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Industries without smokestacks

Telecommunication and ICT-Based Services Trade

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I. Introduction: moving towards the new economy

It is unquestionable that we are witnessing a major technological revolution, with respect to which the medium and long-term economic and social implications are not yet clear. Even if one agrees with the view advanced by Robert J. Gordon[1] that the improvements in economic welfare and well-being of earlier broad-based innovations (1870-1970) far surpasses the gains propitiated by the spate of new information and communications technologies (ICTs), the latter is having an unmistakable effect on families, firms and governments.

ICTs have shortened distances; allowed for instantaneous communications across the globe at a quasi-zero cost; improved at an unimagined degree access to information; and led the creation of a myriad of new business ventures. ICTs are also promoting in physical and virtual spaces collaborative arrangements to mobilize people, and channel resources, time and energy to economic endeavors, and social and political causes[2]. It is important to underline that – as defined in this paper – ICTs are a new set of technologies (and platforms) that cannot be confounded with computers and telecom services considered "state of the art" until the mid to late 1990s.

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[1] See, for instance, The Rise and Fall of American Growth: the U.S. Standards of Living since the Civil War. Princenton Economic History of the Western World. Princeton, N.J., 2015. He argues that total factor productivity (TFP) gains arising out of earlier advances (1920-70) would be over three times that observed since 1970.

[2] An ITU study concerning the impact of broadband diffusion on productivity and economic growth concludes that the contribution is significant and tends to increase with the so called "network effects". See "The Impact of Broadband on the Economy" (http://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf). See as well *Information and Communications for Development 2009: Extending Reach and Increasing Impact*, Washington, DC: World Bank and the major new publication on the subject - *Internet for Development*, The World Development Report 2016, The World Bank, Washington, D.C.

These new technologies – as described in section 2 - are nothing short of revolutionary. For they facilitate the creation, diffusion *and* use of new ideas and products, empowering users – be them in their capacity as citizens, producers, consumers, as well as managers of firms, cities and governments. Countries will be faced with the challenge of creating an environment which is conducive to appropriating these technologies – no matter where generated -, and ensuring that their population is connected and has the means to use the available innovations. The very concept of a "knowledge-based economy" [3] will change: using proficiently the new ICTs will possibly be of greater relevance from both a production and trading perspective than generating them.

For developing countries, the new-generation ICTs open the opportunity to at least partially bridge the gap with advanced economies, to the extent such ICTs will be both more affordable and user friendly. A fundamental step is to lower transaction costs, remove the barriers to the local supply of devices and services, and undertake joint public-private initiatives to radically facilitate connectivity with the internet. For the more fluid is the access to and exchange of information, the more individuals, firms and governments, will be able to explore the opportunity frontier – in terms of ideas, markets, and solutions to citizen's problems.

The object of this paper is to provide a basic understanding of the nature of emerging key ICT technologies, and establish the distance of countries and their citizens to high quality access to the internet – the necessary gate one needs to cross in order to make use of such technologies. Having crossed the gate, many are the possibilities, including the export of services, once the quintessential realm of very few developing countries – those with an elastic supply of English-speaking skilled labor.

[3] For earlier views, see Moses Abramowitz and Paul David, in "Technological change and the rise of intangible investments. The U.S. economy's growth-path in the twentieth century", in Employment and Growth in the Knowledge-Based Economy, pp. 35–60, Paris: OECD, 1996.

After this Introduction, section II lists and briefly discusses the ongoing ICT revolution, and its dominant feature: *connectedness and mobility*. No single paper would be able to list the innovations streaming out of individuals, labs and firms, in what appears to be at an increasing rate. At this point, it is also still unclear if such innovations will allow developing countries to significantly bridge their distance to developed and emerging economies, while strengthening their position in the production and exports of goods and services. Still, some early evidence shows a narrowing trend, taking into account the dissemination of the smartphone, the multipurpose technology that may indeed help developing countries come closer to the frontier.

It is axiomatic that only by *accessing* the internet will countries be able to use ICT-related innovations. Access fundamentally depends on the ability to connect to mobile, wi-fi, cable, radio and other networks, using the most efficient means – the broadband (as opposed to earlier technologies, such as ADSL-based dial services). In section III, the discussion focuses on where countries stand with respect to access to broadband services and along their quality gradient. It is unquestionable that progress has been made on both fronts, though it appears that coverage has moved faster than quality, quasi universally measured by speed at which data is transmitted. This paper thus describes the *connectivity frontier* based on two parameters – extent of broadband coverage and transmission speeds, and measures the distance countries stand to the frontier and over time.

Finally, section IV defines the new *access paradigm* - the ICT foundation for connecting people and markets. This paradigm will enable a far larger number of countries to enter service export markets, moving beyond the more traditional outsourcing model, of which India is the most successful case. The question therefore, is how to provide high quality, affordable, safe connection to the internet to the vast majority of the population of developing countries?

This final section underlines the importance of creating a more open and competitive environment to attract infrastructure investment (in terms of fiber rings and cable links, among others), and foster rivalry among suppliers of devices and services, thereby benefitting users – be them individuals, firms or governments. But possibly governments will have to do more, namely attracting major players – such as Alphabet and Facebook – to partner in the provision of cost effective infrastructure. Governments would need to think out of the box - while looking for public-private partnerships - if they are to successfully steer their societies from being marginalized by the ICT revolution, and make the most intelligent and effective use of the stream of new technologies changing the global economic, social and political landscape.

II. The ICT Revolution in Brief

Few would question that there is an ongoing revolution in the ICT space with implications for the way we live, interact, consume, produce and manage firms, cities and other jurisdictions which are both momentous and unclear. Analysts struggle to bring together in a coherent way the implications for humanity of the flow of innovations due to the difficulty of establishing both their direct and roundabout effects beyond the short-term. Thus, any synthesis, as one attempted in this section, is fraught with difficulties.

One way to visualize the changes is to think about successive layers.

- The core of the "onion" is the process of *codification and digitalization of information*, now five to six decades old, and which allowed for information to be processed by digital computers, which for many years stood at the center of technological change. In the "computer age", the basic relationship was between people (and organizations) and the machine (with its prohibitive innards – the IC, and the software to run and perform tasks): **P to M**

- The second layer was built around *connectivity and mobility* propitiated fundamentally by the growing ubiquity of smartphones. It is now at the center of the ICT revolution. The machine ticks by applications (apps) most of which are free and immediately accessible, a far cry from the earlier age of the computer and unfriendly software languages. All transactions are migrating to hand-held devices: selling and buying, respectively in market places and through e-commerce; paying, borrowing and depositing with financial institutions, bank and non-bank; interacting with government and other institutions; and becoming active parts of social networks. The organization is no more at the center, but civil society and individual

initiatives backed by an expanding universe of opportunities. The connectivity and mobility layer may be summarized by the notion of people to people: **P to P.**

- The third layer is in the making: the *internet of things* (IoT), allowed by the collapsing prices of sensors, data processing and again connectivity, this time among sensors. Although wearables called attention, far more relevant is the fact that the IoT technology propitiates all human and machine processes to be instantaneously monitored. It might sound like the Brave New World, but in fact would have enormous implications for the sustainability of human life on Earth, with the potential not only to measure and monitor the footprint of human activity, but to make cities and other agglomerations far more "intelligent", economizing on resources, optimizing their allocation. This would be Big Data at work. In this layer, the dominant relationship is sensor to sensor: **S to S**.

- The final layer – the contours of which can only be sensed today – will be driven by *artificial intelligence*, the ability of machines not only to operate without human intervention, but to learn, reason, correct "mistakes", by interacting with the environment and other machines. Individual robots are not exactly the expression of this outer layer, although they do capture the imagination, mainly as humanoids; it is the unmediated relationship among learning and adapting machines which will characterize this ICT. In this coming era, the fundamental relationship is machine to machine, without – costly and inefficient - human intervention: **M to M**.

At this juncture, it is the second layer and their implications that are of most interest. For it is *mobility with connectedness* centered on the smartphone that will possibly bring the most relevant changes for developing economies. Massive

digitalization of information (voice, data, images); being transmitted at increasing speeds; stored and processed at faster rates; in which use – for production, trade, education, and entertainment activities – are being carried in ever more friendly environments, causing changes that may improve the lot of firms and entrepreneurs in developing countries. A glimpse of ongoing transformation is captured by the projected growth of IP traffic globally, and the increase in mobile share (Table 1).

