How Mexico can benefit from the digital economy

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1 Introduction: the importance of the digital transformation

The 2016 World Bank Development Report, *Digital Dividends* (WBR, 2016), is a thoughtful review of the impact the “greatest information and communications revolution in human history” has had, which has led to a situation in which the “poorest households are more likely to have access to mobile phones than to toilets or clean water”¹. While access to voice has a great effect, access to data, via smart phones and the Internet, magnifies it further.

Where does the this revolutionary impact come from? Essentially, from three sources. First, it reduces the cost of existing activities, such as shopping or delivering existing health care. Second, it puts services, including basic ones such as education, within the reach of people who were previously deprived of them; it is thus inclusive. And thirdly, it permits new things to be done, such as interacting real-time with virtual groups around the globe (think of social media).

Thus, it is hardly an exaggeration to say that information and communications technologies (ICT) leave very few acts of production or consumption unaffected. Clearly this applies not only to information products (such as streamed video, for example), but to almost every public or privately produced good and service. In fact, the degree to which digitisation has penetrated most sectors of the economy makes it extremely difficult to quantify its reach.² Can we clearly separate brick and mortar business and digital activity? Can we isolate digital advances in typical technological industries from those that apply in less affected? Digitisation has, *de facto*, imbued our economic and social life.

Take agriculture as an example – a sector which in Mexico employs about one worker in eight. Agricultural *productivity* can be enhanced by the better communication of agricultural extension advice or weather forecasts. The *operation* of the agricultural supply chain, and the underpinning logistics, are profoundly affected by ICTs. And the *market place* for agricultural products – how inputs (such as fertilizer and seeds) and outputs (agricultural products) are bought and sold and over what geographical area – is also affected: many studies have shown how access to mobile phones enables farmers to get better and more stable prices.³

The goal of this study is to describe the benefits which Mexico might gain by taking advantage of the opportunities of digitisation, to evaluate Mexico’s performance to date, and to identify ways in which that performance might be improved by various public policy interventions. It is clear both that this project is crucial to the economy’s success and that success requires putting in place a wide range of complementary inputs. The study does not, however, attempt to examine the impact that digitisation has had on non-economic aspects of the life of a society, such as plurality of opinions and freedom of expression. While we recognise their importance, we have excluded these aspects form the present study.

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² See OECD *Digital Economy Outlook 2015*, Ch. 3. The difficulty of measuring the “digital economy” can be contrasted with the relative ease of measuring the output of ICT-producing sectors.
³ See Deichmann et al., *Will Digital Technologies Transform Agriculture in Developing Countries?*, World Bank, 2016.
With this in mind, we consider successively in sections 2 to 7:

- Where Mexico now stands comparatively in digitally transforming the economy;
- Whether the level of connectivity in Mexico is adequate to current and future needs;
- How an important but varied subset of complementary inputs will contribute to the success of the digitisation of the economy;
- What progress has been and could be made in a number of illustrative areas – e-commerce, banking, finance and associated tax issues, health and education;
- The degree to which the spread of mobile voice and data communications has contributed and will contribute to the growth of Gross Domestic Product (GDP);
- What public policy recommendations flow from our analyses.

2 Where Mexico stands now with the digital transformation

While the Internet has spread quickly in some countries, the rate of adoption of technologies that use the Internet has a wider variance. According to the WBR 2016, adoption of new technologies is closely related to the level of competition that firms face. “Larger, fast-growing, skill-intensive, export-oriented, and urban firms tend to use digital technologies more”. More competition on the ICT sector in turn increases demand for services from firms. More importantly, there seem to be barriers of adoption that arise, for example, when regulation lacks the flexibility to include disruptive entrants – think of Uber – or when dominant firms exploit their positions to solidify their substantial market power or to capture new markets.

Thus, this article looks at where Mexico stands in terms of the overall trends in digitisation and asks the questions of whether the new regulatory framework is playing a role in allowing it to reap the benefits of digitisation. We therefore present estimates of Internet access and current market value of e-commerce, and the main drivers of growth for the Mexican digital economy, including those residing inside and outside the telecommunication sector. In addition, we identify strategic sectors that have been benefitting by the digital economy growth, for example, finance, as well as opportunity areas that may help leverage other sectors’ evolution, such as government services, taxation and the health sector.

In doing so, we describe the online services and transaction that Internet users demand, citing any available evidence of progress made in 2016 as compared with earlier years and comparable countries whenever data is available. We particularly focus on the obstacles to promoting the digital economy, that is, entry barriers, high prices, availability of payment mechanisms, lack of trust, privacy issues, and other institutional obstacles. This section describes basic trends in digitisation, as well as public and government services. The rest of the outline above is covered after the basic scan of the digitisation of the economy and the description of the evolution of the telecommunications sector.
2.1 Trends in digitisation of the economy

To begin with a sense of how Mexico is doing internationally in terms of digitisation, we use several measures, all of which point in the same direction: Mexico is languishing in a lower place in the table than it should be, and that it would like.\(^4\)

We illustrate such an approach with a “digitisation index” developed by Katz et al. (2014),\(^5\) which incorporates not only the development of basic infrastructure but also other aspects which affect appropriation and the capacity of a country to take advantage of ICTs. According to the authors, digitisation puts additional emphasis on two dimensions: cumulative impact of information, and communications and usage. Real impact of ICTs is associated with adoption as well as the intensity of use. The authors argue that an index to measure the development of public policy to promote the widespread use and availability was needed, as other existing indices (e.g., Network Readiness Index by the World Economic Forum or WEF, or the Digital Opportunity Index by the International Telecommunication Union or ITU) capture only a portion of the ongoing transformations.

The “digitisation index” is a weighted linear combination of six variables. “Affordability” is measured through the cost of ownership of a residential fixed line, of a mobile line and of fixed and mobile broadband accesses (installation fee and usage costs). “Infrastructure reliability” considers investment in mobile, broadband and fixed line networks. “Network access” considers broadband penetration (fixed and mobile), as well as personal computer (PC) penetration and mobile network coverage. “Capacity” refers to international Internet bandwidth per user and broadband speeds. “Usage” comprises Internet retail, e-government, Internet penetration, non-voice services as percent of wireless average revenue per user (ARPU), social network visitors and short message service (SMS) usage. Lastly, “human capital” incorporates two measures of education (engineers as a percentage of the population and the percentage of labour force with more than a secondary education).

Using this index as a measure of how digitised Mexico is, we can see that the index number has grown in the period 2004-2015 from 25.2 to 46.1, an average annual rate (CAGR\(^6\)) of 5.6% (see Figure 1). In contrast, during the same period the rest of the world has moved faster (from 18.4 to 41.2, a CAGR of 7.6%), driven by Africa (7.0 to 23.5, or 11.7%), Asia (15.9 to 39.5, or 8.6%), and even Latin America (21 to 47.4, or 7.7%). In fact, Mexico’s percentile relative to the rest of the world has decreased 16.7 percentage points, going from the 65\(^{th}\) percentile to the 48\(^{th}\). On the positive side, the “infrastructure reliability” and “capacity” components have improved on a relative basis (+9 and +2 percentage points), but the “network access”

\(^4\) See, for example, the World Bank Digital Adoption Index, the Network Readiness Index of the World Economic Forum, the ITU’s Digital Opportunity Index, and indices constructed by various consultancy firms such as the Boston Consultancy Group’s e-Intensity Index (see section 6 below).


\(^6\) Compound annual growth rate.

\(^7\) For clarification purposes, this means that 67% scored worse than Mexico in 2004, but by 2015, only 48% did. That is, according to this index, Mexico’s position decreased substantially in the twelve years to 2015.
component, which mostly measures penetration, has lost 20 percentage points. It should be noted that for every single component of the index Mexico has made substantial absolute progress (see Figure 2).

**Figure 1. Digitisation index – Mexico compared to the rest of the world**

Note: In this and other figures presented on this paper, we have not individually labelled certain data points (as the evolution trends for Western Europe, North America, Eastern Europe, Asia and Africa above), but have opted to graph them individually so that they can be used as a frame of reference. We believe this simplifies the reading of the figure and avoids including information which adds little value to the argument presented.

Source: Authors’ analysis based on Katz et al., 2016.

**Figure 2. Evolution of Mexico’s absolute and relative standing for each of the components of the “digitisation index”**

Source: Authors’ analysis based on Katz et al., 2016.

Data are not available yet for 2016, but our preliminary estimates, based on partial information published for the third quarter of last year, indicate that overall Mexico made relevant progress

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in the last twelve months using this index as a proxy. From 46.1, the index has increased to around 50.7, an annual growth of 10.1%, mostly driven by “affordability” and “usage”, followed by “infrastructure reliability” (investment).

2.2 Digitisation for government and public services

Although governments have invested heavily in digitisation of public services, one of the principal criticisms that have been levied at them is that often strategies tend to be isolated, uncoordinated and sometimes lack a comprehensive plan. The WBR 2016 particularly notes that “digital technologies have helped willing and able governments better serve their citizens” [emphasis added]; in fact, “efficient service delivery requires a capable government that can implement policies and spend public resources effectively.”(p. 152). A government’s capability, it notes, is strongly related with the strength of the underlying institutions, which in turn create incentives for politicians to deliver better outcomes.

For Mexico, this leads to several questions, namely whether the government has a clear digitisation strategy and an effective implementation plan, particularly one that can measure progress and allows for accountability.

The 2013 telecommunications reform in Mexico established for the State the constitutional obligation to guarantee Mexican’s access to ICTs. Among many actions linked to this mandate, the government of Mexico issued the National Digital Strategy (EDN) in 2013 to guide its actions and policies aimed at granting Internet access and broadband connectivity to the population as a whole; the office charged with implementing this strategy was established at the level of the presidency. The EDN rests on five general objectives, some of which we will address in more detail in section 5:

1. Digital government (taxation, for example)
2. Digital economy (e-commerce, mobile banking, etc.)
3. Quality education (e-education)
4. Universal health (e-health)
5. Citizen safety

What projects have been implemented and what advances made?

In 2015, the single national information and government services window for the federal public administration was established to allow 4,421 government services to occur online mainly in education, identity, health social programmes, labour and taxes. The government also unified its communication in one common Internet page that linked information for 25 ministries.

Examples of electronic services include “Reconstrucción MX” to provide information on resources spent on natural disasters, Radar CiSalgo that provides georeferenced information

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9 Article 6, paragraph 3, Political Constitution of the United Mexican States.
10 Gobierno de la República de México, Estrategia Digital Nacional, 2013.
11 Emergency Care Fund (or FONDEN for its acronym in Spanish Fondo para la Atención de Emergencias) available in fonden.datos.gob.mx.
for health establishments and a pilot called Prospera Digital which gives online information for pregnant women. A digital inclusion programme connects community centres to offer digital education and support for microentrepreneurs. While all of these programmes describe objective indicators to measure success based on a 2018 target, there are no data to evaluate relative success. The index that measures the degree of interaction between citizens and government through the Internet and measured by the OECD has no data for 2013 and 2015 due to a change in methodology by the National Institute of Statistics and Geography (INEGI); and the Digitisation Index that uses the Katz et.al. methodology, has no published results.\(^1\) Compared with other countries, Mexico is in the last position in the OECD’s measure of digitalisation, and in the fifth position for Latin American countries for 2011.

