

Digital infrastructure: Overcoming Digital Divide in Emerging Economies

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Since the 1990s when the internet began to be commercialised globally, the debate on how to close the digital divide has attracted widespread attention. In this Policy Brief, we review the literature on the digital divide in emerging economies with a view to explaining: 1) how internet connectivity promotes social and economic inclusiveness, efficiency and innovation; 2) why the physical access to the internet alone is insufficient to capture the full benefits of digital technology and what other social conditions should be considered; and 3) how to further connect the unconnected population.

The digital divide prevents societies from harnessing the full benefits that information and communication technologies can deliver. In this context, actions to foster physical access to the internet remain essential, but they are not sufficient to ensure a truly inclusive information society. Therefore, strong leadership is needed at the global and local levels, to ensure more coordinated efforts among governments, local authorities and actors on the ground. Conversely, maintaining the *status quo*, while technology progressively pervades every sector of the economy, may critically widen disparities across countries and within national territories.

This report offers two sets of policy recommendations: 1) a set of general principles that the G20 should endorse to overcome disparities between emerging and advanced economies; and 2) a set of policy guidelines each nation should follow to bridge the digital divide and foster inclusiveness.

Challenge

The rapid growth of digital technology, often referred to as information and communications technologies (ICTs) in a broader sense, has largely reshaped our daily lives and how we do business globally. The internet has become one of the most fundamental and vital infrastructures around the world. According to the World Economic Forum (2014), each additional 10% of internet penetration can lead to a 1.2% increase in per capita GDP growth in emerging economies.

The digital divide, however, which refers to the gap in usage and access to digital infrastructure and services between individuals, households, businesses or geographical areas, remains significantly wide for emerging economies. More specifically, it affects certain population segments, for instance low-income and rural communities, due to the lack of digital infrastructure, affordability and skills.

Against this background, this section identifies four major challenges, presented below from the easiest to the most difficult ones to address.

The lack of digital infrastructure and services

This challenge includes the lack of access to network connections, to devices and to software and applications. A recent study points out

that in emerging economies, especially in rural or remote areas, more than four billion people still remain unconnected to the internet (Facebook, 2016). In addition, there are gaps in high-speed internet access that have important effects on media access such as streaming video. Recent data show that only 49% of African-Americans and 51% of Hispanics have high-speed internet at home, as compared to 66% of Caucasians. Therefore, bridging the digital divide requires providing adequate infrastructure and services both in the poorest countries and poorest areas of developed countries.

The lack of affordable network services, devices and applications

This challenge is not about availability; instead, it is about affordability, due to the higher costs of acquiring necessary devices and services. The same study mentioned above (Facebook, 2016) shows that nearly two billion people do not have a mobile phone, which is the easiest way in emerging economies to get connected to the internet. Therefore, bridging the digital divide requires making the internet accessible for the poorest people.

More importantly, the lack of digital skills to create or add value

This challenge means that internet users in emerging economies cannot create added value even when they have access to the internet, ICT devices and applications. Cullen (2001) points out that although conditions to ensure physical access to the internet are essential, they are not sufficient alone to achieve the “full benefits” of digital technology (which are discussed in the next section of this brief). The essential lesson of this challenge is that, without proper education and skill training, the potential of digital technology cannot be fully tapped. Therefore, digital literacy is key to enable citizens and companies to use the internet and foster a deeper integration of digital technologies into business and public services. Stronger attention should be drawn to the necessary conditions to develop the knowledge and the shared competence necessary to achieve a more inclusive digital economy.

Most importantly, the lack of coordinated efforts to foster social and economic equality

This challenge means that digital technology is neutral. Its potential cannot be released without coordinated efforts from human organizations: governments, industry, civil society organizations and academics. In the absence of such coordinated efforts, we could witness negative impacts, such as the following scenarios:

- When the internet delivers scale economies for firms but the business environment inhibits competition, the outcome could be excessive concentration of market power and the rise of monopolies, preventing future innovation.
- When the internet automates many tasks but workers do not possess the skills that technology requires, the outcome will be greater inequality, rather than greater efficiency.
- When the internet helps overcome information barriers that impede service delivery but governments remain unaccountable, the outcome will be greater control, rather than greater empowerment and inclusion.

The essence of this last challenge is that the internet is a powerful tool that can do positive or negative things; it all depends on the way it is harnessed. Interestingly, the negative impacts listed above are most likely to happen in emerging economies.