Table 1: IP traffic by type and mobile share
2015 (actual), 2016-20 (proj.), PB per month

Global IT traffic	2015	2016	2017	2018	2019	2020	CAGR 2015-2020 (%)
Fixed Internet	49,494	60,160	73,300	89,012	108,102	130,758	21
Managed IP *	19,342	22,378	25,303	28,155	30,750	33,052	11
Mobile Data	3,685	6,180	9,931	14,934	21,708	30,564	53
Total	**75,521**	**88,719**	**108,533**	**132,101**	**160,561**	**194,374**	**22**
Mobile Share (% of total)	5	7	9	11	14	16	-
Smartphones Share (% of mobile access)	89	91	93	95	97	98	-

Source: Cisco and own elaboration.
Note: 1 PB (petabyte) = 1,000,000 GB (gigabytes); *Includes corporate IP WAN traffic and IP transport of TV and VoD.

It is thus important at the outset to underline that mobile technology is the preeminent multipurpose technology in the world. Its dissemination has reached a point that one can envision that most of the population in developing countries will have in their hands smartphones (and their variants, such as phablets) capable of connecting them to people, markets and services, and not radically different than those living in developed countries. Prices are falling while the realm of potential applications is fast expanding, with over an estimated 2 million apps (!) available for Android and iOS operational systems (Table 2).

Table 2: Global average selling price of smartphones worldwide and number of apps available on major app stores (approximate value)
2010-2016, US$ and thousands of apps

	2010	2011	2012	2013	2014	2015	2016*	CAGR (%)
Average smartphone prices	440	420	381	333	310	305	283	-7.1
Google Play	38	200	500	850	1,300	1,400	2,200	97
Apple Store	150	425	585	850	1,200	1,500	2,000	53.98

Source: Statista. *Projection.

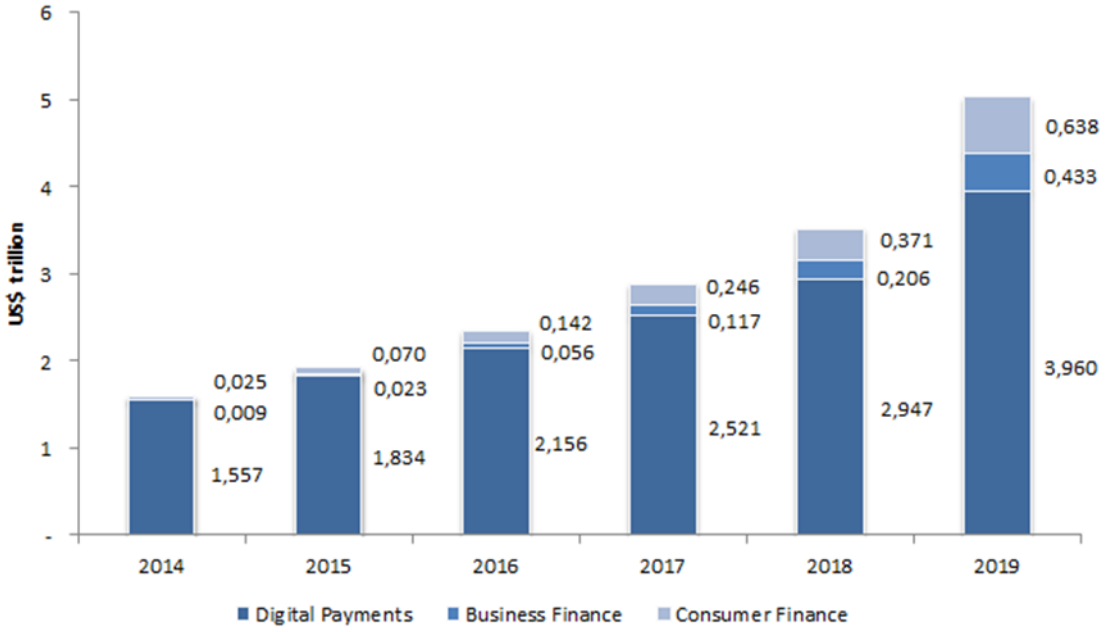
Maybe the most important aspect is how *user friendly* are most applications, which allow people with limited education to search for and manipulate information; transact in multiple virtual spaces; while substituting services for goods in economic activities.

- Information is the building block of knowledge: accessing it with the help of *search engines* (Google, Yahoo, Bing and Baidu, the latter in China, and Yandex in Russia) has already radically transformed the way people purposely strive for economic citizenship. And the intelligent use of information is leveraged by distance education as it becomes more available and affordable, allowing people to be educated/trained at a fraction of usual costs.
- Transactions which used to occur in physical settings are occurring in virtual platforms such as *market places*, Amazon and Alibaba being the quintessential examples, in addition to e-Bay and Flipkart (the latter in India); and they perform two fundamental roles: e-commerce, but as importantly, they host virtual stores at quasi zero cost, which dramatically lowers entry barriers.

- *Fintechs*, capable of providing in the digital realm multiple financial services, an instrument of financial inclusion and business transaction facilitation, will likely capture a growing share of digital payments, business and consumer finance, without resort to physical banks and branches. It is estimated that between 2015 and 2019, *Fintechs* will grow at an average annual rate of 27%, and achieve over US$ 5 trillion in transaction value, with the fastest expansion in business finance (Graph 1).

Graph 1: Transaction value in the "FinTech" market

2014-2019, in US$ trillion



Source: Statista

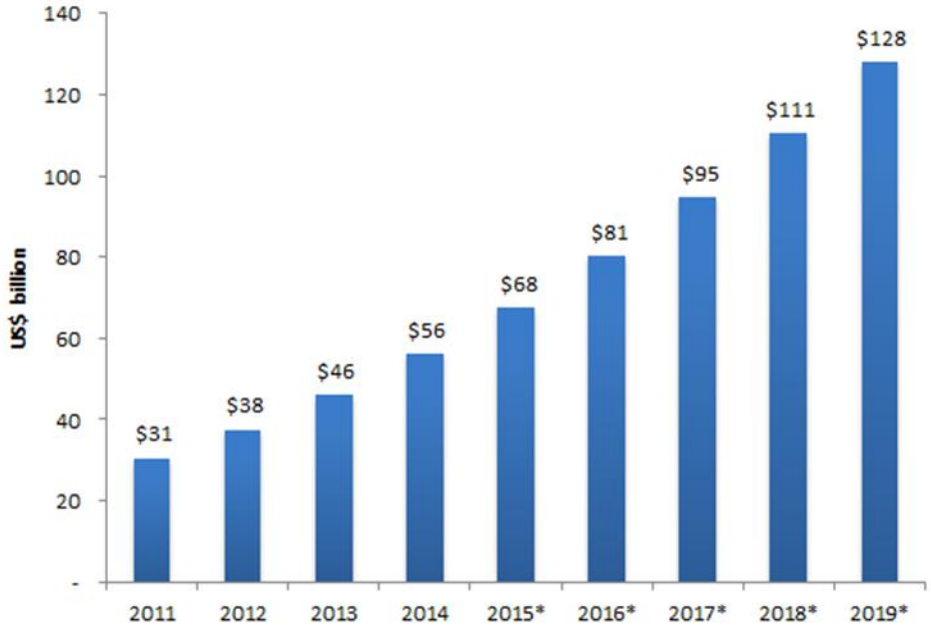
Finally, the very nature of economic activity is changing:

- With distance manufacturing, one will be able to export concepts, ideas, designs and prototypes – the latter helped by 3-D printers – and materialize them close to consumers;

- With fast growing cloud computing (Graph 2), one does not need in house or even nearby data processing machines and/or facilities – only connection to such facilities irrespective of their location; and ditto for storage space, as long as one is connected to remote storage facilities.

Graph 2: Size of Cloud Computing and hosting market worldwide

US$ billion, 2011-2019



Source: Statista

Those technologies are convergent in a fundamental sense: they point to facility of use and lower entry barriers, as initial fixed costs of setting up (and operating) a business venture or a manufacturing facility are substituted for variable costs, namely the purchase of a service[4]. To take advantage the first step is to connect to the internet, and connectedness has been at the core of "digital inclusion".

