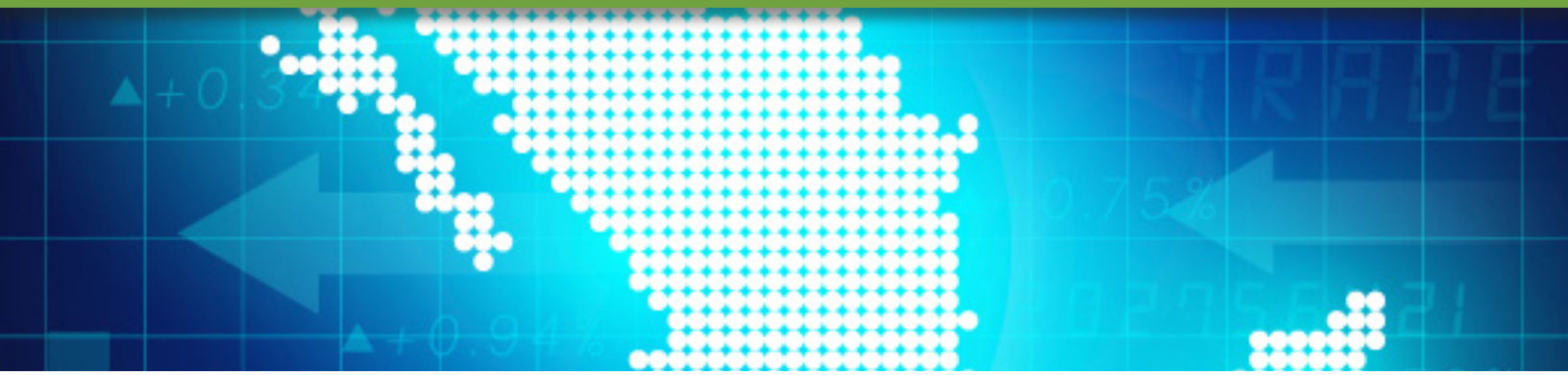
COORDINATING POLICIES TO REALIZE BENEFITS FROM THE DIGITAL ECONOMY: THE CASE OF MEXICO



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I. 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: the "poorest households are more likely to have access to mobile phones than to toilets or clean water."[2]

Access to data, via smart phones and the Internet, comes from three sources. First, it reduces the cost of existing activities; second, it is inclusive by putting services, including basic ones such as education, within the reach of people who were previously deprived of them; and third, it permits new things to be done, such as interacting in real-time with virtual groups around the globe (think of social media).

The degree to which digitization has penetrated most sectors of the economy makes it extremely difficult to quantify its reach.[3] 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 industries? Digitization has, *de facto*, imbued our economic and social life.

Our study aims to describe the benefits which Mexico might gain by taking advantage of the opportunities of digitization, and to identify ways in which that performance might be improved by various public policy interventions. We do not, however, attempt to examine the impact that digitization has had on non-economic aspects of the life of a society, such as plurality of opinions and freedom of expression.

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2 Page xiii. The report is available at: http://www.worldbank.org/en/publication/wdr2016.

3 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.

II. 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. To begin with a sense of how Mexico is doing internationally in terms of digitization, 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 "digitization 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 information and communications technologies ("ICTs"). The "digitization 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.

- "Infrastructure reliability" considers investment in mobile, broadband and fixed line networks.

- "Network access" considers broadband penetration (fixed and mobile), as well as personal computer 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, social network visitors and short message service usage.

- "Human capital" incorporates two measures of education (engineers as a percentage of the population and the percentage of labor force with more than a secondary education).

Using this index as a measure of how digitized 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 percent. 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 percent), driven by Africa (7.0 to 23.5, or 11.7 percent), Asia (15.9 to 39.5, or 8.6 percent), and even Latin America (21 to 47.4, or 7.7 percent). In fact, Mexico's percentile relative to the rest of the world has decreased 16.7 percentage points, going from the 65th percentile to the 48th.[7] 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" component, which mostly measures penetration, has lost 20 percentage points.