More recent numbers from the same source are not yet available, but the Katz’s Digitisation Index, as described above, shows that relevant but insufficient progress has been made. Mexico’s economy is not as “digital” as it deserves to be.

### 3 The key precondition: enhanced connectivity

We have considered in Section 2 some trends in the digitisation of the economy as a whole. In this section, we dig more deeply into the performance of the telecommunications sector considered more narrowly, because improvements in this regard are a vital input into digitisation.

Dissatisfaction with the state of telecommunications in Mexico became strong enough in 2011 to persuade the Government to invite the OECD to carry out a profound review of the Mexican telecommunications sector. The results, published in early 2012, highlighted a significant number of issues that hindered the sector from taking off to become an enabler of the digital economy. This report became one of the most important inputs to the constitutional reform of 2013.

The OECD identified a number of barriers to entry – such as foreign direct investment restrictions, a complicated and non-transparent licensing framework, the creation of artificial scarcities (such as in spectrum) – which it recommended be eliminated. It also exemplified that the system tended to be non-transparent and discriminatory; regulation was not applied equally to all and its application was not effective; processes were cumbersome and slow, an aggravation, particularly in a fast changing sector.

It also addressed institutional considerations, such as a confusion of regulation and public policy, as well as overlapping responsibilities between different government entities (the “double window”, mostly between the Ministry of Communications and Transport, SCT, and the Telecommunications Federal Regulator, COFETEL). It stressed that the regulator needed to be independent and transparent in its decision-making processes and that it should also be given the legal tools to effectively enforce regulation: it had to be able to impose fines for

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wrong behaviour, request (and receive) information, and publish market information (e.g., quality indicators).

The report also diagnosed that regulation was not promoting competition. It recommended certain issues needed to be addressed ex ante (e.g., quality of service, interconnection rates); the regulator had to be able to determine the existence of agents with significant market power and impose adequate asymmetric regulation quickly and in a coordinated fashion. To be effective, the never-ending injunction procedures (amparos) needed to be simplified and limited.

Many other aspects were highlighted (such as recommendations of price regulation, price registry, rights of way, universal service), but the message was clear: an independent regulator and enforceable competition regulation were necessary conditions to help Mexico address its deficient telecommunications sector.

The OECD emphasized that new comers into the Mexican market faced significant barriers to entry, such as infrastructure sharing restrictions; long, uncertain, and discretionary processes to obtain licenses; and difficulty in obtaining required rights of way and access to passive infrastructure. Deploying new telecommunications networks was one of the main roadblocks to foster competition in the sector. Lack of competition created inefficient markets that imposed significant costs to the economy and negatively impacted social welfare. The population – and the economy as a whole – was subject to high prices, low quality, insufficient supply, and meagre competition. Fostering entry and the deployment of new infrastructure was essential to re-energize the sector.

Before describing the regulatory changes which followed the OECD review, it is useful to examine Mexico’s performance in telecommunications in more detail. For most of the last three decades, Mexico had an underperforming telecommunications sector in terms of availability, uptake, and prices. Even though through this period we can identify four distinct discontinuity points in terms of public policy – namely, the privatization of Telmex (1990), the creation of a regulator and the introduction of competition (1995), the first overhaul of the regulatory institution (2005), and the recent constitutional reform and its legal framework (2013) – overall trends have not shown significant changes. Without a doubt, progress has been made, but no regulatory overhaul has eliminated the gap between Mexico and comparable peer countries. There is hope that the 2013 telecommunications reform, which is the most recent discontinuity, might finally help close the gap; we believe, though, that it is still too early to tell whether this will be the case.

The following sections first compare the evolution of the Mexican telecommunications sector with the rest of the world to see how some gaps have shortened while others have widened. Secondly, we address the evolution of total investment since privatization. We then describe trends in pricing, where the 2013 telecommunications reform has had its most noticeable impact. It wraps up with the description of a comprehensive measure of digital technologies appropriation and analyses of Mexico’s current standing before describing the regulatory
changes enacted since the OECD review. We circle back to the data and conclude with some thoughts on the impact that these regulatory changes have had so far.

3.1 Mexico and the rest of the world

With respect to basic telecommunications services, Mexico has consistently shown lacklustre performance. From a high-level perspective, average performance would rank Mexico roughly in line with its GDP per capita, which, in 2015, ranked 64 out of 185 (65th percentile); nevertheless, the historical evolution of most relevant telecommunications indicators shows otherwise (see Figure 3).

- **Fixed telephony**: Fixed telephony penetration, currently at 16%, puts Mexico at around the 54th percentile, or above 54% of other countries; accordingly, it is below not only developed countries but also behind the Latin American average. It is noteworthy that penetration has stayed reasonably flat for most of the last decade, in contrast with the sharp declines observed in Europe and the United States. As the number of lines has remained roughly constant at 19.5 to 20 million since 2005, worldwide trends have pushed Mexico five steps higher in the ranking since 2012. This is partly explained by a less pronounced effect of the substitution of fixed lines by mobile lines, which Mexico leapfrogged by first-time customers adopting mobile technology.

- **Mobile telephony**: In terms of mobile telephony penetration (total number of access lines per 100 inhabitants), Mexico has never been able to catch up with what has been the trend worldwide – more than two thirds of countries have penetrations above 100%, whereas Mexico’s currently stands at 89%. In 2015, the country ranked 140th at a dismal 33rd percentile – i.e., better than only one third of countries.

- **Unique users**: Mobile penetration statistics, though, do not tell the complete story, as the picture is much better when the actual number of unique users is considered. Penetration is in line with Latin America, with 70% of the population actually having a mobile phone, only 9 and 17 percentage points lower than the rest of North America and Western Europe respectively. The main reason behind the apparent contradiction of both indicators is that individuals with more than one phone are much less common in Mexico than in the rest of the world, mostly due to pricing, low mobile termination rates, large areas with only one telecom provider and the reduced need to own more than one SIM card given the large on-net community of the largest operator. The country has seen its worldwide standing increase by almost 4 percentile points in the last three years.
Figure 3. Mexico: Telecommunications basic services – Relative performance

Source: ITU\(^{13}\), GSMA Intelligence\(^{14}\); figures for Mexico have been cross-checked with information published by IFT.

Note: In Figures 1 and 2, both absolute rankings and percentiles are shown, as the number of countries for which the data are available varies from year to year. For comparison purposes, percentile statistics better reflect Mexico’s relative standing.

\(^{13}\) http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

\(^{14}\) GSMA Intelligence (www.gsmaintelligence.com) is the database of the GSMA, which can be accessed subscription.
Broadband services so far show a marginally better performance when compared to the rest of the world. Mexico was the 50th country in the world to launch mobile broadband\textsuperscript{15} (second half of 2005):

- **Fixed broadband**: Fixed broadband penetration, half of which is provided with DSL technology, 34% with cable modem, and 13% with fibre, has reached 12%. As 88% of connections are residential, household penetration currently stands at around 47%. These numbers are in line with the world’s median, at around the 55th percentile. The positive trend during the decade to 2012 has apparently reversed, but it is marginal and too early to tell how sustainable it will be in the future.

- **Mobile broadband**: Mobile broadband is still growing at over 20% per year\textsuperscript{16} and has already reached more than 69 million connections\textsuperscript{17} (penetration of 53%), which, according to the GSMA, means that 44.7% of the population has a mobile broadband connection. Mexico’s ranking, currently at 96 (57th percentile), is slightly better than for traditional services, but the country has started to recede mostly because many low penetration countries are still showing growth rates above 30%, thus quickly catching up with Mexico, while high penetration countries have significantly slowed down their uptake to 5 to 7%.

- **Population using the Internet**: In Mexico, in 2015 more than 57% of the population 6 years and over accessed the Internet with certain frequency. Use is higher than the Latin American average. Mexico’s relative standing – at the 60th percentile – is better than in any other telecommunications-related statistic. This percentage, when compared to household and mobile broadband penetration, implies that many broadband connections are shared by several persons, many of which probably access the Internet through public connections. According to a recent survey conducted in Mexico City\textsuperscript{18}, 22% of adults (16 years and over) have Internet access at work, 15% use public WiFi spots, and, notoriously, 64% of the time spent on the Internet is through a WiFi connection.

With respect to estimating the population using the Internet, it should be noticed that appropriation, defined as the process by which people adopt and adapt technologies, fitting them in their daily lives and working practices, is extremely hard to measure. Available statistics, whenever they exist, tend to use different definitions\textsuperscript{19}. Even with similar definitions, surveying the population is not easy; national statistics agencies thus usually extrapolate appropriation from other variables or past surveys, frequently changing methodologies. This is the case with Mexico where, as of 2015 there is a break in comparability.\textsuperscript{20} Hence, except for

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\textsuperscript{15} Defined as allowing downloads at a speed of 256 kpbs or higher.

\textsuperscript{16} 24% in 2015, 25% in the year to June 2016, IFT, *Segundo Informe Trimestral Estadístico 2016*.

\textsuperscript{17} IFT, *Segundo Informe Trimestral Estadístico 2016*.

\textsuperscript{18} SEDECO/CONVENIO/07/2016 Número de registro UNAM: 43178-2888-4-XI-15. Report not available as of the date of publication of this article.

\textsuperscript{19} For example, the period considered as relevant (e.g., whether the person used the Internet at least once during the last month should count as a positive or as a negative observation).

\textsuperscript{20} As of 2015, the new ICT survey is a stand-alone self-respondent survey, whereas before it was a module attached to a main survey responded by an informed person of the household who responded on behalf of all the household’s members.
saying that it has consistently gone up, little can be said of the recent evolution of appropriation of the Internet.

Figure 4. Mexico telecommunications broadband services – Relative performance

Source: ITU, GSMA Intelligence; figures for Mexico have been cross-checked with information published by IFT.

As can be seen from the evolution of six key indicators that describe the state of the sector and the appropriation of telecommunications, Mexico has not done well and there is still significant room for improvement. Realized demand does not seem adequate for a country with Mexico’s development. Appropriation has arrived slowly. These two factors together clearly demonstrate that there is still much to be gained – socially and economically – from improving the performance of Mexico’s telecommunications sector.
3.2 Trends in investing

Widespread availability, universal coverage and last generation technologies are the natural consequence of investments in the sector. In its 2012 report on Mexican telecommunications,\textsuperscript{21} the OECD mentions that investment in the country is the lowest among its members, at around 35-45 US dollars per capita.\textsuperscript{22} Accumulated per capita investment in the period 2000-2009 was USD 346, while the OECD average was USD 1,447. Though these numbers are outdated, they do raise a red flag; the state of the network at any given moment is a reflection of the accumulated investment (usually referred to “stock”). From 2010 to 2015, these figures have barely increased; investment per capita per year remains stuck at around USD 40. Lack of incentives, low competition and a relatively uncertain regulatory framework most likely explain an important fraction of this gap.