Closing the digital divide may play a critical role in the development of the emerging economies, as it can improve the social and economic equality, favour social mobility of people and boost innovation and economic growth. Against this background, G20 policymakers and other leaders should coordinate their efforts and adopt innovative solutions to tackle all these challenges and achieve a sustainable and inclusive prosperity throughout the globe in the digital era.

Proposal

1. Possible responses from the G20

Digital technologies have fundamentally reshaped our lives by expanding the base of information, reducing the costs for information sharing, transmission and acquiring, and bringing innovation that lead to the greater connectivity among people, businesses and governments (World Bank, 2016). We divide this section into two parts: the first defines the “full benefits” to expect from digital development; the second suggests concrete measures to be implemented to overcome the digital divide.

Part 1. What are the full benefits of ICT and internet connectivity?

The ultimate goal of closing the digital divide is to inclusively provide every member of a society with an equal opportunity to benefit from digital development. The “full benefits” of the digital development include the following aspects.

The ICT and internet connectivity promote efficiency

First, the decline in the price of digital technologies has led businesses and governments to replace traditional factors such as labour and non-ICT capital with ICT capital and to automate some of their activities. Second, digital technologies strengthen the factors that are not substituted and make them even more productive. By optimizing the production process and increasing the productivity of existing factors, digital technologies increase economic efficiency with potential benefits for firms, workers and governments.

The ICT and internet connectivity promote social and economic inclusiveness

By cutting down the costs for information sharing, transmission and acquiring and increasing transparency, the development of ICT and the internet reduces the inefficiency caused by the lack of information or information asymmetry, and makes new transactions possible. Nowadays, mobile technologies and all forms of e-commerce such as B2B, B2C and C2C, the sharing economy, online reputation mechanisms and digital identification systems all help to overcome the information barriers. While the ICT and the internet make the market more efficient, one of the greatest benefits seems to be their market-creation effects: expanding trade, creating jobs and increasing access to public services—and thus promoting social and economic inclusion. The concept of ‘market creation’ can be very well explained by the following paragraph:

When most industries emerge, their products and services are so costly and inaccessible that only the wealthy can buy and use them. Market-creating innovations transform such offerings into products and services that are cheap enough and accessible enough to reach an entirely new population of customers. The Model T Ford, the personal computer, the smartphone, and online equity trading are examples of market-creating innovations. Because many more people can buy such products, the innovators need to hire more people to make, distribute, and service them (Mezue et al., 2015).

The ICT and internet connectivity promote a new economy

The rapid growth of ICT and the internet also leads to the booming of the “new economy”, in which transactions are executed in an extremely efficient fashion: highly automatic without human input, and at low cost. By enabling almost frictionless communication and collaboration, the internet can support new delivery models, encourage collective action and accelerate innovation.

Table 1. The benefits of digital technologies for business, people and governments:

| | | | | | |
|--------------------------|--|---------------------|-------------------|---------------------|--------------------|
| Efficiency | Social & Economic Inclusion | New Economy | Business | Capital utilization | Trade |
| Competition | People | Labour productivity | Job Opportunities | Consumer welfare | Governments |
| Public sector capability | Participation | Voice | | | |

Source: World Bank (2016).

Part 2: Our proposals

The digital divide commonly encompasses two main aspects: 1) the conditions to access ICTs from the supply side of digital infrastructures and services and 2) the levels of internet use and the motivations and abilities in using ICTs and internet services. The concept keeps on evolving along with technological developments supported by industrial trends (e.g. internet of things), emerging consumption patterns, and the uptake of new devices and applications (e.g. smartphones, tablets, smart TVs) spurring demand for an increasingly heavy load of data traffic on communications networks.

There may not be quick or easy solutions to the problem of the digital divide. Although the physical access to the internet is most essential, other factors are equally important to foster the up-take of digital technologies and ensure meaningful investment in infrastructure. In line with the four challenges we have identified in the section above, we suggest the following actions to bridge the digital divide in emerging economies.

Connect the unconnected

A useful framework for analysing supply-side ICT policies is to consider the value chain that stretches from the point where the internet enters a country (the first mile), passes through that country (the middle mile) to reach the end user (the last mile), and certain hidden elements in between (the invisible mile).