[4] It is, of course, possible to make the contrary argument, as many point to an emerging 4th industrial revolution, with intelligent systems-driven manufacturing based on intense machine-to-machine

III. Access to Information and the Connectivity Imperative

It should be said at the outset that although ICTs are having a transformative effect on a global scale, many if not most countries still face significant barriers to make their most effective use.

First, the level of education and degree of literacy, which were once quasi binding barriers, have been softened by the ICT revolution through a multiplicity of user friendly applications, starting with search engines and the ability to look for answers for literally any question. Yet basic skills remain an important lever to make effective use of such technologies and appropriate extant opportunities. *Second*, and possibly more important, are regulatory barriers which if not impede, make it more difficult and costly for people to purchase devices (mobile and otherwise), and connect themselves to the internet with the help of broadband providers. *Finally*, the provision of physical infrastructure – such as energy – is quite critical, although numerous initiatives are attempting to simplify the requirements for the use of new generation ICTs.

Increasingly (as argued in the final section of this paper) integration into global information, production and trade networks will depend on enlightened policies and bold public-private initiatives; and governments giving up pursuing contradictory objectives, such as protecting the telecom incumbents against new service providers or raising revenues by taxing imports of devices. Aligning policy and assuming a pro-active stance to enable citizens in developing countries cross the access gate is the first step to move towards a gradual convergence of opportunities among the digital – and income - divide.

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communications, the widespread use of robots and other frontier components. See, for instance, Erik Brynjolfsson and Andrew McAfee, The Second Machine Age, W.W. Norton, 2015. Being this the case, developing countries would be left behind not only due to the difficulties inherent in using and maintaining such complex manufacturing technology, but the fact that the process becomes more knowledge intensive and value migrates to intellectual property products.

While the convergence over the "digital divide" is still in the future, the ongoing ICT revolution launches some bridges across the development chasm. Crossing them depends on developing countries closing in the ***connectivity*** frontier – defined in terms of the extent of internet access and the corresponding speed.

Let us discuss each in turn, beginning with the extent of broadband coverage. In this respect there have been pronounced gains among developing and emerging economies, mostly centered on mobiles (Table 3). Taking the two extremes from a regional perspective, while in Europe in 2010 the "TAI" was 54.1 expanding to 107.8 in 2015, in Africa the TAI gains were far more pronounced, namely from 2.0 to 17.9, with the Europe/Africa ratio decreasing from 27 to 6 in five years. There is still a considerable gap, but progress in access seems unmistakable.

Table 3: Broadband subscribers (per 100 inhabitants)
Mobile, Fixed and "Total Access Index" (TAI)*
Major regions, 2005, 2010-2015

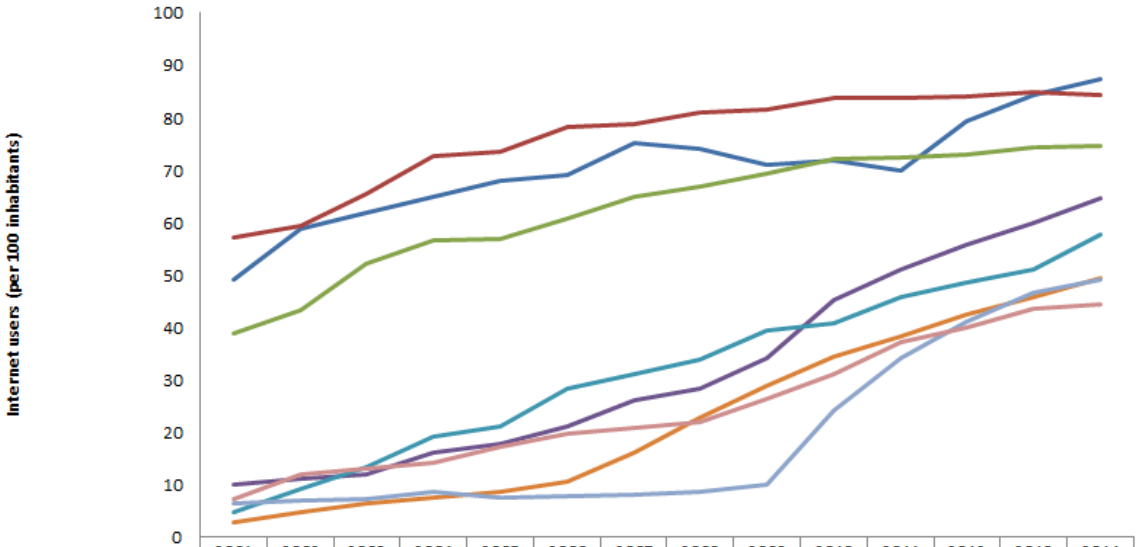
Region	Type	2005	2010	2011	2012	2013	2014	2015	CAGR 2010-15
Africa	Mobile	N/A	1,8	4,6	8,5	10,3	12,9	17,4	57.4
	Fixed	0,0	0,2	0,2	0,2	0,3	0,4	0,5	20.1
	TAI	**0,0**	**2,0**	**4,8**	**8,7**	**10,6**	**13,3**	**17,9**	**55.0**
Arab States	Mobile	N/A	5,1	13,1	16,1	27,3	36,1	40,6	51.4
	Fixed	0,3	1,9	2,2	2,6	3,2	3,4	3,7	14.2
	TAI	**0,3**	**7,0**	**15,3**	**18,7**	**30,6**	**39,5**	**44,3**	**44.6**
Asia and Pacific	Mobile	N/A	7,4	11,0	15,3	18,5	29,7	42,3	41.7
	Fixed	2,2	5,5	6,4	7,0	7,8	8,3	8,9	10.1
	TAI	**2,2**	**12,9**	**17,4**	**22,3**	**26,3**	**38,0**	**51,2**	**31.7**
Europe	Mobile	N/A	30,5	39,4	49,1	56,1	69,3	78,2	20.7
	Fixed	10,9	23,6	24,8	25,7	27,7	28,6	29,6	4.6
	TAI	**10,9**	**54,1**	**64,2**	**74,8**	**86,0**	**97,9**	**107,8**	**14.8**
Americas	Mobile	N/A	24,6	34,1	41,9	55,7	67,3	77,6	25.8
	Fixed	7,5	14,0	15,0	15,8	17,0	17,4	18,0	5.1
	TAI	**7,5**	**38,6**	**49,1**	**57,7**	**72,7**	**84,7**	**95,6**	**19.9**

Source: ITU and own elaboration; * Defined here as the sum of Mobile and Fixed Broadband

World Bank data allows a look at a broader measure of access, namely the proportion of internet users for individual countries (Graph 3). In the last 15 years, emerging economies have narrowed the gap with respect to the U.S., South Korea and Hong Kong, with coverage growing at far faster rates. Indeed, while coverage in the U.S. grew by 4.5% p.a., South Africa expanded by 17% p.a., and China attained a rate of 25.3% p.a., with half the population still with limited access. Quasi-universal coverage - that is 85% of the population – will likely to be achieved within the next decade.

Graph 3: Internet users per 100 inhabitants[5]

2001 – 2014, Developed and Emerging Economies.