Since privatization in 1990, annual investment has varied significantly from year to year, but on a multiyear perspective it has only marginally gone up (see Figure 5). The average of the last three years (2013-2015), at USD 3.85 billion, is slightly higher than the average of the last decade, but it still positions Mexico as the country with the lowest investment per capita among OECD countries.\textsuperscript{23}

\textbf{Figure 5.} Investment in telecommunications (billions of nominal USD)

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure5.png}
\caption{Investment in telecommunications (billions of nominal USD)}
\end{figure}

For the 2013 constitutional reform to be successful, investment will need to increase significantly in the short term and show an upward trend rather than a flat one. Entry of new operators should help on this respect, not only by bringing new investment to the sector but

\textsuperscript{21} OECD, \textit{Estudio de la OCDE sobre políticas y regulación de telecomunicaciones en México}, 2012, p. 40.

\textsuperscript{22} Amounts for 2008 and 2009.

\textsuperscript{23} There are strong indications that investment in 2016 is lower than in 2015, with a further decline possible in 2017, as some large operators have already announced CAPEX cuts.
also by exercising pressure on existing players to improve the performance and coverage of their networks.

3.3 Trends in pricing

Though the recent telecommunications regulatory framework overhaul has only started to reverse past trends in service uptake, it has already created a significant discontinuity in pricing. For wireline communications, which include basic telephony and fixed broadband, prices had been slowly creeping down, decreasing 6% in nominal terms in the four years to December 2014. In 2015, the recently approved law prohibited charging for long distance services. This new rule immediately translated into a one-time 6.4% drop in the telecommunications pricing index (see event 1 in Figure 6). Since then the upward trend has resumed, having increased almost 2% in the last years.

Figure 6. Trends in pricing

For mobile telecommunications, the trend is significantly different. From the publication of the reform until the enactment of the new law, prices fell at their historic rate. During these fourteen months they only decreased around 6.8%. But in August 2014 (event 2 in Figure 6), with the entry into force of the new law, interconnection for the “preponderant agent” was set at zero, effectively allowing all other telecommunications companies to terminate traffic in América Móvil’s networks for free. This rapidly set the stage for a change in pricing strategies; all operators, fixed and mobile, started offering unlimited calls for a fixed amount. This effect has been exacerbated by the arrival of a new player which revived the dormant companies that been competing in mobile telephony and broke the gradual price trend that had been observed in mobile telephony for a very long time. Previous mobile plans had historically charged on a per-minute basis, so this change in strategy quickly translated into higher use and lower prices (see

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A “preponderant agent” is a corporation which holds more than 50% of the telecommunications or broadcasting sectors in at least one of several metrics (subscribers, traffic, revenues, capacity, audiences). In March 2014, the regulator declared América Móvil as the “preponderant agent” in telecommunications. See section 2. “Preponderance” only applies to sectors; it does not apply to specific services or markets.
Two years after this legal change, mobile prices, as measured by the CPI, have gone down on average 38.7%, for a total decrease of 42.8% since the reform came into effect.

Figure 7. MOU and ARPU in the Mexican market

In the two years to the third quarter of 2016, Telcel saw an increase of 67% in its minutes of use per connection per month (MOU), while Movistar saw a 40% increase. In the same period, average revenue per user (ARPU) dropped by 23% and 29% for Telcel and Movistar respectively.

As differentiation with bundles of minutes has become harder, companies have already started adding additional elements to their offers. Most bundles now include limited access to apps (WhatsApp) and other services (Facebook, Twitter), in an effort to attract customers while being competitive. Though positive for users, we believe this strategy might potentially bring different competition concerns going forward.

The reduction in prices, without any doubt, has been the main benefit that has been brought about to consumers by the reform.

### 3.4 The 2013 regulatory changes

The 2013 constitutional reform included the term “preponderance” used to describe any agent in the telecommunications and broadcasting sector that had a market share above 50%, measured by at least one of several indicators.25 It was included to be able to quickly label as

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25 Subscribers, traffic, revenues, capacity, audiences.
“dominant players” two companies that, through legal injunctions, had avoided being declared as such in the past. Since then, the concept of “preponderance” has been adopted by other countries, among them Ecuador.

The constitutional text allows the regulator to impose asymmetric measures on those agents deemed preponderant. The Federal Telecommunications Institute (IFT) dictated its measures on March 2014. Most measures were reinforced by the Telecom and Broadcasting Law in July 2014, though new ones were added. The most relevant rule added in the law which had not been included in the “preponderance declaration” was setting interconnection rates to the preponderant agent’s networks at zero, which reduces significantly the impact of the rule of “replicability” of retail commercial offers for voice services, as described below.

The original text published by IFT, consisting of more than 1,700 pages, imposed more than 100 asymmetric rules the preponderant agent had to comply with. The regulator said these rules would be reviewed every two years to evaluate their effects on competition and the evolution of the sector. It could impose, if deemed necessary, additional obligations or make existing ones more stringent.

- Interconnection is mandatory at regulated rates, which would be determined by IFT using a cost model. The preponderant agent should comply with the general interconnection agreement.26
- All its plans must comply with a “replicability” condition, which means that competitors have to be able to offer a similar plan without incurring losses27.
- For both fixed and mobile networks, the preponderant agent must open its network by providing access to links, transit services, colocation, roaming, resale, and elements of passive infrastructure. Though rates are, in principle, not regulated, they have to be non-discriminatory and, in case of an impasse in negotiation, IFT has the power to intervene. It cannot enter into exclusivity agreements with any player. For all regulated services, a public reference offer, approved by the regulator, must be published. It should charge its own operations the same amount as it charges other providers, thus extending the “replicability” rule for services other than voice.
- Unbundling of its network is also mandatory.
- All information regarding its networks, including the plans to build new infrastructure, must be made available to other providers through an “electronic management system”.28
- With respect to end customers, it cannot offer any services in tied sales, elements of bundles have to be also offered separately, and users should have access to usage

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26 Convenio marco de interconexión, as set forth in Annex 5 of the “Declaración de preponderancia”.
27 Replicability in retail plans is measured in terms of the average rate (ARPM – average revenue per minute), which has to be above interconnection. As interconnection to the preponderant agent’s networks was set at zero, this rule is always met.
28 Sistema Electrónico de Gestión.
details. The agent cannot charge for roaming on its network and prepaid phones cannot be blocked.

- The preponderant agent must comply with separate accounting rules.
- Minimum quality obligations for retail and wholesale services were also addressed, including maximum periods to comply with delivery for most types of services.
- The preponderant agent must comply with significant information requirements, as well as submit any other information that the regulator deems necessary.
- It cannot enter into exclusivity content agreements if such content is considered “relevant”.  
- No cross-ownership is allowed between the preponderant agent in telecommunications and the preponderant agent in broadcasting.
- The prohibition to provide broadcasting services, including pay television, is maintained.

These rules will go through a first evaluation period in the short term, somewhat behind the original two-year deadline. So far, IFT has not made any formal statement of the degree of compliance by the preponderant agent.

3.5 The impact of and requirement for ongoing regulatory change

As shown by the data, the Mexican telecommunications sector is still underperforming with respect to the rest of the world. Imposing the regulatory rules was no simple task; and evaluating – much less modifying them – is not easy either, as the period of asymmetric is short and follows decades of almost unrestricted dominance.

It is illusory to think that significant changes in regulation would yield results in a short time frame. The new regulator and the new telecommunications act are only 36 and 30 months old. It is too early to tell whether the reforms have altered in a sustainable way the rate of change in the trends in the right direction.

There are already some positive signs – investment is slightly higher today than historically, the concentration index is slowly decreasing (as the preponderant agent has lost around 3 percentage points of market share, currently at around 68%) and uptake of different platforms is still increasing. Success will take time. Loosening regulatory intervention too early risks giving away progress already made, as small as it may be, thus negatively impacting the development of the Mexican digital economy.

4 Other important contributory factors

This section discusses a number of measures supporting the successful digitisation of the Mexican economy. The list of potential candidates is long, and ranges from the mundane, such

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29 IFT published a list of relevant contents in May 2014, all of them related to sports events (soccer and Olympic Games).
as improving postal deliveries to encourage e-commerce, to high level issues, such as encouraging trust in digital modes of operation. Not all of them are necessary for progress to be made: international experience suggests the existence of work-arounds for some of the recommendations.\textsuperscript{30} Here we illustrate what is at stake by outlining a small number of important factors in a summary fashion, noting that the case studies in the next section address similar questions in a more granular way.

4.1 Independence of regulators

There is broad agreement that the substantial and sometimes risky investments required to create a digitised economy within a framework of regulation is more likely to be forthcoming when that regulatory framework is predictable and not subject to surprises. There is also a fair amount of agreement that having an independent regulator is the arrangement best placed to provide a stable background against which the investment can go ahead.\textsuperscript{31}

This does not absolve the government from involvement in setting objectives and in making broad economic and social policy decisions. The government is also a major producer of public services, which it is likely to want to manage in an increasingly “digital” way. But it does imply a hands-off approach by government when detailed technical decisions (for example, standard setting or giving preference to technologically neutral solutions), or decisions which impinge on the relative positions of different operators, are being taken; the goal is to remove them from what may be a short-term or politicised arena.

Under the 2013 Constitutional Reform, the IFT became an agency independent of the federal executive, and the previous complex regime involving a “double window” (through which government and regulator interacted on the same decisions) was abolished. In addition, the IFT is in charge not only of regulation but also of enforcing competition policy in the communications sector. The elimination of the “double window” made a cleaner separation between policy and regulation; the joint implementation by the IFT of regulation and competition law puts both levers in the same hands and should reduce delays and permit a better choice of means of intervention.

As noted in section 3, the IFT engages with fixed, mobile and broadcasting market places exhibiting very asymmetric market structures, and has been granted strong powers to intervene. This complicates the normal economy-wide transition noted by the World Bank Development Report 2016, in which emerging countries first have to encourage infrastructure investment and enforce product market competition, in both communications and elsewhere, and then move on to a transitional stage of removing regulatory barriers and encouraging the entry of Internet start-ups, which provide a disruptive element. In Mexico, the enforcement of competition in communications markets is being put in place simultaneously with the

\textsuperscript{30} For example, in countries where electronic payment is unavailable or mistrusted, there is a more costly alternative for e-commerce: payment of cash on delivery or inspection of the goods at the point of (self)-collection. Both of these measures are common in parts of Asia, where they may impede but do not stop the growth of e-commerce.

transitioning phase, and even in some sectors with the transforming phase of regulating the
digital economy to level the playing field between incumbent and Internet firms. Moreover,
the disruptive element brought about by the entry of Internet start-ups has involved the same
incumbent players as those participating in infrastructure investment and product markets;
namely, América Móvil — the preponderant agent in telecommunications — with its entry into
digital streaming services, Claro Video, and Televisa — the preponderant in broadcasting —
with its video streaming service Blim. This introduces a novel and challenging element into
the regulation of the sectors as vertical integration is rampant in Mexico. Given the very
asymmetric market shares of the players, the IFT must be very alive to the possibility of vertical
and horizontal leveraging of market power by dominant players, as well to the possibility of
dominance being transferred to other markets.