Although governments have invested heavily in digitization of public services, one of the principal criticisms that have been levied at them is that strategies tend to be isolated, uncoordinated and sometimes lack a comprehensive plan. The WBR 2016 notes that "digital technologies have helped *willing* and *able* governments better serve their citizens" [emphasis added]. 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.

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.

5 Katz, R. P. Kutroumpis & F. Callorda, Using a digitisation index to measure the economic and social impact of digital agendas, Info, vol. 16, n.1, 2014, pp- 32-44.

6 Compound annual growth rate.

7 For clarification purposes, this means that 67 percent scored worse than Mexico in 2004, but by 2015, only 48 percent did. That is, according to this index, Mexico's position decreased substantially in the twelve years to 2015.

For Mexico, this leads to several questions, namely whether the government has a clear digitization strategy and an effective implementation plan, particularly one that can measure progress and allows for accountability. Compared with other countries, Mexico is in the last position in the OECD's measure of digitalization, 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 Digitization Index shows that relevant but insufficient progress has been made. Mexico's economy is not as "digital" as it deserves to be.

III. THE KEY PRECONDITION: ENHANCED CONNECTIVITY

Dissatisfaction with the state of telecoms in Mexico became strong enough in 2011 to persuade the government to invite the OECD to carry out a review of the Mexican telecoms 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. The OECD identified a number of barriers to entry – such as foreign direct investment restrictions, a complicated and non-transparent licensing framework and 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"). 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 needed to be simplified and limited.

The message was clear: an independent regulator and enforceable competition regulation were necessary conditions to help Mexico address its deficient telecoms sector.

A. Mexico and the Rest of the World

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

- **Fixed telephony:** Fixed telephony penetration, currently at 16 percent, puts Mexico at around the 54th percentile, or above 54 percent of other countries; accordingly, it is below not only developed countries but also behind the Latin American average.

- **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 percent, whereas Mexico's currently stands at 89 percent.

- **Unique users:** Penetration is in line with Latin America, with 70 percent 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. But 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 telecoms provider and the reduced need to own more than one SIM card given the large on-net community of the largest operator.

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[8] (second half of 2005):

• **Fixed broadband:** Fixed broadband penetration, half of which is provided with DSL technology, 34 percent with cable modem, and 13 percent with fiber, has reached 12 percent. As 88 percent of connections are residential, household penetration currently stands at around 47 percent. These numbers are in line with the world's median, at around the 55th percentile.

• **Mobile broadband:** Mobile broadband is still growing at over 20 percent per year[9] and has already reached more than 69 million connections[10] (penetration of 53 percent), which, according to the GSM Association ("GSMA"), means that 44.7 percent 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 percent, thus quickly catching up.

• **Population using the Internet:** In Mexico, in 2015 more than 57 percent 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 telecoms-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.

With respect to estimating the population using the Internet, appropriation, defined as the process by which people adopt and adapt technologies, is extremely hard to measure. Given changing methodologies and in this measurement which prevents comparability, we can only say that it has consistently gone up, but little can be said of the recent evolution of appropriation of the Internet. Thus, there is still significant room for improvement. Realized demand does not seem adequate for a country with Mexico's development. Appropriation has arrived slowly.

B. Trends in Investing and Pricing

In its 2012 report on Mexican telecoms,[11] the OECD mentions that investment in the country is the lowest among its members, at around USD $35-45 per capita.[12] Accumulated per capita investment in the period 2000-2009 was USD $346, while the OECD average was USD $1,447. From 2010 to 2015, these figures have barely increased. Lack of incentives, low competition and a relatively uncertain regulatory framework most likely explain an important fraction of this gap.

Though the recent telecoms 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 percent 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 percent drop in the telecoms pricing index. Since then the upward trend has resumed, having increased almost 2 percent in the last years.

For mobile telecoms, the trend is significantly different. From the publication of the reform until the enactment of the new law, prices fell at an historic rate. But in August 2014 with the entry into force of the new law, interconnection for the "pre-

8 Defined as allowing downloads at a speed of 256 kpbs or higher.

9 24 percent in 2015, 25 percent in the year to June 2016, IFT, *Segundo Informe Trimestral Estadístico 2016*.