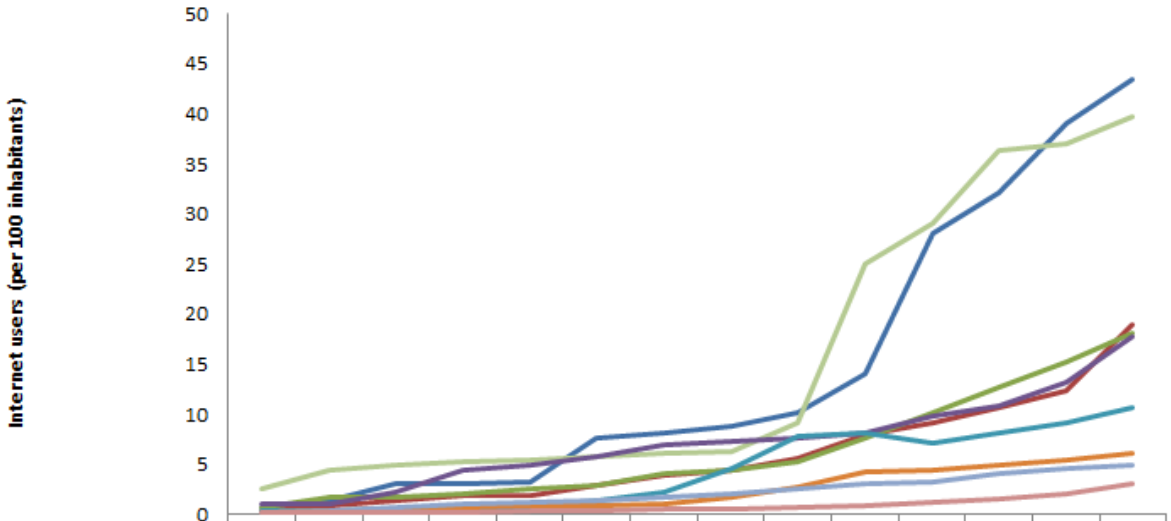
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
United States	49,08	58,79	61,70	64,76	67,97	68,93	75,00	74,00	71,00	71,69	69,73	79,30	84,20	87,36
South Korea	56,96	59,40	65,50	72,70	73,50	78,10	78,80	81,00	81,60	83,70	83,76	84,07	84,77	84,33
Hong Kong, China	38,67	43,08	52,20	56,40	56,90	60,80	64,80	66,70	69,40	72,00	72,20	72,90	74,20	74,56
Argentina	9,78	10,88	11,91	16,04	17,72	20,93	25,90	28,11	34,00	45,00	51,00	55,80	59,90	64,70
Brazil	4,53	9,15	13,21	19,07	21,02	28,18	30,88	33,83	39,22	40,65	45,69	48,56	51,04	57,60
China	2,64	4,60	6,20	7,30	8,52	10,52	16,00	22,60	28,90	34,30	38,30	42,30	45,80	49,30
South Africa	6,35	6,71	7,01	8,43	7,49	7,61	8,07	8,42	10,00	24,00	33,97	41,00	46,50	49,00
Mexico	7,04	11,90	12,90	14,10	17,21	19,52	20,81	21,71	26,34	31,05	37,18	39,75	43,46	44,39

Source: Own elaboration based on World Bank data.

[5] Defined by the World Bank as individuals who have used the internet (from any location) in the last 12 months, via computer, mobile phone, personal digital assistant, games machine, digital TV, etc.

During that 15-year period, developing countries have also made major strides, with Kenya, Ghana and Rwanda becoming relevant examples of countries growing out of very small bases (Graph 4). As noted, however, internet access is fundamentally a phenomenon of the diffusion of mobile devices, mostly smart phones (and advanced 3G/4G networks). Nonetheless, it is impressive what Kenya has achieved in such a relatively short period – as well as other developing countries such as Ghana, Senegal and Rwanda. It is no coincidence that a number of significant mobile-based services initiatives have taken place in Kenya.

Graph 4: Internet users per 100 inhabitants
2001-2014, Developing Economies



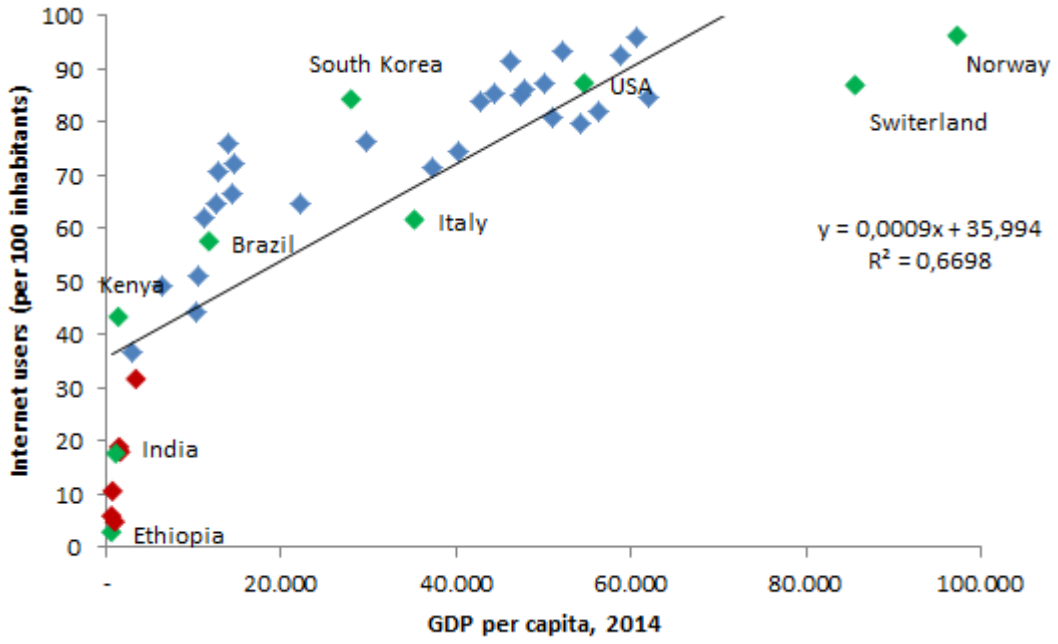
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Kenya	0,62	1,21	2,94	3,02	3,10	7,53	7,95	8,67	10,04	14,00	28,00	32,10	39,00	43,40
Philippines	2,52	4,33	4,85	5,24	5,39	5,74	5,97	6,22	9,00	25,00	29,00	36,24	37,00	39,69
Ghana	0,20	0,83	1,19	1,72	1,83	2,72	3,85	4,27	5,44	7,80	9,00	10,60	12,30	18,90
India	0,66	1,54	1,69	1,98	2,39	2,81	3,95	4,38	5,12	7,50	10,07	12,58	15,10	18,00
Senegal	0,98	1,01	2,10	4,39	4,79	5,61	6,89	7,12	7,50	8,00	9,80	10,80	13,10	17,70
Rwanda	0,24	0,29	0,36	0,43	0,56	1,34	2,12	4,50	7,70	8,00	7,00	8,02	9,00	10,60
Mozambique	0,16	0,26	0,42	0,68	0,85	0,84	0,91	1,56	2,68	4,17	4,30	4,85	5,40	5,94
Tanzania	0,17	0,22	0,67	0,87	1,10	1,30	1,60	1,90	2,40	2,90	3,20	3,95	4,40	4,86
Ethiopia	0,04	0,07	0,11	0,16	0,22	0,31	0,37	0,45	0,54	0,75	1,10	1,48	1,90	2,90

Source: see Graph 1

Graphs 5 and 6 provide a complementary assessment of cross-country differences, this time relating internet access to GDP per capita. Among the more developed economies, South Korea stands out; in the developing economies cluster, Kenya is indeed above "the curve"[6]. It is noteworthy that India, often regarded as a country with important initiatives with respect to digital inclusion, appears to be significantly below the curve in view of its very large rural population below the poverty line living in areas underserviced by basic infrastructure.

Graph 5: Internet users per 100 inhabitants and GDP per capita

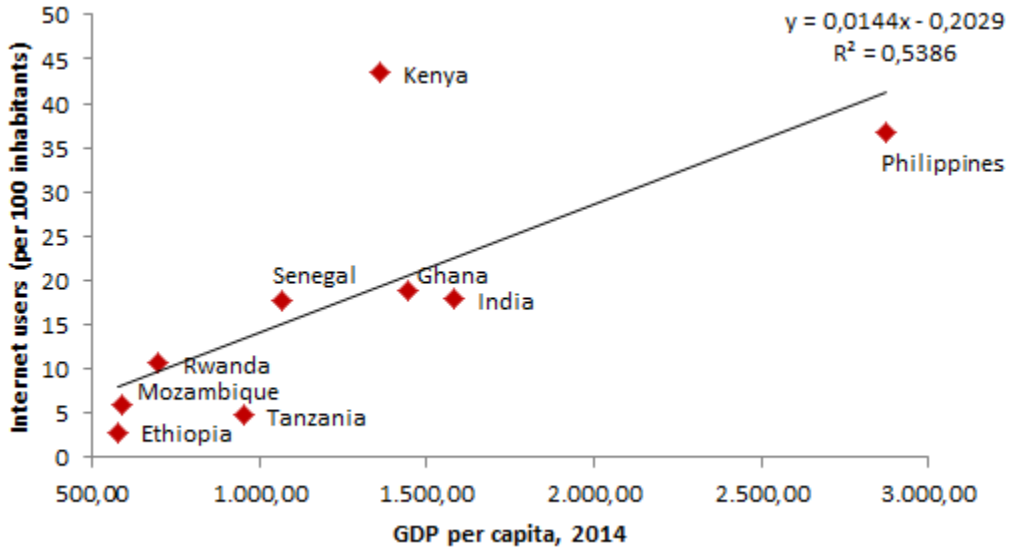
Selected countries[7].