The major role in regulation belongs to the IFT – and, like all other regulators, it still needs to
fully develop its knowledge base of the sector. But other independent regulators are required.
The reach of digitisation extends way beyond the broadcasting and telecommunications
sectors, which the IFT regulates. Where the service for sale or supply is not an information or
communications service, the Mexican competition authority (COFECE) will be involved, as
will regulators in other sectors. Cases are likely where intermediary online platforms are
inserted between the supplier and the customer. Examples are: retailing (Amazon), taxis (a
regulated sector where ride-hailing apps are likely to have a significant impact), and other
sectors such as banking and insurance, where digital information and comparison sites are
beginning to have an impact.

Such platforms may or may not require intervention on competition or other grounds. But the
digitisation process will be advanced by a clear system of governance by independent
regulatory agencies, which avoids the confusion which might arise from overlapping
responsibilities exercised by, for example, the IFT, the competition authority and the consumer
protection agency (PROFECO).

4.2 Trust

The use of digital services requires acts of trust. A person buying goods on the Internet, and
paying in advance will need confidence that the goods will arrive in the first place, and will be
replaced if they turn out to be defective. In commercial processes and government and public
services ones, personal information – for example, credit card details or information about
health states – may be disclosed, and the risk of invasion of privacy is always there.

The World Economic Forum, together with A.T. Kearney, Microsoft and other stakeholders\(^\text{32}\) has suggested that there are five objective and two subjective variables that determine the
“context” under which a consumer will be asked to transact online:

**Objective variables:**

1. Type of data: What type of data is involved? (e.g., financial, medical, location)

2. Type of entity: Who is accessing the data? (e.g., retailer, employer, government)
3. Device type: What kind of device is used for the transaction? (e.g., mobile phone, desktop)
4. Collection method: How is the data collected? (e.g., actively provided by the user, passively collected or generated without user awareness)
5. Data usage: What is the level of user involvement in using data? (e.g., from explicit consent and active engagement to being unaware and using automation)

Subjective variables:
6. Trust in service provider: What relationship, if any, do users have with the service provider they are interacting with?
7. Value exchange: How do users perceive the benefits they receive from the use of their data? (e.g., personal benefits, benefits to the community)

The researchers concluded that willingness to trust is dependent on the context of the disclosure, as captured by these variables, and that “more research is needed on how context can be defined more clearly and simply, and how it can be practically integrated into systems and interface designs that create meaningful user engagements. This understanding is essential to developing effective ecosystems and policies. Too often, the sociological and behavioural aspects are overlooked in favour of more technocratic approaches that have not worked when actually implemented.”

The implication is that whether the digital interaction is commercial or public sector in nature, careful thought must be given as to how to organise the interaction. Business incentives are likely to align strongly with a context-appropriate approach: that way revenue is maximised. But public service organisations may need constant reminding of this aspect of their digital activities. This lays out a very important role for, for example, competition advocacy, a role that IFT may need to more forcefully use in the coming years.

Digital markets do have their own accompanying means of building trust. A passenger summoning a vehicle via the ride-hailing app Uber is asked to grade the driver’s performance, and it is known that drivers with poor feedback are dispensed with. In the case of Airbnb, both host and guest are reciprocally assessed, and the resulting data offer some reassurance to both sides. This process of eliciting and aggregating customer feedback back and transmitting it to subsequent customers can build trust. However, increasingly prevalent fake online reviews can undermine this confidence. At least one national consumer protection agency has warned firms that soliciting fake reviews may breach the law.

Trust can be undermined, at least for a time, by unlawful hacking, the public release of private information, or electronic theft of assets (for example, from bank accounts). Encouragingly, Mexico is NOT among the top 50 countries in the Rapid7 2016 comparative analysis of cybersecurity risks.33

33 Beardsley et al., Rapid7 National Exposure Index 2016.
4.3 The “App Economy”

Apps, especially mobile apps, now constitute a major and fast-moving component of the communications value chain. They are mostly supplied via two intermediaries: the Apple App Store and Google Play.

It was only eight years ago that Apple decided to market (after appropriate vetting) other developers’ apps, and Google followed suit shortly afterwards with Android apps. This has had a major effect on how software for smartphones is distributed and is a development which is very profitable for the large mobile platforms.

It also has a big effect in countries outside the magic circle of 10 countries which are said to receive 95% of app revenues. But this concentration not only disadvantages developers in other countries but may also skew markets more widely, promoting products and services from some countries but not from others.

A recent international study on apps sheds some light on Mexico’s experience. It shows Mexico punching well below its weight in several respects. The number of app developers in Mexico City is the same as in Lima, half that in Buenos Aires and one third that in Sao Paolo.

An overall comparative picture is given in Figure 8. Mexico performs poorly in terms of total number of developers, developers/per million population, domestic market share and value capture (or revenue). The information on domestic market share is confirmed by a study which shows that in a three month period in late 2016, Mexican-made apps accounted for only 1.6% of free apps and 0.5% of paid apps downloaded from the Apple AppStore; the equivalent figures for Google Play were 1.6% and 0.6%.

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35 Ibidem. p. 31-49.
36 It should be noted that some of the individual estimates may contain a significant margin of error.
37 Presentation given by Dr Roslyn Layton of Aarlborg University, Denmark at an IFT conference in Mexico City, 23 November 2016.
Figure 8: Performance of the App Economy in selected lower income countries.

App economy performance

<table>
<thead>
<tr>
<th>Country</th>
<th>Total developers</th>
<th>Developers/100</th>
<th>Domestic market share</th>
<th>Value capture</th>
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<tbody>
<tr>
<td>Brazil</td>
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<td>Egypt</td>
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<td>Turkey</td>
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<td>Mexico</td>
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<td>Belarus</td>
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<td>South…</td>
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<td>Thailand</td>
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<td>Nigeria</td>
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<td>Ukraine</td>
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<td>Philippines</td>
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<td>India</td>
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<td>Pakistan</td>
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<td>Tanzania</td>
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This situation may arise from a number of factors, of which lack of training may be one. It may also be exacerbated by intense competition in the large number of apps written in Spanish. Apps are becoming the main interface of users with the digital economy, so significant local expertise will be required if the country is not to be left behind. Given the importance of the App Economy, it is important that the Mexican Government and business community understand these factors and seek to counteract them.

5 Review of progress and prospects in key sectors: e-commerce; banking, finance and taxation; e-health and e-education

In the following section we analyse four sectors which have presented significant advances in inserting Mexico into the digital economy. First we address e-commerce, which is poised to grow rapidly in the next few years. Secondly, we analyse e- and m-banking together with taxation, as these areas are heavily linked and could potentially permit creating a virtuous circle of reinforcement. Thirdly, we describe progress to date in e- and m-health. And finally we look
at e-education. Because of space limitations we cannot give comprehensive assessments, but aim to convey a sense of how well Mexico is doing in these activities.

5.1 e-commerce

Superficially, e-commerce looks like a comparatively simple application of the digital economy, but, like other applications, it has a varied list of complementary inputs, ranging from enhanced connectivity and improved payments, to the availability of parcel delivery and the development of trust in the supplier of the goods.

e-commerce or digital trade conventionally falls into two major categories:

a) The purchase of tangible goods from an online platform (which requires “analogue”, or “bricks and mortar”, means of delivery, which may need upgrading);

b) The acquisition of entitlements (to travel or insurance, for example) and of digital content itself, such as data, software, research content, eBooks, journals, magazines, music and video. These can be digitally transmitted to the purchaser.

Digital trade or e-commerce can take several forms: business to consumer (B2C), business to business (B2B) and consumer to consumer (C2C). The focus of most of the discussion has been on B2C, but B2B is potentially of great importance. Where an SME or micro-business is the customer, it may face obstacles broadly similar to those encountered by a consumer.

In almost every jurisdiction of significant size, the bulk of e-commerce is domestic, at least for the first category described above, and takes place within a country’s borders, rather than being cross-borders. Even so, 57% of those surveyed by the Internet Association of Mexico shopped cross-border, with two-thirds of those making a purchase in the United States.\(^{38}\)

Getting customers to use a new distribution channel, or more broadly encouraging currently disengaged customers to widen their choices, is a common problem. Success in solving it typically requires a series of measures involving different agents. Normally all these measures must be in place for engagement to take place and yield benefits.

The problem of getting customers to engage successfully can be summarized as requiring “three As”. Adapted to the present case, these three components are:

- **Access (or connectivity):** Clearly a digital commerce customer must have access to the online supplier. In the first instance this requires access to the Internet, which is increasingly accomplished via a smart phone.

- **Assess:** If the customer is to make rational choices, she must be able to compare possible e-commerce transactions with one another, and in appropriate cases with buying from a “bricks and mortar” store. Commercial organizations are motivated to provide such comparative information, either separately, as through a price comparison website, or via an online platform which retails the services of competing suppliers. A

crucial part of assessment concerns the risks of the transaction going wrong – for example the goods not arriving or being defective. Trust is necessary.

- **Act**: To accomplish the transaction, arrangements must often be in place which often lie outside the control of either the customer or the supplier. Three important examples of such arrangements are: i) the availability on reasonable terms and conditions of a reliable payments system; ii) in the case of tangible goods, the availability on reasonable terms of a delivery service (which can be self-delivery); and iii) clear, practicable and reasonable arrangements for the collection of sales taxes.

Dependable and affordable broadband connectivity is a necessary condition for e-commerce. The government can play a role in improving affordability by, for example, reducing the taxes on operators and consumers, as well as promoting competition and investment.

Availability of 3G and 4G networks is essential. Download speeds which allow the use of rich graphics or video to display products are required and low latency is critical for payments.

Mexico’s ranking within the 137 countries in its UNCTAD’s e-commerce index is shown in Table 1, together with that of some Latin American countries, and their growth projections.

**Table 1. Mexico’s position in e-commerce compared with others.**

<table>
<thead>
<tr>
<th></th>
<th>Mexico</th>
<th>Chile</th>
<th>Argentina</th>
<th>Brazil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of individuals using the Internet</td>
<td>44</td>
<td>72</td>
<td>65</td>
<td>58</td>
</tr>
<tr>
<td>Share of individuals with a credit card</td>
<td>18</td>
<td>28</td>
<td>27</td>
<td>32</td>
</tr>
<tr>
<td>Secure servers per 1 million people</td>
<td>61</td>
<td>73</td>
<td>65</td>
<td>67</td>
</tr>
<tr>
<td>UPU postal reliability score</td>
<td>73</td>
<td>68</td>
<td>51</td>
<td>68</td>
</tr>
<tr>
<td>UNCTAD B2C e-commerce index value</td>
<td>50.0</td>
<td>60.3</td>
<td>51.9</td>
<td>56.2</td>
</tr>
<tr>
<td>Rank</td>
<td>63</td>
<td>43</td>
<td>57</td>
<td>51</td>
</tr>
<tr>
<td>e-commerce share of retail sales, 2015 (%)</td>
<td>1.4</td>
<td>NA</td>
<td>1.9</td>
<td>3.1</td>
</tr>
<tr>
<td>e-commerce expected share of retail, 2019 (%)</td>
<td>2.6</td>
<td>NA</td>
<td>3.2</td>
<td>4.6</td>
</tr>
</tbody>
</table>


In contrast to the UNCTAD ranking in Table 1, AT Kearney, which studies e-commerce globally, ranks Mexico above both Chile and Brazil, and rates its prospects highly, as “a young, connected population which is increasingly willing to shop online”.³⁹ US-owned and other international retailers are also highly active.

