomed to struggle each 6 years to foment internationally competitive industries. The problem is that new opportunities are vanishing. Although this situation needs drastic changes in the national development plan, the current Mexican regime seems to have been more preoccupied with satisfying the financial and macroeconomic requirements rather than the development issues.

On the other hand, all around the world, the expansion of the digital economy has acted as a driver of economic growth. From e-commerce to automated vehicles, Massive Open Online Courses, and enhanced social interactions and personal relationships, ITs are integral to professional and personal life; individuals, businesses and governments are

increasingly inter-connected via a host of devices at home and at work, in public spaces and on the move.

Prominent among these changes are firms like Apple in Smarthphones and tablets, Google in web searches, Amazon in electronic commerce and Facebook in social media. Moreover, the convergence of fixed, mobile and broadcast networks, along with the combined use of machine-to-machine (M2M) communication, the cloud, data analytics, sensors, actuators and people, is paving the way for machine learning, remote control, and autonomous machines and systems. Devices and objects are becoming increasingly connected to the Internet of Things, leading to convergence between ITs and the physical economy [28].

The telecoms reform that set up in March 2013 should help Mexicans to harness the advantages of the IT era. According to the most recent survey (2014) on Internet habits, the main online activity is the access to social networks even more than sending/receiving emails, even though it is mainly for leisure, followed by email management and music downloading [13]. Given the popularity of sites like Facebook and Twitter among youngsters, is not surprising that ComScore, the IT consultancy firm, places Mexico in a leadership position in this category worldwide[4].

Similarly, possessing a Smartphone is crucial for most of the Internet users because Apps are widely diffused. In addition, for 87% of those who have a Smartphone, making and receiving phone calls is as important as to have access to the internet [13].

Finally, it is worth mentioning that the INEGI's survey on Internet habits shows that IT penetration rate already exceeds 50% among the Mexican target population (people 6 years old and older). Internet access is mainly produced at home (84%), followed by access from the work place (42%). The preferred access technology is paid WiFi (80%), followed by Internet access through public hot spots (58%). As regards the principal devices for accessing the network, laptops are at the top (68%), followed by Smartphones (58%), which together with tablets, are rising their their role as internet tools; provoking that mobility is now more important than fixed access through computer desktops. The survey also reports that the daily time that Mexicans spend on the internet reached 6 hours, eleven minutes in 2014, which is 24 minutes more than in 2013 [13].

VII. CONCLUSIONS

Technological factors play an important role in Internet diffusion. However, diffusion of the Internet is contingent upon certain existing technological and infrastructure network factors, which include telecommunications and personal computers. Since 2005, telephone landlines have been shrinking mainly due to the prominence of mobile telecommunications. As a consequence of the the passage of the telecoms legislation in May 2014, a new regulatory and competition agency is now fully operational. This agency, called Federal Institute of Telecommunications (IFT in Spanish) has exclusive authority for regulation and competition enforcement in the telecommunications and media industries, and has a range of new regulatory capabilities to promote competition, such as imposing obligations on dominant operators. TELMEX, the dominant operator in the fixed-line market, has an 80% market share, while its mobile company (TELCEL) has a 70% market share. Nonetheless, the IFT's request to TELMEX to provide free interconnection to other operators, triggered its announcement of a plan to sell assets to reduce its market share below the 50% regulatory threshold to avoid the application of asymmetric regulations. Apparently, the telecom reform is having an impact impact, though attention will need to be paid to whether a smaller market share still ensures adequate market competition. Yet, the country lacks a proactive policy for encouraging the telecommunications infrastructure, which has been deteriorated by the paucity of investments by TELMEX. Importantly, under the 2013 telecom reform, greater foreign investment is now allowed, which can stimulate the construction of more fixed telephone lines, and push mobile telephony, internet and broadband.

In this context, it is still necessary to increase the number and quality of IT devices (i.e., personal computers, laptops, and tablets) capable of supporting the Internet in order to enable users to harness the potential of the digital world. Undoubtedly, the rapid adoption of IT devices will profoundly influence how services providers will compete in the Mexican consumer market, where Facebook, Google, Apple and Amazon can play a critical role.

Given the increasingly important link between economic wealth and the adoption of new technologies, GDP per capita is a significant explanatory factor of the Internet penetration rate. In Mexico, high Internet access rates and considerable equipment costs represent a substantial share of annual earnings per capita, which obviously hinders Internet penetration. Moreover, in the context of those nations where the Internet has been widely adopted, the price level of IT services (such as connection and access fees) and equipment costs (such as PCs, terminals and servers) are subjected to fierce competition, which, in turn, benefits the consumer.

Providing universal Internet access in Mexico through Internet kiosks may not be enough if people cannot afford to pay for the services and equipment or do not have the required skills to use the systems. Besides, in bridging the digital divide in Mexico, one not only needs to take into account the technological factors of the problem but also the socio-economic dimensions of it.

Although weak telecommunications infrastructure is to be blamed for the persistent low level of Internet penetration in

[4] ComScore reports that Mexico has a 98.2% reach in social media sites, which positions the country above other regions. Data can be consulted at the URL: http://www.comscore.com/Insights/Blog/The-State-of-Social-Media-in-Mexico [accessed on April 11, 2016]

Mexico, numerous studies show that affordable access charges play an important role in encouraging the adoption of IT services.

Mexican policy-makers have a vital role to play in ensuring sufficient competition. This includes making sure there is adequate available spectrum, abundant IP addresses and fair competition between operators and Over-The-Top providers. These established findings suggest that excessive charge rates set by telecommunication regulators and network operators seriously hamper the diffusion of Internet innovation. However, the solution of this situation is still missing in the design of the governmental agenda of Mexico.

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