[6] See Robert Schumann and Michael Kende, "Lifting Barriers to Internet Development in Africa: suggestions for improving connectivity", Report for the Internet Society, May 2013. A combination of government ability and commitment to attract infrastructure investment (such as the East African Submarine Cable System sponsored by the World Bank and the Development Bank of Southern Africa, and the East Africa Marine System, responsibility of the Kenyan government, with collaboration from Etisalat Emirates Telecommunications Corporation), and open up to a variety of service providers (as well as device suppliers), has been instrumental in making Kenya a standout in Africa, with the highest bandwidth per person in Africa, the fastest speeds and one of the lowest internet rates.

[7] Selected countries: South Africa, Germany, Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, South Korea, Denmark, Egypt, Spain, USA, France, Netherlands, Hong Kong, Hungary, India, Ireland, Israel, Italy, Malaysia, Mexico, Norway, Poland, Portugal, UK, Russia, Singapore, Sweden Switzerland, Turkey, New Zealand, Kenya, Ghana, Senegal, Mozambique, Ethiopia, Rwanda, Tanzania and Philippines.

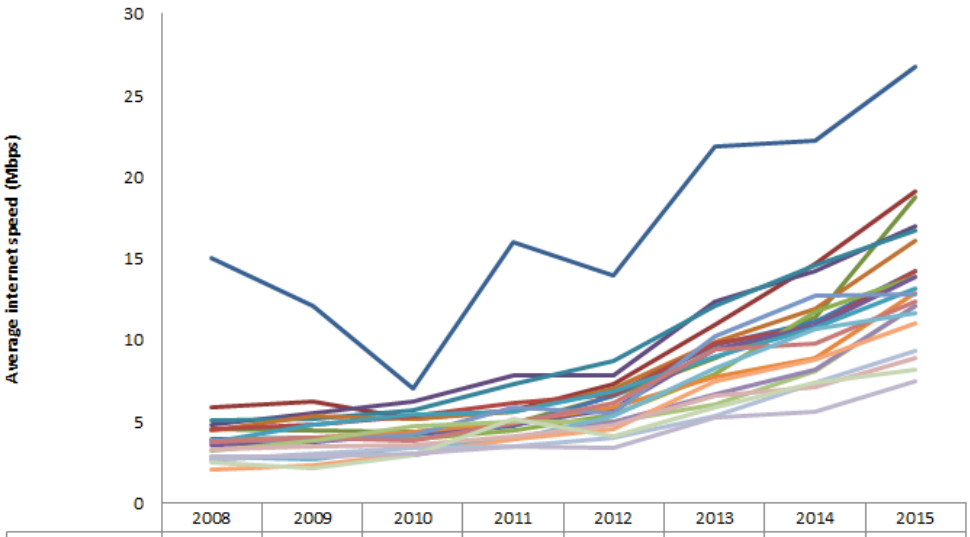
Graph 6: Internet users per 100 inhabitants and GDP per capita
Developing countries subset



Source for Graphs 5 and 6: see Graph 1.

In this paper, the *quality* of access is measured by data transmission speeds (Graphs 7 and 8). While average speeds have increased, the relative gap between the more advanced and other economies seem to have widened in recent years, most likely due to the fact that as coverage increased, speed suffered, with most providers announcing maximum speeds, while traffic goes at far lower average speeds. Although coverage, driven by the dissemination of mobile devices, initially outpaces the ability of telecoms and providers to offer high quality access, progressively they seem to be catching up. Increasing speed generally depends on infrastructure investments, the return on which until recently was less attractive unless one could find large number of paying users willing to purchase traditional broadband and related services. A number of public and private initiatives targeted at developing economies are attempting to provide low-cost high quality (mobile) connections in order for them to jump over the speed barrier, which separates them from developed countries.

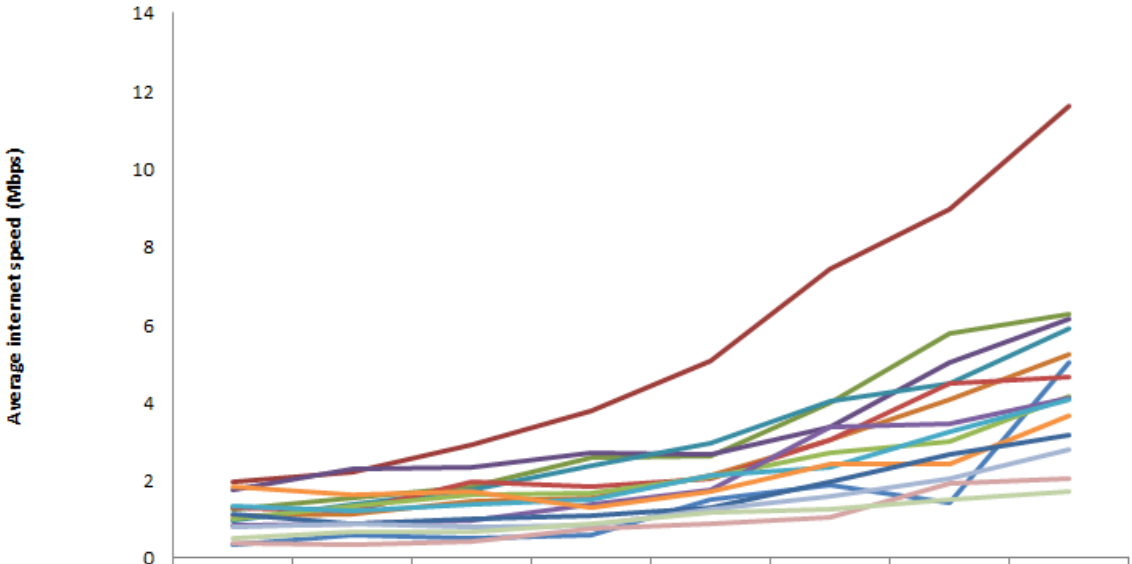
Graph 7: Average speed in *Mbps*
2008 – 2015, Selected countries



	2008	2009	2010	2011	2012	2013	2014	2015
South Korea	15,03	12,10	6,99	16,00	13,97	21,88	22,23	26,74
Sweden	5,85	6,20	5,13	5,63	7,26	10,90	14,62	19,06
Norway	4,48	4,47	4,37	4,83	6,54	8,91	11,39	18,75
Netherlands	4,79	5,50	6,23	7,78	7,80	12,38	14,20	16,97
Switzerland	5,07	5,11	5,63	7,29	8,73	12,04	14,52	16,66
Denmark	4,40	5,36	5,14	5,60	7,02	9,85	11,85	16,08
USA	3,90	3,97	4,16	4,73	6,57	9,64	11,06	14,24
Belgium	4,52	4,76	5,33	6,1	6,62	9,72	10,84	14,17
Singapore	3,79	3,88	3,90	4,46	5,39	7,93	11,69	13,88
UK	3,52	3,76	4,22	4,81	5,75	9,44	10,87	13,85
Canada	3,76	4,75	5,44	5,61	6,80	8,95	10,70	13,12
Germany	3,80	3,94	4,30	4,99	5,88	7,69	8,83	12,88
Ireland	3,79	3,79	4,14	5,81	5,53	10,25	12,67	12,76
Austria	3,74	4,01	3,83	4,85	6,09	9,43	9,79	12,34
Portugal	3,21	3,78	4,72	4,95	4,99	6,03	8,03	12,10
Spain	2,64	2,93	2,96	4,00	4,92	6,65	8,18	12,07
Israel	2,86	2,67	3,46	3,88	5,33	8,21	10,64	11,62
Poland	2,01	2,29	3,02	3,86	4,51	7,48	8,75	10,98
New Zealand	2,69	3,00	3,40	3,46	4,01	5,28	7,33	9,30
France	3,24	3,46	3,51	4,06	4,79	6,59	7,07	8,91
Australia	2,48	2,13	2,88	5,16	4,08	5,82	7,36	8,15
Italy	2,86	2,82	3,02	3,44	3,32	5,20	5,58	7,44

Source: Akamai Faster Forward, "The State of the Internet"; own elaboration.