But Mexican online retailers are found to fall short in the product information they make available online and in providing online help services. At present, only a third of Mexico’s Internet users shop online, and three-fourths of them use a computer rather than a mobile device. These are disproportionately located in Mexico’s three biggest cities. These facts underline the potential of the mobile Internet and smart phones. At present, many shoppers research online and buy off-line: for the purchase of online physical goods, delivery times of

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10-15 days may be a disincentive,\textsuperscript{40} but also an indication that connectivity alone cannot improve purchasing behaviour without an improvement in other infrastructures, such as postal services.

Payment mechanisms are a crucial component of e-commerce. In other jurisdictions, online payments co-exist with cash-on-delivery and collection and cash payment by the customer. Mexico has an unusually high number of debit cards, with a high fraud risk compared with credit cards. Cash payments are considered risky. Lack of trust by both sides in the transaction may be inhibiting online payments and purchases. Processes are cumbersome and not fully reliable.

In summary, while there is great promise in e-commerce in Mexico, current levels of activity are low, even though they are projected to rise at about 25\% per year. To increase the probability of such growth, certain policy interventions are required:

- Competitive investment in upgrading networks and services providing connectivity;
- Supporting e-commerce skills of the labour force;
- Enhancing Mexican firms’ web and marketing abilities;
- Encouraging e-payments;
- Increasing trust by various means, including consumer protection legislation and antifraud measures.

5.2 Banking, finance and taxation

e-banking, understood as the performance of banking activities via the Internet, and e-finance, defined as any financial activity carried out electronically (more specifically, over the Internet) simply cannot exist without the support of reliable ubiquitous telecommunications networks through which to carry out fast and secure transactions.

The availability of ICTs is a necessary condition, but it is not sufficient. e-banking requires the existence of rules that not only guarantee the confidentiality, security and efficiency of transactions, but also foster a competitive environment. Trust in the system is essential. Basic ICT skills are needed. Underlying systems have to be simple for people to use, as complicated systems (e.g., not user friendly, too many steps, cumbersome registration processes) hinder potential users from appropriating e-banking.

e-banking, together with e-payments, is also highly correlated with financial inclusion, which is considered one of the most important levers to help people exit poverty. Financial inclusion not only helps people better manage payments and expenses, but also helps them manage cash flow spikes, mitigate the shocks of emergencies, smooth consumption, and build working capital. Financial inclusion in Mexico still has long ways to go. In 2014 (last number available), only 38.7\% of adults had a bank account, compared to a world average of 53.7\%\textsuperscript{41}, positioning Mexico at the 38\textsuperscript{th} percentile (see Figure 9). Cash is still the preferred way for consumer

\textsuperscript{40} AT Kearney, \textit{The Tipping Point for e-commerce in Mexico}, 2016.
\textsuperscript{41} Unweighted average.
transactions. According to IMCO,\textsuperscript{42} in 2013 around 96\% of these types of transactions, representing 47\% of total value, were carried out with cash.

**Figure 9. Financial inclusion in the world\textsuperscript{43}**

Nevertheless, in spite of this low banking situation, electronic transfers have grown dramatically in the last decade, though absolute numbers are still low. The system for “instantaneous” electronic transfers (SPEI), which became available in August 2004, unified several existing transfers platforms. In the five years to 2015, they grew from 85.9 to 334.9 million transactions per month (CAGR of 23.7\%). In the first eleven months of 2016 they had grown already more than 5.3\% (see Figure 10).


\textsuperscript{43} The Mexican financial inclusion report (Consejo Nacional de Inclusión Financiera (CONAIF), *Reporte Nacional de Inclusión Financiera*, 2016) uses the 2014 Global Findex number for Mexico.

\textsuperscript{44} World Bank Group, *Global Financial Inclusion Database*, 2015.
Financial inclusion, e-banking, formality, and direct taxation go hand in hand. For example, IMCO\textsuperscript{45} estimates that by reducing 1% the number of cash transactions, which are largely related to the informal economy, GDP might grow between 0.4 and 0.5 additional percentage points.

The Mexican government has pursued initiatives in this sense. It has made efforts in many areas, three of which stand out. Firstly, it has boosted its efforts to increase the taxpayer base. From January 2010 to December 2012, it grew 35.6%, from 28.4 to 38.5 million. From December 2012 til October 2016, it increased from 38.5 to 55.2, an impressive 43.4%. Since 2009, it is mandatory to submit tax returns online (for those earning more than 400,000 pesos – USD 20,000 – or receiving income from more than one source). It also introduced (as early as 2004) the possibility of billing and invoicing electronically (“facturación electrónica”), which became mandatory in 2014. Overall, revenues from income tax have increased more than 107% since 2010\textsuperscript{46}.

It is hard to isolate the effects of each one of these initiatives. There is a significant relationship between total tax revenues and the size of the taxpayer base (see Figure 11), so directing efforts towards registration has been a priority. Nevertheless, as can be seen in Figure 12, tax payments made over the Internet have barely budged in the last decade, which most likely is explained by lack of appropriation and difficulty for making payments online.

\textsuperscript{45} Idem.

\textsuperscript{46} There was an overhaul of the tax system – mostly, an increase in taxes – in 2014, but the huge increase cannot be explained only by inflation and the tax increase. The tax authorities have been working on many fronts simultaneously. Isolating the effects of each front goes beyond the scope of this paper.
Figure 11. Relationship between the taxpayer base and total tax revenues

Lastly, it can be seen that the “factura electrónica” has taken off since it became mandatory (see Figure 13). No tax deductions\(^{47}\) can be made without an electronic invoice, thus creating the incentive to be requested by the payor. Given penetration statistics and the minimum requirements to be obliged to submit a yearly tax return, the “factura electrónica” will most likely level off in the near future unless new incentives are put in place to make taxpayers demand it from providers. Efforts should be made to move from a punishment-based to an incentive-based system.\(^{48}\)

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\(^{47}\) With a few minor exceptions.

\(^{48}\) Examples abound, such as awarding credits for electronic transactions or for creating incentives for consumers to demand electronic invoices.
Given the link that exists between e-banking and taxation, Mexico could develop public policies to increase both simultaneously, entering into a virtuous growth cycle where one variable feedbacks into the other. This will only be successful if good reliable telecommunications networks exist and penetration and coverage are high.

Leaving aside the general recommendations which apply to the digital economy, for e-finance (comprising e-banking and e-payments) to fully take off will require additional policy intervention. Once again, trust in the system is essential – subject to antifraud measures, strict consumer protection regulations must ensure that complaints and problems are addressed.

49 Most taxpayers have their taxes deducted directly by their employer, thus significantly reducing the number of required payments.
quickly. Today, problems abound, customer service processes are cumbersome and designed to deter the consumer and the taxpayer from complaining. In fact, they assume as a starting point that the consumer is not right and is potentially abusing the system. Government access by default to all types of transactions undermines confidence in the system; unchecked access should be limited. Regulation should push for simpler and more user-friendly processes (such as registration, information required, number of steps, regulatory delays).

So what about the unbanked?

So far, the above description has focused primarily on online payments using the formal financial sector. But what about the remaining 60% of the population who remains unbanked? One of the main setbacks for the development of non-banking alternatives for e-payments has been regulation.

Over the last decade or so Mexico’s banking regulators have placed emphasis and prioritised regulation to limit dubious transactions that can lead to money laundering. While this continues to be a priority, a new objective has been gaining prominence: fostering financial inclusion. Non-bank electronic payments are a clear means to achieve this.

There are two recent services that, although linked to banks, are now offering a hybrid to non-financial electronic payments: Saldazo® card and Transfer® service. Changes in the Law for Credit Institutions in 2008 and 2010 allowed third parties, not just banks, to establish contracts with banking institutions and act as their agents; the reform allowed these third parties to also include other parties to do so through the operation of mobile telephony. Further changes allowed for a simpler process to open an account.

Transfer® is a mobile payment service linked to a simplified account that is available to Telcel users. It allows for the opening of an account without identity documents (account 1), with only basic identity data but not keeping any of those documents (account 2) or with full identity documents but without keeping a copy of these (account 3). Initially Transfer® only offered operations using a mobile phone; later on a debit card was incorporated; by 2014 Banamex (the largest bank in Mexico), Femsa (the holding company of the largest Coca Cola bottler in Latin America, among other businesses) and Visa jointly launched the Saldazo® card for the largest convenience store chain, OXXO (also owned by Femsa) – about 18,000 points of sales and growing — that can be linked to the service.

Figure 14 illustrates the effect that Saldazo® has had on the economy of around 30% of Mexicans who use bank correspondents instead of banks as their principal financial channel. According to information from Banamex, the Saldazo® card generates 5,000 daily accounts of which 80% get associated with Transfer® and 95% of cardholders are new clients for the institution. It is telling, particularly about the importance of trust in these transactions, that

50 For example, a complaint about a transaction that went wrong, if it is not solved quickly – and, by default, in favour of the user – will only lower trust in the system. He will be reticent about using the system again.


face-to-face interactions, albeit with a convenience store, have been able to reach more Mexicans than a mobile transaction only did before, even if it was carried out by the largest incumbent operator.

**Figure 14. Evolution of accounts associated with Transfer®**

![Figure 14](image)

**Source:** CONAIF, 2016.

5.3 e-health

e-health is the use of information- and telecommunication technologies for provision, support or improvement of health and/or healthcare. These technologies seek to help strengthen medical care services and bridge healthcare gaps between different communities in the country. While e-health developments have tended to be implemented more in the private sector as hospitals have digitised and used these tools more often, there have been important initiatives led by the Ministry of Health in Mexico. Although many of them have been directed at process improvement rather than at changing doctor/patient relationships via use of ICTs, we nevertheless include a brief description of some of these below.

The National Centre for Technological Excellence in Health (CENETEC) was created in 2004 with the aim of applying and adopting tele-health services within the national health system. The objective was to incorporate telematics technologies related to medical attention services. Nonetheless, a study by Cepal in 2010 noted that the use of ICTs had been mostly directed at improving administrative processes rather than the adding value to clinical areas.\(^5\)

The Ministry of Health, for example, did not begin to develop an Electronic Medical Record until 2007, and the plan was programmed in 6 phases between 2007 and 2012, ensuring interoperability. Advances have been made in the government’s social security service (IMSS), which has implemented an electronic medical record to integrate various services as has the Public Sector Workers’ Social Security Service (ISSSTE). Both institutions use videoconferencing and telemedicine as a means of launching medical centres in rural areas or at arriving to a diagnosis from a distance.