10 IFT, *Segundo Informe Trimestral Estadístico 2016*.

11 OECD, *Estudio de la OCDE sobre políticas y regulación de telecomunicaciones en México*, 2012, p. 40.

12 Amounts for 2008 and 2009.

ponderant agent"[13] was set at zero, effectively allowing all other telecoms companies to terminate traffic in América Móvil's networks for free. Two years after this legal change, mobile prices, as measured by the CPI, have gone down on average 38.7 percent, for a total decrease of 42.8 percent since the reform came into effect.

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.

C. The 2013 Regulatory Changes

The 2013 constitutional reform included the term "preponderance" used to describe any agent in the telecoms and broadcasting sector that had a market share above 50 percent, measured by at least one of several indicators.[14] It was included to be able to quickly label as "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. 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.

Nonetheless, the Mexican telecoms 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 asymmetry is short and follows decades of almost unrestricted dominance. Success will take time, and loosening regulatory intervention too early risks giving away progress already made.

IV. OTHER IMPORTANT CONTRIBUTORY FACTORS

A. Independence of Regulators

There is broad agreement that the substantial and sometimes risky investments required to create a digitized 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.[15]

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 politicized arena.

In Mexico, the enforcement of competition in communications markets is being put in place simultaneously with the transitioning phase, and even in some sectors with the transforming phase of regulating the digital economy to level the playing field

13 A "preponderant agent" is a corporation which holds more than 50 percent of the telecoms 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 telecoms. "Preponderance" only applies to sectors; it does not apply to specific services or markets.

14 Subscribers, traffic, revenues, capacity, audiences.

15 See B. Levy and P. Spiller, *Regulations, Institutions and Commitment,* Cambridge University Press, 1996.

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 telecoms — 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. 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. The digitization process will be advanced by a clear system of governance by independent regulatory agencies.

B. 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.

In a report by A.T. Kerarney,[16] researchers concluded that willingness to trust when transacting online is often overlooked when developing complex systems, "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 behavioral aspects are overlooked in favor 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 organize the interaction. Business incentives are likely to align strongly with a context-appropriate approach: that way revenue is maximized. But public service organizations 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.

C. 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 percent of app revenues.[17] 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.[18] 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.

16 World Economic Forum and A.T. Kearney, *Rethinking Personal Data: Trust and Context in User-Centred Data Ecosystems*, 2014.

17 Caribou Digital, *Winners & Losers in the Global App Economy Farnham*, Surrey, United Kingdom: Caribou Digital Publishing, 2016, p. 8

18 Ibid. p. 31-49.

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 within 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.

V. PROGRESS AND PROSPECTS IN KEY SECTORS: THE CASE OF 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 telecoms 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 iality, 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 in Mexico still has a long ways to go. In 2014 (last number available), only 38.7 percent of adults had a bank account, compared to a world average of 53.7 percent,[19] positioning Mexico at the 38th percentile. Cash is still the preferred way for consumer transactions. According to IMCO,[20] in 2013 around 96 percent of these types of transactions, representing 47 percent of total value, were carried out with cash. Nevertheless, in spite of this low banking situation, electronic transfers have grown dramatically in the last decade, though absolute numbers are still low.

Financial inclusion, e-banking, formality, and direct taxation go hand in hand. For example, IMCO[21] estimates that by reducing one percent 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 many areas, three of which stand out:

- It has boosted its efforts to increase the taxpayer base. From December 2012 until October 2016, it increased from 38.5 to 55.2 million, an impressive 43.4 percent.

- 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).

- Since 2004 it also introduced the possibility of billing and invoicing electronically ("factura electrónica"), which became mandatory in 2014. Overall, revenues from income tax have increased more than 107 percent since 2010.[22]

19 Unweighted average.

20 IMCO, USAID, *Reducción de uso de efectivo e inclusión financiera*, 2016, citing MasterCard Advisors, "Measuring progress toward a cashless society," 2013.

21 Id.

22 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.