Graph 8: Average speed in Mbps
2008-2015, Selected Emerging and Developing Economies

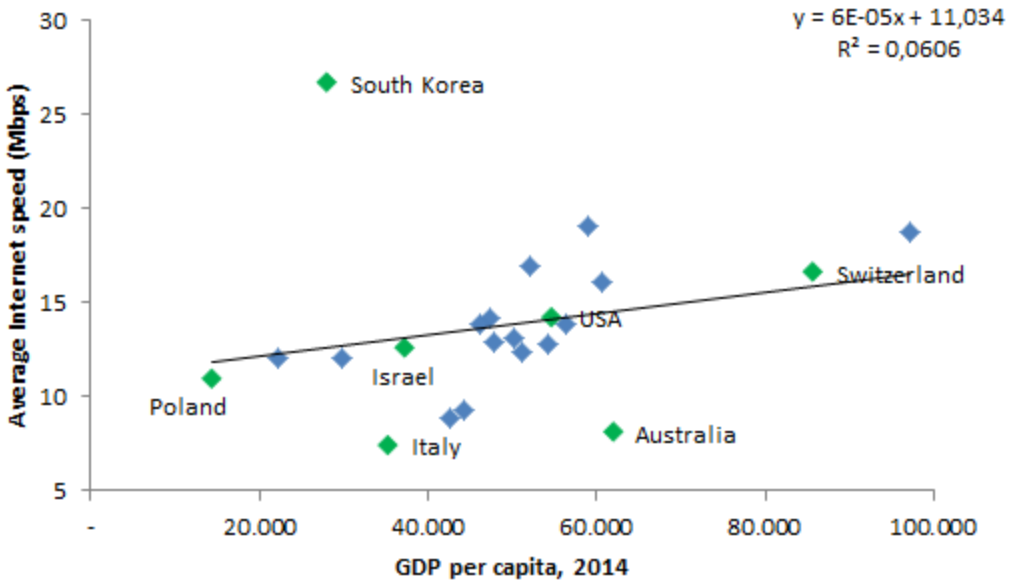


	2008	2009	2010	2011	2012	2013	2014	2015
Russia	1,95	2,19	2,93	3,78	5,06	7,41	8,96	11,61
Turkey	1,25	1,55	1,82	2,58	2,63	4,00	5,76	6,27
Chile	1,75	2,27	2,33	2,69	2,67	3,35	5,01	6,14
Mexico	0,95	1,37	1,75	2,38	2,94	4,01	4,48	5,88
Malaysia	1,10	1,13	1,48	1,56	2,12	3,03	4,08	5,24
Kenya	0,34	0,57	0,49	0,57	1,50	1,89	1,42	5,01
Argentina	1,29	1,21	1,97	1,85	2,03	3,05	4,50	4,67
Brazil	0,99	1,32	1,61	1,67	2,10	2,69	2,99	4,14
China	0,84	0,88	0,97	1,37	1,77	3,37	3,45	4,12
South Africa	1,34	1,21	1,38	1,50	2,11	2,35	3,23	4,07
Morocco	1,82	1,62	1,69	1,29	1,71	2,42	2,43	3,65
Philippines	1,11	0,86	0,99	1,07	1,31	1,95	2,66	3,15
India	0,79	0,86	0,78	0,84	1,24	1,60	2,05	2,79
Algeria	0,38	0,34	0,43	0,74	0,88	1,05	1,91	2,06
Egypt	0,49	0,69	0,67	0,90	1,18	1,26	1,50	1,70

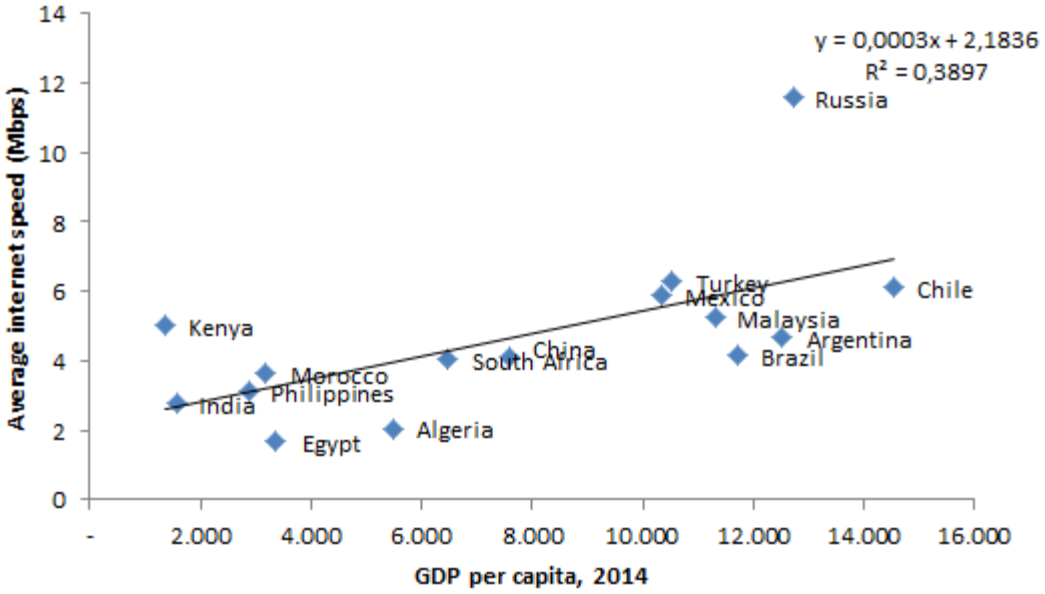
Source: Akamai Faster Forward, "The State of the Internet"; own elaboration.

Graph 9 relates average transmission speed with GDP per capita for 10 relevant economies, with most countries not diverging far from the fitted line. One significant exception is again Kenya, which consistent to its standing when compared to other developing countries with respect to coverage, stands above the curve for its level of income per capita. It is also a country with a number of public-private initiatives to provide better access and services.

Graph 9: Internet Average Speed and GDP per capita
Selected developed economies[8]



Graph 10: Internet Average Speed and GDP per capita
Selected emerging and developing economies

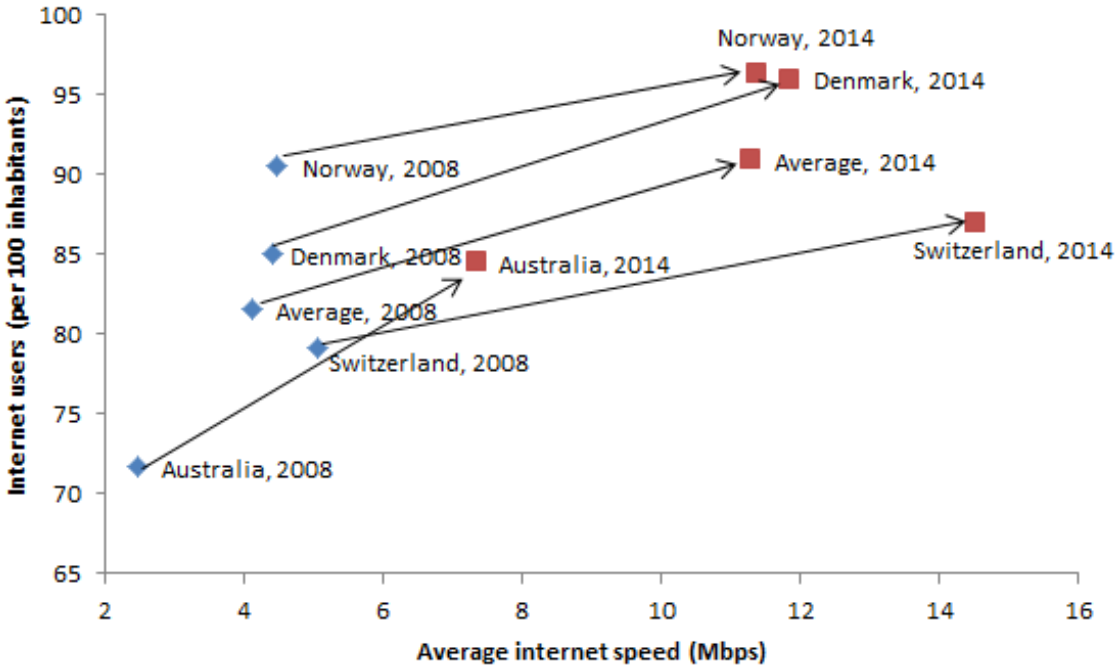


Sources for Graphs 9 and 10: Akamai Faster Forward, "The State of the Internet" and World Bank data; own elaboration.