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In 2015 the Ministry of Health announced that it would be adopting the Medical Management and Hospital Information System (SAMIH), which includes a hospital management system of electronic medical records. The system allows communication between 31 hospitals in Mexico City. While medical professionals are still being trained in the use of this system, the government expects that patients will benefit from reduced time in undertaking medical tests, sharing of medical information, better attention times, ease in issuing medical orders as well as a unique ID for patients providing secure and confidential use of their private information.\textsuperscript{54} However, public data are not available to measure substantive effects, and data provided are only partial. For example, public statistics from 2016 have put the number of health centres and hospitals with Internet connectivity at 93,803 but this still does not answer the number of patients or the types of medical services that benefit from technological applications in the sector. The whole system is still not interoperable and some authors note that interoperability should not be expected until 2024.\textsuperscript{55}

Telesalud is a public e-health program which aims to provide medical assistance and an integrated service health providers through the use of telecommunications. Figure 15 offers a partial look at population coverage by this program. The first case is a national average that covers the years 2013 to 2015. The next table proxies coverage by interconnectivity of hospitals; data is for 2012 but broken up by region, which evidences partly the regional disparities that characterize the country – centre vs. periphery, urban areas vs. rural. For 2013, the percentage of the population potentially benefitted by Telesalud projects as stated by CENETEC\textsuperscript{56} was 2%; it went up to 3.02% in 2014. In 2015, after changing the methodology for measurement\textsuperscript{57}, the number reported was 1.28%.

\textsuperscript{57}Only people living in the municipality where the service is offered is considered.
### Figure 15. Telesalud – Percentage of population coverage by state. 2012

<table>
<thead>
<tr>
<th>State</th>
<th>Population Coverage (%)</th>
<th>State</th>
<th>Population Coverage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edo. De México</td>
<td>12.6</td>
<td>Ciud. de México</td>
<td>7.88</td>
</tr>
<tr>
<td>Jalisco</td>
<td>6.21</td>
<td>Veracruz</td>
<td>5.88</td>
</tr>
<tr>
<td>Guanajuato</td>
<td>4.4</td>
<td>Puebla</td>
<td>4.3</td>
</tr>
<tr>
<td>Chiapas</td>
<td>4.19</td>
<td>Nuevo León</td>
<td>3.6</td>
</tr>
<tr>
<td>Michoacán</td>
<td>3.59</td>
<td>Oaxaca</td>
<td>2.86</td>
</tr>
<tr>
<td>Chihuahua</td>
<td>2.68</td>
<td>Tamaulipas</td>
<td>2.56</td>
</tr>
<tr>
<td>Guerrero</td>
<td>2.54</td>
<td>Sinaloa</td>
<td>2.45</td>
</tr>
<tr>
<td>Hidalgo</td>
<td>2.34</td>
<td>Sonora</td>
<td>2.34</td>
</tr>
<tr>
<td>San Luis Potosí</td>
<td>2.21</td>
<td>Coahuila</td>
<td>2.14</td>
</tr>
<tr>
<td>Tabasco</td>
<td>1.99</td>
<td>Querétaro</td>
<td>1.6</td>
</tr>
<tr>
<td>Yucatán</td>
<td>1.5</td>
<td>Durango</td>
<td>1.42</td>
</tr>
<tr>
<td>Morelos</td>
<td>1.41</td>
<td>Baja California</td>
<td>1.34</td>
</tr>
<tr>
<td>Zacatecas</td>
<td>1.2</td>
<td>Aguascalientes</td>
<td>1.05</td>
</tr>
<tr>
<td>Nayarit</td>
<td>0.97</td>
<td>Quintana Roo</td>
<td>0.97</td>
</tr>
<tr>
<td>Tlaxcala</td>
<td>0.96</td>
<td>Campeche</td>
<td>0.73</td>
</tr>
<tr>
<td>Colima</td>
<td>0.56</td>
<td>Baja California Sur</td>
<td>0.35</td>
</tr>
</tbody>
</table>

% of the population benefited from the total of the country

Source: SCT, *Places with WiFi connectivity for hospitals and health centres; and the population in their respective municipalities, 2016.*

While public sector institutions are using current technology as a means of improving care or reducing costs, they have done so to a lesser degree than the private sector. Private institutions have made use of e-health technologies more widely. For example, Torre Médica, the American-British Cowdray Hospital (ABC Hospital) and Médica Sur hospitals have already begun using online technology to assist in surgeries. Universities – mostly private ones – have used e-health initiatives to connect and improve their learning facilities mostly to stimulate distance learning.

One of the recurring themes in the description of policies aimed at digitising health services has been the poor connectivity of Mexican households. In fact, connectivity is a hurdle in implementing m-health initiatives: the use of mobile devices for health purposes. These

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58 The following description comes from Sector Report e-Health Mexico of The Embassy of the Kingdom of the Netherlands, 2015.

initiatives are not just based on the possession of mobile phones but also on the possibility of using patient monitoring devices, Personal Digital Assistants (PDAs), as well as wireless devices. Among the applications for m-health are treatment adherence monitoring, community mobilisation, clinical data collection, wellness and self-care, chronic disease management, etc. m-health is seen as a key contributor for achieving universal health coverage by reaching remote and underserved communities.

The World Health Organization (WHO) provides information that helps compare Mexico’s readiness for e-health deployment relative to an average global response. However we found that there is little useful information in these statistics to accurately estimate its progress and/or challenges. In the WHO’s Atlas eHealth country profiles 2015: The use of eHealth in support of universal health coverage, self-reporting answers to very general questions do not allow for a comparison of the degree with which Mexico has implemented a Health Information System (HIS), or how in-depth is the training of science students and professionals in e-health, for example. The information does not really allow us to determine whether Mexico’s position relative to other countries in terms of e-health initiatives has contributed to strengthening e-health foundations.

Table 2 below illustrates this point. Mexico, for example, has an affirmative response in the use of e-learning in health science in 75.5% of the questions relating to this issue, a higher percentage than South Africa and Turkey, but also above the US, Russia and Switzerland—a baffling result. In terms of m-health foundations, however, Mexico significantly lags other countries – with the exception of Australia and Italy – and its responses in this indicator is the least affirmative of all e-health indicators. We can speculate that the degree of development of mobile connectivity plays an important role in Mexico’s lag, but have no hard facts that can explain this with more certainty.
Table 2. e-health indicators, 2015
(percentage of affirmative answers for each of 8 modules)

<table>
<thead>
<tr>
<th></th>
<th>Big data</th>
<th>Electronic health records (EHRs)</th>
<th>Tele-health</th>
<th>m-health</th>
<th>Legal fame works for e-health</th>
<th>Use for e-learning in health sciences</th>
<th>Social media</th>
<th>e-health foundations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>50</td>
<td>23.1</td>
<td>40.0</td>
<td>60.7</td>
<td>84.6</td>
<td>83.3</td>
<td>66.7</td>
<td>75.0</td>
</tr>
<tr>
<td>Australia</td>
<td>50</td>
<td>61.5</td>
<td>40.0</td>
<td>28.6</td>
<td>15.4</td>
<td>100.0</td>
<td>58.3</td>
<td>50.0</td>
</tr>
<tr>
<td>Canada</td>
<td>0</td>
<td>84.6</td>
<td>50.0</td>
<td>78.6</td>
<td>76.9</td>
<td>100.0</td>
<td>83.3</td>
<td>58.3</td>
</tr>
<tr>
<td>China</td>
<td>0</td>
<td>92.3</td>
<td>50.0</td>
<td>57.1</td>
<td>15.4</td>
<td>100.0</td>
<td>83.3</td>
<td>75.0</td>
</tr>
<tr>
<td>Italy</td>
<td>0</td>
<td>76.9</td>
<td>50.0</td>
<td>28.6</td>
<td>84.6</td>
<td>91.7</td>
<td>83.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Japan</td>
<td>50</td>
<td>15.4</td>
<td>80.0</td>
<td>50.0</td>
<td>53.8</td>
<td>100.0</td>
<td>41.7</td>
<td>66.7</td>
</tr>
<tr>
<td>Mexico</td>
<td>50</td>
<td>84.6</td>
<td>80.0</td>
<td>28.6</td>
<td>92.3</td>
<td>75.5</td>
<td>91.7</td>
<td>75.0</td>
</tr>
<tr>
<td>Russia</td>
<td>0</td>
<td>76.9</td>
<td>80.0</td>
<td>78.6</td>
<td>46.2</td>
<td>8.3</td>
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<tr>
<td>South Africa</td>
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<td>0.0</td>
<td>46.4</td>
<td>30.8</td>
<td>0.0</td>
<td>25.0</td>
<td>58.3</td>
</tr>
<tr>
<td>Switzerland</td>
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<td>40.0</td>
<td>39.3</td>
<td>53.8</td>
<td>50.0</td>
<td>33.3</td>
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<tr>
<td>Turkey</td>
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<td>100.0</td>
<td>100.0</td>
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<td>0.0</td>
<td>83.3</td>
<td>25.0</td>
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<tr>
<td>U.K.</td>
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<td>50.0</td>
<td>64.3</td>
<td>61.5</td>
<td>100.0</td>
<td>91.7</td>
<td>75.0</td>
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<tr>
<td>U.S.</td>
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<td>Uruguay</td>
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<td>40.0</td>
<td>64.3</td>
<td>84.6</td>
<td>100.0</td>
<td>58.3</td>
<td>58.3</td>
</tr>
</tbody>
</table>

Source: WHO, 2016. Big data refers to affirmative answers by governments about strategies or policies adopted by governments to govern the use of big data—it does not however, provide us with an approximation of whether these policies have been appropriated within the health sector itself. The same can be said of EHRs. In the case of telehealth, if Figure 15 above is any indication, the numbers simply reflect municipalities that have an Internet connection and not the degree to which population is covered within the municipality—the data therefore, does not provide an indication about the degree of porosity or real access to these services by the population within a municipality.

Compared to other countries, Mexico is seen as strong in the legal framework that underlies e-health, social media and electronic health records, but notes that the greatest challenge for the country is the implementation of m-health.
Table 3. m-health indicators for Mexico

<table>
<thead>
<tr>
<th>Accessing/providing health services</th>
<th>Health system levels**</th>
<th>Programme type**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toll-free emergency</td>
<td>Intermediate</td>
<td>Established</td>
</tr>
<tr>
<td>Health call centres</td>
<td>National</td>
<td>Established</td>
</tr>
<tr>
<td>Appointment reminders</td>
<td>National</td>
<td>Established</td>
</tr>
<tr>
<td>Mobile telehealth</td>
<td>Local</td>
<td>Pilot</td>
</tr>
<tr>
<td>Management of disasters and emergencies</td>
<td>†</td>
<td>†</td>
</tr>
<tr>
<td>Treatment adherence</td>
<td>†</td>
<td>†</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accessing/providing health information</th>
<th>Health system levels**</th>
<th>Programme type**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community mobilization</td>
<td>†</td>
<td>†</td>
</tr>
<tr>
<td>Access to information, databases and tools</td>
<td>†</td>
<td>†</td>
</tr>
<tr>
<td>Patient records</td>
<td>†</td>
<td>†</td>
</tr>
<tr>
<td>Mlearning</td>
<td>†</td>
<td>†</td>
</tr>
<tr>
<td>Decision support systems</td>
<td>†</td>
<td>†</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Collecting health information</th>
<th>Health system levels**</th>
<th>Programme type**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient monitoring</td>
<td>Intermediate</td>
<td>Pilot</td>
</tr>
<tr>
<td>Health surveys</td>
<td>†</td>
<td>†</td>
</tr>
<tr>
<td>Disease surveillance</td>
<td>Intermediate</td>
<td>Informal</td>
</tr>
</tbody>
</table>

Note: †: indicates question was unanswered.