It is hard to isolate the effects of each one of these initiatives. Nevertheless, 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. The "factura electrónica" has taken off since it became mandatory as no tax deductions[23] can be made without an electronic invoice, thus creating the incentive to be requested by the payor. But given penetration statistics and the minimum requirements 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.

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 telecoms networks exist and penetration and coverage are high. In addition, trust in the system is essential – subject to antifraud measures, strict consumer protection regulations must ensure that complaints and problems are addressed quickly.[24] Today, problems abound, customer service processes are cumbersome and designed to deter the consumer and the taxpayer from complaining.

So far, the above description has focused primarily on online payments using the formal financial sector. But what about the remaining 60 percent 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 prioritized 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).[25] 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.[26]

Around 30 percent of Mexicans who use bank correspondents instead of banks as their principal financial channel have benefited from Saldazo®. According to information from Banamex, the Saldazo® card generates 5,000 daily accounts of which 80 percent get associated with Transfer® and 95 percent of cardholders are new clients for the institution. It is telling, particularly about the importance of trust in these transactions, that 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.

23 With a few minor exceptions.

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

25 CNBV, *Libro Blanco de Inclusión Financiera*, 2012.

26 CONAIF, *Reporte de Inclusión Financiera 7*, 2016.

VI. A PROJECTION OF OVERALL BENEFITS

This report has identified progress and problems (such as low investment, slow appropriation, and insufficient competition) in achieving the digitization 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 percent of the total weighting. It measures various aspects of fixed and mobile infrastructure deployment.

- **Engagement**, which accounts for 25 percent, measures how actively businesses, governments and consumers are embracing the Internet.

- **Expenditure**, also accounting for 25 percent, 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.[27] 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 digitization on the economy, we need to recognize 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 labor market, better job matching;

- New business processes and organizational structures: better stock control, quicker contracting and "just in time" production. For example, a major U.S. grocery store reported that its logistics operation in the U.S. was quite different from the same function in Mexico, because Mexican stores were less well connected; and

- 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 telecoms markets and sought to measure the detriment to the economy resulting from lack of competition on the basis of the scale of excessive prices.[28] 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.

27 See The Boston Consulting Group, *The 2015 BCG e-Intensity Index*, 2015.

28 OECD, *OECD Review of Telecommunications Policy and Regulation in Mexico*, 2012, Annex C.

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. Thus we model the relationship between the spread of mobile connectivity and the level of a country's GDP,[29] using a telecoms dataset of annual data from 48 countries for the fifteen-year period between 2001 and 2015.[30] 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 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.

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 percent effect on the level of their GDP at a mobile penetration level of 60 percent; they get a 3.5 percent effect at 80% penetration; a jump at 4.6 percent for 100 percent penetration; and 5.2 percent for penetration in excess of 120 percent.

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.

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 percent 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 percent increase in their GDP for every 10 percentage point increase in adoption over others with simpler technologies available. This effect jumps to 0.11 percent 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.

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 above, Mexico can aspire to catch up its past poor performance, 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 percent of population on an annual basis and a progressive transition towards 4G mobile broadband by the majority of the subscriber base. This favorable outcome has the potential to add an additional 4 percent to GDP in the period from 2016 and 2021. While this maximum figure is an aspiration, 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.

29 For details of this model, please feel free to contact either author. All GDP data in this section are in real (constant prices) terms.

30 We use all the available information from GSMA which covers 48 countries and combine this information with data from the World Bank and DotEcon.

VII. 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 digitization 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 neighborhood and globally are pursuing similar initiatives, Mexico cannot afford to be left behind.

We list here some public policy recommendations which are by no means exhaustive, nor a substitute for a more thorough and comprehensive policy analysis.

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. 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.

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 (CNBV, Banxico and CONDUSEF, most notably) establish clear rules as to which takes the lead in dealing with the different elements of the ecosystem. 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. Trust takes time to build but seconds to destroy. 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. 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.

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 digitization of the economy. It is generally assumed that rethinking the process of education and training should begin very early, possibly pre-school. 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 behavior, 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 digitization strategy, and should be coordinated among all public entities to increase effectiveness. 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.

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.