[8] South Korea, Sweden, Norway, Netherlands, Switzerland, Denmark, USA, Belgium, Singapore, UK, Canada, Germany, Ireland, Austria, Portugal, Spain, Israel, Poland, New Zealand, France, Australia and Italy.

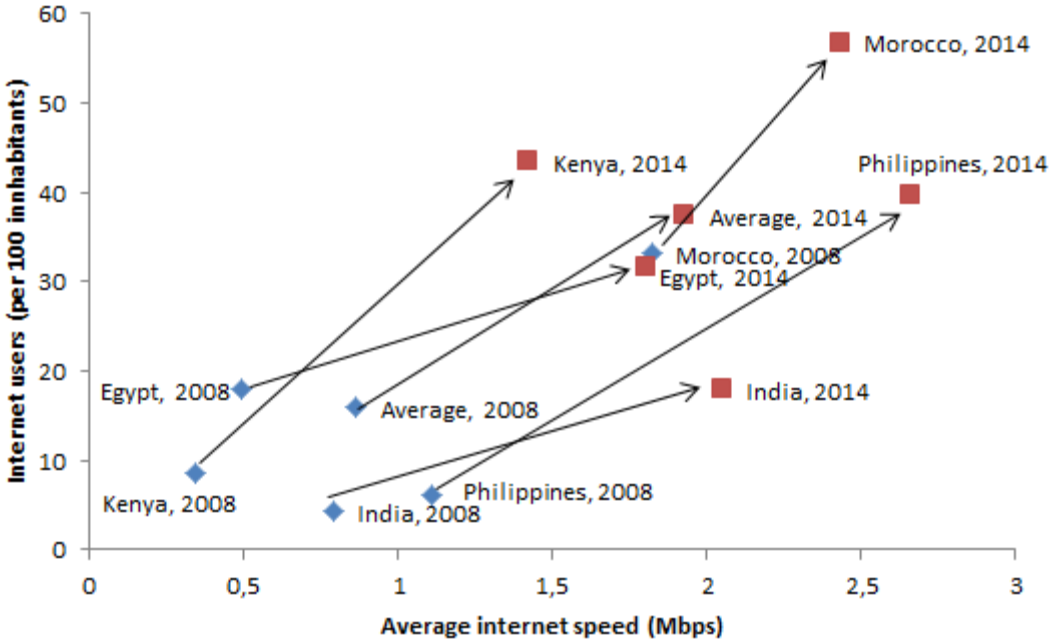
In this paper, we define the connectivity frontier as the distribution of countries across the internet access - average speed space (Graphs 10 and 11). The frontier dynamics is captured over the interval 2008-14. The differences between these two years provide country-specific absolute and relative movements. The graphs suggest a fast moving frontier and confirm widespread cross-country gains. Among developed countries, the gains are mostly concentrated in speed, while for developing economies the period reveal major strides in coverage.

Graph 10: The moving connectivity frontier
2008-2014, selected developed economies



For developing economies, approaching the connectivity frontier is a precondition to the effective use of key technologies and platforms, capable of facilitating the production and exports of services (and goods) which until recently where outside their realm, or with respect to which these countries had at most a marginal participation.

Graph 11: The moving connectivity frontier
2008-2014, selected developing economies



Sources for Graphs 10 and 11: Akamai Faster Forward and World Bank data; own elaboration.

Despite the importance of the dissemination of hand-held devices and similar general-purpose technologies, their usefulness as a transformative instrument will still depend on robust connectivity and the quality of ICT infrastructure. Obviously, the technologies and platforms discussed in section II are not a *deus-ex-machina* of trade, be in goods or services. Nevertheless, they do provide the first breakthrough for developing countries that might shorten the long ascent towards relevance in world trade flows, beyond the now past commodity super cycle. As noted in the next section, countries would do well to mobilize resources required for universal access and high quality connectivity, and attract providers by lowering entry barriers, in addition to undertaking trade facilitation and related economic reforms to make sure that they capture ICT-opened opportunities.

IV. ICTs and Services Trade: a half opened door to developing countries

At the outset, it should be noted that services trade are already responsible for an estimated 25% share of global trade (and 55% in value added) and growing at rates significantly above trade in goods. It is therefore not hard to argue for the importance of countries investing in the enabling conditions to capture a share of this market. Among those enabling conditions, it appears that ICTs will play a critical role.

When discussing ICTs and trade, it is important to differentiate between first and second-generation *ICT-based* services trade. India has been the quintessential example of a successful trade strategy focusing on the cross-border supply of business and other advanced services, characterized by intensive use of first-generation ICTs (computers, and high-speed satellite and cable links), and high levels of transportability and tradability[9]. Grounded on a combination of an elastic supply of English-speaking well-educated professionals, and telecoms infrastructure that connected the country to the rest of the world, India's service exports grew at a very fast rates since the mid 1990s. By 2000, India's exports of business services already amounted to US$ 16 billion, and since then India's share of world service exports tripled to over 3 percent by 2013. And a few other developing countries such as the Philippines, which shared some of the same endowments as India, followed the strategy breaking into the cross-border supply of business services[10].

[9] See Rahul Anand, Kalpana Kochhar, and Saurabh Mishra, "Make in India: Which Exports Can Drive the Next Wave of Growth?", IMF Working Paper 119, May 2015.

[10] The Philippines and India are also at the forefront of ICT service exports, defined as computer and communications services (telecommunications and postal and courier services) and information services (computer data and news-related). In 2015, they made up 70.4% and 67.5% of total service exports. See http://data.worldbank.org/indicator/BX.GSR.CCIS.ZS?view=map.

Yet ICTs have moved considerably beyond computers and companies-centered technologies capable of connecting them with buyers through exclusive links. This chapter's perspective focuses on the *second generation* of service exports, which the ongoing ICT revolution of this decade is beginning to propitiate to developing countries. For the new ICT – as argued in section 2 – is fundamentally different, for it empowers people individually, entrepreneurs, small and medium-sized firms to break into markets until now closed to them. It does not mean that infrastructure is unnecessary, but new ICTs open new doors for connectivity, including to citizens of countries with smaller economies and lower per capita income.

A recent World Bank/World Trade Organization report noted the importance of ICTs to promote trade benefitting the poor[11]. In discussing policies to maximize the gains from trade for the poor, by "integrating markets and improving the enabling environment", the report underlines the importance of access to ICTs. This would be instrumental to facilitate transportation logistics and the management of the supply chain; to allow for business process outsourcing (in the paradigmatic example of India); or still, to offer on-line freelancing and other decentralized modes of connecting customers and providers, and other forms of cross-border trade in services (GATS Mode 1)[12]. Importantly, the report states that "export survival rates appear to be significantly higher for firms participating in e-commerce [which] is facilitating the participation of a greater number of smaller firms in international trade"[13].

[11] World Bank Group and World Trade Organization, The Role of Trade in Ending Poverty. World Trade Organization, Geneva, 2015.