5.4 e-education

e-education is defined as the use of ICT in the process of educating, training and learning. Education through the Internet, at least in theory, brings huge benefits. It eliminates the need for physical interaction. It has large economies of scale, so it is extremely cost-effective – the marginal cost of an additional student is negligible. It significantly reduces the barriers for ongoing and on-the-job training, or even retraining, as has been identified as one of the most important levers to reduce long-term unemployment. For users, it is an affordable and often free solution, allowing them to potentially go at their own pace. And very importantly, it has a far larger reach than any other teaching system, significantly expanding access to knowledge, potentially reducing inequality arising from access to knowledge, information and opportunities. The use of ICTs has the potential to transform entire societies only by transforming education.

Though many of these advantages are self-evident and have proven true, especially in adult training, evidence is thinner when it comes to basic and secondary education. According to the OECD\textsuperscript{60}, “even where computers are used in the classroom, their impact on student

\textsuperscript{60} OECD, Students, Computers and Learning. Making the connection, PISA, OECD, 2015, publishing http://dx.doi.org/10.1787/9789264239555-en
performance is mixed at best. Students who use computers moderately at school tend to have somewhat better learning outcomes than students who use computers rarely. But students who use computers very frequently at school do a lot worse in most learning outcomes, even after accounting for social background and student demographics.” (p.3). In other words, it is clear that digital tools are often complementary to teaching, learning and developing skills, both basic and advanced, but are definitely not a substitute. Many practical skills are hard to pick up from online resources.

Nevertheless, as the OECD points out, there are still many questions unanswered. The evidence should not be used as an argument to limit the digitisation of education. The impact remains sub-optimal and the potential contribution “to teaching and learning have yet to be fully realised and exploited.” We will not explore in detail why ICTs should be fully incorporated into education; we take this as a given.

To fully realize the potential of ICTs in education, a comprehensive long-term public policy strategy is required. Though, as the OECD points out, the elements of this strategy are not yet clear-cut, it is obvious that fast connectivity needs to be universal and sufficient access infrastructure (i.e., computers or other terminal equipment) is required. ICTs cannot be fully exploited if only terminal equipment, without access to the Internet, exists. This is expensive: networks need to reach far-flung places, there is a recurrent cost for the service, and terminal equipment needs to replaced frequently because of wear-and-tear and obsolescence. As almost anything related to education, the implementation of an e-education strategy is a long-term commitment, not a one-off action; results take time to realize.

Mexico has experimented with several programs to incorporate ICTs in education. In the 2000-2006 administration it created “e-México” (Sistema Nacional e-México), an initiative to take advantage of the “ICT revolution” from all perspectives: reduce the digital gap among governments, enterprises, households, and people. The system was built on three axes (connectivity, contents and systems) and four pillars (e-learning, e-health, e-economy and e-government). SCT was the main driver of the initiative, but the Ministry of Education (SEP) was heavily involved. Among many other things, interactive screens were installed in many schools and a system (Enciclomedia), which emulated surfing the web on a closed system without access to the Internet, was developed. Though significant resources were spent, the program is not generally considered a success.

e-México survived the change of government in 2006, though in 2009 a reorganization of the Ministry changed its name to “Coordinación de la Sociedad de la Información y el Conocimiento” (CSIC). The CSIC, together with the SEP, have since then spent significant effort increasing broadband connectivity of schools, universities and health centres, as well as providing free access in public places, such as public libraries and community centres. Under the current administration, this initiative now operates under the brand name “México Conectado.”

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There are two important e-education initiatives being implemented by the current administration. The first one derives from a campaign promise of giving all fifth and sixth grade public school students a tablet. In four years, the program has gone through four stages (Micompu.mx, PIAD\textsuperscript{62}, and two versions of the Program @prende 2.0). Through these stages, 240,000 computers were delivered in 2013-2014 in three states (Colima, Sonora and Tabasco); 710,000 in 2014-2015 in six states (Colima, Sonora, Tabasco, México, Puebla and Mexico City), as well as ancillary equipment, such as routers and servers; and over 1 million in 2015-2016 in nine states. The program was suspended for the 2016-2017 cycle because of budgetary restrictions. The SEP is evaluating whether there is positive evidence of the impact of the program for education purposes. Though the computers were given for free and belong to the students, they were loaded with educational material that can be used offline, in many ways reminiscent of previous attempts to benefit from ICTs without having the supporting telecommunications infrastructure.

The other initiative, called “Escuelas al CIEN”, where CIEN (which means a hundred) has the double meaning of “being perfect” and the acronym for “Certificados de Infraestructura Educativa Nacional” (Certificates of National Educational Infrastructure). The objective is to improve the physical premises of schools throughout the country (building infrastructure, restrooms, water fountains, furniture and basic equipment, handicapped access, administrative areas, wiring for telecommunications connectivity, activities rooms), funding the initiative through the placement of bonds maturing in more than 20 years, with the payment of principal and interest coming from a specific federal budget item\textsuperscript{63}. The government plans to spend 50 billion pesos in the three years to 2018. By September 2016 (last report available), refurbishing had started in over 9,400 schools.

How far is Mexico in terms of connectivity for schools?

Consistent international information on connectivity in schools is scarce, as it is not published frequently and the measuring methodology varies from country to country. The OECD published statistics in 2015 which arose from their PISA 2012 study (see Figure 16). Though the results are based on students’ self-reports and only considers 29 OECD countries and 13 of its partners, it can be seen that Mexico, at 72.2% does poorly, only marginally better that China (Shanghai) (71.5%) and Costa Rica (70.1%), well below the OECD average of 92.4%.

\textsuperscript{62} Programa de Inclusión y Alfabetización Digital. 
\textsuperscript{63} Fondos de Aportaciones Múltiples.
Figure 16. Connectivity in schools, 2012
Percentage of students with access to the Internet at school
Results based on students’ self-reports
OECD countries and partners

Source: Table 2.10, Annex B, OECD (2015).

Figure 17, which shows the official statistics in Mexico published by the National Institute of Educational Evaluation (INEE\textsuperscript{64}), depicts an even gloomier picture. The figure shows, for primary and secondary schools, for the last four school years, the percentage of schools that have at least one computer for educational purposes, the percentage of those schools that have access to the Internet, and the percentage of schools with Internet access.

\textsuperscript{64} Banco de Indicadores Educativos, Instituto Nacional de Evaluación de la Educación, at http://www.inee.edu.mx/index.php/bases-de-datos/banco-de-indicadores-educativos
Except for a slight increase in 2013 for secondary schools, where Internet access went from around 40% to 44%, all figures have stayed roughly flat or decreased during the last four last years. That is, according to the INEE, which is an independent government institution, little can be seen from the several initiatives that the government has implemented in the recent past.

If Mexico is to take advantage of ICTs in general, and more specifically in education, educators and students need to develop the digital skills required to become productive members of society. For that, they will require, before anything else, access to the Internet. On this front, an uphill battle is necessary if Mexico wants to reduce the gap with the rest of the world. A long-term strategy, based on best practices, is necessary.

### 6 A projection of overall benefits

This report has identified progress and problems (such as low investment, slow appropriation, and insufficient competition) in achieving the digitisation of the Mexican economy against the background of the pervasive benefits for the economy available from a successful implementation. This section discusses the scale of those benefits at a macro level, both achieved in the past and attainable in the medium term future.

At a high level, there appears globally to be a relationship between levels of digital intensity and GDP per capita. This is illustrated by the Boston Consulting Group (BCG), which compares its e-intensity index with the GDP per head of various countries. The e-intensity index is based on the following:

**Enablement** accounts for 50% of the total weighting. It measures various aspects of fixed and mobile infrastructure deployment.

**Engagement**, which accounts for 25%, measures how actively businesses, governments and consumers are embracing the Internet.
Expenditure, also accounting for 25%, measures the proportion of money spent on online retail and advertising.

The BCG scatter diagram showing the e-intensity index and GDP per capita exhibits a pronounced upward slope, with some outliers and with Mexico just about in the middle of the “middle income countries” pack.65 But the problem with such correlations is that they risk confounding cause and effect. Does e-intensity cause the economy to grow, or do people make more use of e-intensive products and services as they grow richer?

Secondly, when examining the impact of digitisation on the economy, we need to recognise that it has spill-over effects both between and within the various sectors of the economy and the universe of firms operating within it, and from household to household. For example, a connected consumer can benefit others, as a result of her better search capability and her suppliers’ response to it by offering lower prices to all customers. The ways in which these effects operate are various; they include:

- Better access to markets, as new firms can use the web to bring their products or services before a wider customer base spread over a broader geography – what is sometimes called the “death of distance”; in the labour market, better job matching;
- New business processes and organisational structures: better stock control, quicker contracting and “just in time” production. For example, a major US grocery store reported that its logistics operation in the USA was quite different from the same function in Mexico, because Mexican stores were less well connected;
- More innovation in general, made possible by new communications services, notably social media.

An indispensable driving force behind these processes is improved connectivity, and this suggests that a plausible causal factor is the availability and use of communications services.

When the OECD published its 2012 Review of Mexico, it looked at the performance of telecommunications markets and sought to measure the detriment to the economy resulting from lack of competition on the basis of the scale of excessive prices.66 But this approach is too static and limited to capture the radical and expansive nature of the processes involved in the interaction of communications services with the rest of the economy. Accordingly, we are looking for a more dynamic method which seeks to pin down the effect of connectivity as a significant causal factor affecting Mexico’s growth prospects in the medium term.

With this in mind we have used a well-established methodology which focuses on connectivity, but it is designed to capture in a dynamic process the benefits to the Mexican economy as a whole. The focus of the method is on mobile connectivity, which is the major source of communication services for the majority of Mexican households and businesses (see Figure 4 above).

Put most simply, the model establishes – on the basis of international data – the relationship between the spread of mobile connectivity and the level of a country’s GDP.67 The analysis is embedded in a framework in which there is both a model for the determination of total output, with mobile infrastructure as an input, and a separate model of demand for mobile services, where income per head is a determining factor. Adopting this approach enables us to disentangle the overall effect (including spill-overs) of mobile infrastructure on GDP – our focus of interest, from the reverse effect of income on demand for mobile services, which is a separate matter. In other words, our approach confronts the problem of confounding cause and effect, noted above.68

The telecommunications dataset used consists of annual data from 48 countries for the fifteen-year period between 2001 and 2015.69 The dataset includes six countries from Latin America. For most countries we have a breakdown of mobile take-up by generation – 2G, 3G and 4G.

Once estimated, the model allows us to identify a notional “baseline” penetration rate, which indicates for a specified value of GDP per head the level of mobile take-up which we would expect a country to have, based on the overall experience of the 48 countries.

Our first result is that the penetration rate of mobile communications in Mexico is substantially lower than we observe in the “average country” in our panel. This is shown in Figure 18, which compares the actual level of mobile penetration of Mexico (the lower line) with the average penetration for the same period across 48 countries. This shortfall could be attributable to various reasons, including competitive distortions in the mobile marketplace.

Secondly, the data indicate that the impact on GDP of what connectivity there was in Mexico is substantially less than the impact expected to be found on the basis of international experience, as reflected in the model. Thus Mexico appears to suffer both from a lower level of mobile penetration than international experience would indicate, and from a lower impact on GDP of what mobile connectivity there is, again as estimated by the model on the basis of international experience.

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67 All GDP data in this section are in real (constant prices) terms.

68 The model was developed and estimated by Dr. Pantelis Koutroumpis of Imperial College Business School. For an account of the general model see P Koutroumpis and M Cave, The mobile broadband premium, December 2016.

69 We use all the available information from GSMA which covers 48 countries and combine this information with data from the World Bank and DotEcon.
The cross-country analysis also suggests that the effect of mobile penetration on GDP varies with the level of mobile penetration. In particular, countries on average experience a 2.2% effect on the level of their GDP at a mobile penetration level of 60%; they get a 3.5% effect at 80% penetration; a jump at 4.6% for 100% penetration; and 5.2% for penetration in excess of 120%.

The first quality change in mobile telephony arose with the provision of 2G services, which allow, as well as voice, some basic data communications to be accomplished. The real revolution was the third generation with download-speeds exceeding 14 Mbps and directly competing with fixed line alternatives. The fourth generation brings a whole new level of applications to smartphone users, thus changing dramatically the capabilities of their users and potentially even reaching 100 Mbps in download speeds. In our model, we utilize a set of data on mobile technologies employed in each country and for each year in our sample. This shows the technologies which are available in each year.

Turning to the effect of the different generations, we note that use of second generation devices in a country has the lowest impact on GDP reaching 0.39% for every 10 percentage point increase in adoption. The broadband effect is manifested in the results from third and fourth generation controls. Countries that introduced 3G enjoy an additional 0.09% increase in their GDP for every 10 percentage point increase in adoption over others with simpler technologies available. This effect jumps to 0.11% of GDP for an identical increase in adoption in cases where 4G has been introduced. The broadband dividend is thus identified in the model as a direct growth-promoting effect that is positive and significant over a relatively long period of time for our sample of countries. These results are illustrated in Figure 19, which shows how the beneficial GDP impact of 2G (the lowest curve in the figure) is enhanced for any level of

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70 The data come from the GSMA Intelligence and Dot.econ (www.dotecon.com).
mobile penetration as subscribers switch to 3G (the middle line) and 4G (the top line). This result is consistent with the enhanced data capacity and higher speeds of successive generations.

Comparing a country with 100% mobile penetration, the implied effect of 2G technologies would be 4% per year on GDP, with 3G this rises to 4.5% and with 4G to 4.8%. This is aligned with the recent academic literature in which researchers report that basic connections are necessary for the majority of the population, but find positive but diminishing returns to speed.71

**Figure 19. Comparison of mobile impact across generations in the baseline country**

![Graph showing the comparison of mobile impact across generations in the baseline country.](source: Authors’ estimations)

The estimations we have made based on data for the period 2000-2015 allow us to project into the future. Given the announced plans of Mexican operators for increased investments in 4G technologies, the falling price of mobile broadband offerings and other changes in market structure discussed in section 3 above, Mexico can aspire to catch up its past poor performance illustrated in Figure 18 above, reach the level of the “baseline” country in our sample by 2020 and even overtake it. This would depend on an increase in subscribers by approximately 5% of population on an annual basis and a progressive transition towards 4G mobile broadband by the majority of the subscriber base. Figure 19 shows the associated trajectory of connectivity-related increases in GDP. It is important to stress that the use of GDP allows capturing the effects of telecommunications access and usage in all of the economy.

Poner un párrafo más que la tecnología móvil tiene impactos que van más allá de este sector, blablablá y crecer este 4 por ciento estaría padre

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71 H Gruber et al., *Broadband access in the EU: An assessment of future economic benefits*, Telecommunications policy 2013, pp. 1046-1058.
As the figure shows, this favourable outcome has the potential to add an additional 4% to GDP in the period from 2016 and 2021. It would, of course, be less if connectivity is of poorer quality or slower to materialise. It also depends upon the Mexican economy’s ability to put in place the other complementary inputs for the digital economy (outlined in Sections 2, 4 and 5) at a level corresponding to the average of other countries at its income level.

This maximum figure is an aspiration. But in our view the calculation shows a realistic possibility for the economy to gain an appreciable benefit from the regulatory and other interventions described in this paper.

Figure 20. The potential impact of mobile catch-up on GDP

![Graph showing GDP effect](Image)

Source: Authors’ estimates.

7 Summary of public policy recommendations

We began by noting that the digital revolution has touched upon production, transactions, and consumption by reducing costs, bringing services closer to all consumers, old and new, and creating new categories of goods and services. It has also increased dramatically the way people communicate – from a simple voice call, to a video call, text messages, and even increasingly large social and professional networks.

This paper has argued that Mexico has an opportunity to grasp the benefits of pursuing a coordinated policy for the digitisation of the economy. We have suggested that there are “pull” factors for doing so, driven by the prospect over the next few years of “catching up” on past performance, as well as benefitting from future deepening of the digital economy. But there are also “push” factors in play: because economies in the neighbourhood and globally are pursuing similar initiatives, Mexico cannot afford to be left behind.

We list here some public policy recommendations which flow from the paper. They are not exhaustive, and are no substitute for a more thorough and comprehensive policy analysis. But
we believe our report identifies some interesting and challenging tasks, with the potential of real benefit for Mexico. We have emphasised that an effective digitisation strategy seeks to bring together a range of complementary inputs, besides the indispensable one of connectivity. Some of these have to be put in place. In the case of others, there are workarounds, but cumulatively they raise costs and reduce customer acceptance and demand; this will only contribute to a slower catch-up relative to Mexico’s peers at the international level.

**Connectivity:** The most conspicuous outstanding task is to maintain pressure through competition in the market place to extend both the speed and the coverage of connectivity. Our measure of the potential of connectivity revolves around the roll-out of fast mobile broadband as a foundation for the digital economy. Section 3 notes that the sector has undergone some changes since the legislative and regulatory measures introduced in from 2013. But the market structure remains mostly unchanged, with only marginal advances in the relevant indicators, including penetration and competition. The status quo in Mexico has proved resilient to change, and this is an argument for stronger or more persistent intervention by the regulator to diminish the influence of the preponderant over the sector. The main short-term effect of reform has been a fall in prices which has been welcomed by customers. But it looks premature to relax any of the asymmetric policies recently imposed before it has been shown decisively that they have yielded their required effect and have worked. The whole digital ecosystem would greatly benefit from an explanation by the regulator of what is the ultimate objective and within what timeframe it can be achieved.

**Avoiding contradictory or overlapping regulatory responsibilities:** In relation to wider issues in the digital economy including sectors using communications services as well as supplying them, we recommend that the various regulators involved – notably IFT, COFECE, PROFECO and the financial regulators (CBNV, Banxico and CONDUSEF, most notably) establish clear rules as to which takes the lead in dealing with the different elements of the ecosystem. Certain elements, such as online platforms, could potentially be in the realm of many regulators simultaneously, creating the possibility of confusion, impasse, and contradiction which have led to rampant litigious behaviour in the very recent past. The creation of the IFT as an independent regulator has been a fundamental pillar of progress and as such, it should be allowed to mature and should be, if necessary, strengthened in its responsibilities.

**Trust:** Trust is a complex concept to define. In principle, it is the reliance on the integrity of whichever process is being supported by the network. From a policy standpoint, it is hard to define rules that increase trust in the system, but it can be addressed through a series of measures. Consigning both personal data and payments to the Internet requires an act of courage. It is important that both public and private sector agents appreciate this fully, with the government taking a lead on cybersecurity, and giving a good example by the care and attention which it gives to maintaining it. First and utmost, users need to know that the communication is confidential and that personal data will be safeguarded; any hint that this is not the case will deter appropriation. Secondly, consumers need to be protected in such a way that if products or services do not reasonably meet expectations, providers are obliged to respond and compensate them in an expeditious way through easy-to-access mechanisms. If trying to solve
a problem burdens the consumer with excessive costs – such as figuring out how to contact the provider, having to comply with a large number of unreasonable requests or spending significant time and effort – trust will be undermined. Antifraud measures without unnecessarily increasing the complexity of transactions – must be put in place. These issues most likely require policy intervention. Trust takes time to build but seconds to destroy.

**Skills and appropriation:** Though basic communication services can easily be put to use (nobody by now needs to be taught the wonders of making a phone call), a somewhat more sophisticated use of communications requires the development of skills. Self-evidently, skills are essential to the successful digitisation of the economy. It is generally assumed that rethinking the process of education and training should begin very early possibly pre-school. But such an approach takes time, so attention needs to be put into today’s potential users. One of the most efficient ways to build digital skills is to create the need for digital services. Policies that move in this direction create a fertile ground for the development of skills. Some can be mandatory (such as requiring that tax returns be submitted online); others can be through negative incentives (such as imposing additional costs for performing certain activities off-line instead of online); and others through positive incentives (such as rewarding certain types of behaviour, like asking for invoices even though they cannot be used for deductions). Public policy should incentivize all potential digital activities through such schemes.

**Promotion of innovation:** Software, and, more specifically, “apps”, are a fundamental element of the digital economy. Our research has shown that Mexico is weak in this area on the basis of the metric of the percentage of total “app” revenue attributed to Mexico generated apps. This might suggest a need for some public intervention, in terms of targeted promotion funds, fiscal incentives, legal processes simplification, and, most importantly, in the development of human capital, which should be an integral part of the education system.

**Public services:** These should play a key and fundamental role in any government and national digitisation strategy, and should be coordinated among all public entities to increase effectiveness. The evidence of our discussion of e-health and e-education initiatives in Mexico in section 5 above suggests that opportunities in this area are not being utilised adequately, and that more is required. The provision of public services through digital means creates the need for access, which becomes an important incentive for appropriation. While public services tend to be thought of as federal, state services form the bulk of day-to-day transactions with citizens. Trying to adopt a general standard for those services may help create a virtuous circle among the various states and create a race to improve these services. Many services can be disaggregated into smaller parts that can be provided by the private sector and create some competition in their provision without relinquishing the responsibility of offering these services.

This is by no means an exhaustive list of policy recommendations, but it provides a starting point to help the digital ecosystem permeate the Mexican economy.
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