[12] The GATS defines four modes of supply. ***Cross-border supply*** (Mode 1) covers services flows from the territory of one country into the territory of another country. ***Consumption abroad*** (Mode 2) refers to situations where a service consumer (e.g., tourist or patient) moves into another country's territory to obtain a service. ***Commercial presence*** (Mode 3) implies that a service supplier of one country establishes a territorial presence in another country. Finally, ***presence of natural persons*** (Mode 4) consists of persons of one country entering the territory of another country to supply a service (e.g., accountants, doctors or teachers).

[13] The Role of Trade in Ending Poverty, pp 46-7. The reference with respect to e-commerce is Suominen, K. (2014) *Aid for eTrade: Accelerating the Global eCommerce Revolution*, CSIS Europe Working Paper, CSIS.

Granted, the evidence is still scattered and of anecdotal nature regarding the growth in service exports from developing countries that can be traced back to new generation ICT investments. At the same time, as shown in section 2, such ICTs are changing the competitive landscape in ways that it lowers entry barriers for countries not as well-endowed as India, among others. *This is what is new*. Exactly because it is new - an emerging trend - it is still little understood and documented, while statistics are fraught with definition problems and data capture.

For the scope of activities in this true next-generation "industry without smokestacks" in which developing countries can reposition themselves not only is large, but hard to anticipate, as the ICT revolution reduces transaction costs along a multiplicity of dimensions relevant to exporters. Moreover, the human capital requirements in the new environment are based less on engineering and hard sciences, and more on creativity and tacit knowledge. Even the concept of *user-friendly* – is changing, to allow massive deployment of new technologies which will dramatically facility the production and export of services, and without resort to software engineers, computer scientists and highly skilled professionals.

There are however some relevant considerations. ICTs in and of themselves do not radically change a country´s comparative advantage, but help overcome geographical, language and other barriers that previously isolated countries and regions. In this sense, it enhances the possibility of a country playing to its advantages. Indeed, as markets become more integrated, economic signals reach agents with less noise, allowing for more effective and timely response. Critically, the growing flow of information allows economic agents to have a better grasp of available opportunities, while new platforms in a few years have transformed the ability of local entrepreneurs reach consumers literally quasi anywhere.

Still, the potential of technology depends on other initiatives to improve the so-called enabling environment for trade. Among the most important are: the progressive reduction of tariff and non-tariff barriers (combined with preference schemes for the least developed); systematic efforts at trade facilitation, including improvements in procedures for border management; and the provision of trade finance[14]. In addition, it has become critical the upgrading of transportation and related physical and "soft" infrastructure (such as trade logistics and regulations), by increasing competition in the provision of such services.

In a not so distant past, access to land lines meant people and businesses were connected. Since the 1990s connectivity meant the availability of an infrastructure which enabled larger businesses and high-end consumers to link up to the rest of the world. Now connectivity needs to be understood in a radically different way. It means *high quality (in terms of speed and stability), universal, affordable, open and safe mobile (and desktop) access to the internet* – let us refer to this as the new *access paradigm*. Infrastructure is still needed, and clearly depends on the country´s ability to attract providers of cable and other links, as Kenya – for instance – has successfully achieved in recent years.

It is likely that in 10-15 years the changes propitiated by ICTs will far surpass our current ability to predict their impact on developing countries and their ability to access markets. Yet without putting in place a set of solid, enlightened and forward looking policies it is unlikely that countries will be able to capture the opportunities available in a fast growing market. Their role will be to attract service providers of infrastructure and services, and create an environment in which agents have both the incentives and the ability to procure the means to leverage the limited resources of these countries with some of the revolutionary ICTs, which bridge in new ways the development cleavage.

[14] See *The Role of Trade in Ending Poverty*, op.cit.

Access is the foundation. This paper posits that what will propitiate people to acquire the skills to become ICT literate, more active citizens and respond to market opportunities is a commitment by governments to the *access paradigm*. In particular, access will be increasingly central to exploit possibilities in export markets hitherto simply unavailable, bridging geographical and economic distance, connecting buyers and sellers, this applying to the exports of goods *and* services.

Even though access is becoming more widespread as the price of mobile devices – smartphones in particular – become lower, it might be still too early to capture systematic evidence on its importance to service exports. Still, a simple correlation between the number of internet users and the export of services[15] in 2010-14 for a sample of countries is indicative that access facilitates or at least is associated with larger service exports (with a few exceptions – see Table 4). Correlation is not causality, but arguably, in this decade access is becoming a *sine qua non* to operate in export markets, and benefit from new technologies and platforms that are beginning to revolutionize commerce.

[15] Business services; communication services; construction and related engineering services; distribution services; educational services; environmental services; financial services; health related and social services; tourism and travel related services; recreational, cultural and sporting services; and transport services.

Table 4: Export of services (GATS modes 1 and 2) and Internet users per 100 inhabitants, 2010-2014

Countries (ordered by per capita income)	Correlation Index
USA	0.8833
South Korea	0.7485
Chile	-0.1255
Brazil	0.8944
Malaysia	0.9846
Turkey	0.9736
Mexico	0.8676
South Africa	0.4352
Namibia	0.7834
Morocco	-0.4326
Philippines	0.9157
India	0.9350
Ghana	0.1725
Kenya	0.9420
Senegal	0.9710
Tanzania	0.9979
Mozambique	0.7776

Source: WTO, World Bank; own elaboration.

If access is the foundation and entry point to take advantage of last-generation ICTs, the question for many – if not most - developing countries, is how to adopt the new access paradigm in the face of scarce resources? To what extent can governments leverage on appropriate policies, partnerships and cooperative arrangements in order to make new technologies and platforms as widely available as possible? Although there is no single recipe that fits all, most countries still have significant adoption barriers, many of which “self inflicting”.

In this perspective, a starting point is an assessment of the country-specific barriers that discourage infrastructure investment, and reduce competition for the supply of devices (desktop and mobile) and the provision of services. To the extent that such barriers are significant or even binding, they need to be removed, insofar as the price – and quality - of products and services are determinant in their diffusion. In this perspective, policy and regulatory reform that attract investment in key infrastructure, and facilitates entry and promotes competition in both markets (devices and services) is the first step for countries to create an enabling environment for ICTs to play its potential.

Consumers, in developing countries above all, should have at their disposal the best cost-performance combination available in the market with a minimum tariff/tax wedge: inexpensive but powerful devices – such as smartphones; and a variety of service providers competing in national (and reginal) markets. Regional trade arrangements may require countries to agree to regional infrastructure investors (such as fiber rings), and open their markets in recognition to the importance of new technologies to modernize the provision of services and spur trade.

However, governments can go further by actively engaging key service providers – such as Alphabet (Google) and Facebook – which have plans to connect people in developing countries and more isolated regions a quasi-zero cost. It is their ability to rope in users/consumers – “the more the merrier” – and the enormous network economies of scale that are making them the economic powerhouses of this age. To a significant degree, by connecting people, they serve the public interest. If in the process they capture more consumers to their services, they also provide the means for low-cost digital inclusion.

Similarly, access can be "traded" for advertising time, mainly in urban areas. In other words, such areas can be "wired" and access be conditional on the willingness of users to spend time being exposed to ads. Governments can negotiate – in the name of its citizens - maximum free time for a minimum advertising time. In the face of limited resources, this may be regarded as a feasible – and pragmatic – way of cities (mainly) in poor countries to move up the digital gradient. There will be a growing number of possibilities of this nature in coming years, signifying one more avenue for digital inclusion and crossing the access door.

A final point: policy makers need to think creatively, "out of the box", to leverage its market and attract technologies which dramatically lower the cost of access, and in recognition of initiatives with similar objectives[16]. If in wealthier and more advanced economies local and even national governments may have enough resources to "wire" the country in recognition to the importance of high-speed access, in most developing countries that is not the case. Thus in addition to removing obstacles for people to access devices on the most competitive basis, and lowering entry barriers and promoting competition among service providers, including infrastructure investors, governments need to experiment with new models of public-private cooperation to bring the country the new access paradigm and improve the lives of their citizens.

[16] Among the most important are the **Telecom Infra Project**, which look for connectivity solutions in strategic network areas such as access, backhaul, and core and management; and the **OpenCellular**, a Facebook initiative for a low cost open code hardware and software that will support from 2G to LTE network, amplifying mobile network signals, each box supporting up to 1500 connections, and covering a radius of up to 10 km.

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