- The first mile can be improved by liberalizing the market for satellite dishes and eliminating monopoly status over the international gateway and cable landing stations.
- Strengthening the middle mile involves liberalizing the market for building and operating backbone networks, encouraging open access to the incumbent's network, requiring all major infrastructure programmes (such as roads, railways, pipelines and energy distribution) to include provision for an optical fibre link, setting up internet exchange points and creating local caches for frequently used content.
- Government policies can encourage the provision of last-mile connectivity by permitting competing facilities, especially for intermodal competition (between cable, wireless and digital subscriber lines), and mandating the incumbent to make local access lines available to competitors at wholesale prices (local loop unbundling).
- The most critical portion of the invisible mile involves spectrum management, which requires increasing the amount of spectrum available, ensuring competitive access, encouraging sharing of essential facilities, such as radio masts, and liberalizing the market for spectrum resale.
- Affordability: Government subsidies or policy can be designed to make internet devices such as smartphones so cheap that everyone can own one; the internet service can become affordable by pricing the services based on service regions and income levels.

China's efforts to overcome the digital divide, in a programme called "Villages Connected", is a good example in this respect. Some 80% of China's population live in rural areas called villages. They are typically farmers who have low incomes and low educational levels. There are about 69,000 villages. In the last decade or so, the Chinese government has made it one of the top priorities to get all villages connected. The efforts are carried top-down by central to local government and the telecommunications industry. The result is that all villages now have some form or another of broadband internet access such as fixed, mobile or satellite.

Industry innovations

In the PC era, visionaries advocated the concept of the \$100 dollar laptop. In the mobile and social computing era, we would like to call for industry innovations to offer \$20 smartphones. Smartphones have helped bridge the divide, as they provide internet access to populations previously disadvantaged. Pew reports that, among smartphone owners, "young adults, minorities, those with no college experience, and those with lower household income levels" are more likely to access the internet primarily through their phones (Zickuhr & Smith, 2012). Interestingly, while smartphone ownership and internet usage continues to climb in emerging economies, rich countries or advanced economies still have higher rates of technology use (Poushter, 2016).

Digital investments need the support of several factors, including for instance: adequate market rules, so that firms can leverage the internet to compete and innovate; improved social digital skills, so that people can take full advantage of digital opportunities; and accountable institutions, so that governments respond to citizens' needs and demands. Digital technologies can, in turn, augment and strengthen these complements—accelerating the pace of development.

Education should be dynamic and stay ahead

Technology is dynamic, and so should be education. The interplay between digital investments and reforms in other areas (such as education and innovation systems) is at the core of policy debates on the impacts of technology on societies. Goldin & Katz (2009) framed the dynamics in the labour market as a "race between education and technology". The same holds true for relations between digital skills and digital technology. As technology progresses, some skills become obsolete. Workers must acquire new skills that help them become more productive thanks to this technology. Adjustment takes time and will be painful for many, but this is how economies progress. Policy and regulations should make sure that education is equally received, especially for those underprivileged such as people living in remote areas and having insufficient resources to access education.

Technology cannot replace human beings in making decisions

The digital divide is more than physical access to the internet or ICT. General knowledge and digital knowledge are equally important. Here general knowledge means how we make decisions using the technology and how we make use of technology to create or add social justice

and economic values to a society. Although artificial intelligence (AI) is automating an increasing number of tasks, general skills revolving around human care and creativity for improved decision-making and ethical judgments are crucial to ensure a broader socio-economic inclusion.

Reaping the benefits from enhanced digitalization is not easy as it requires a series of structural adjustments. Otherwise, digitalization makes persistent problems worse. The key insight is that for complex occupations, business activities or public services, the internet usually can make only a portion of the tasks cheaper, more efficient, or more convenient through automation. Another portion still requires capabilities that humans possess in abundance but computers do not. Many traditional tasks of an accountant or bank teller are now automated, such as making calculations or processing withdrawals. Others require complex reasoning or socio-emotional skills, such as designing tax strategies or advising clients. Likewise, many public services involving the provision of information or routine permissions can be automated. But others, such as teaching or policing, need a high degree of human discretion, tacit knowledge and judgment.

Coordinated efforts

The first-generation of ICT policies involving market competition, private participation and light-touch regulation have led to near-universal access and affordability of mobile telephone, but so far they have been less successful in spreading internet services. Much of the explanation lies in continued policy failures such as regulatory capture, troubled privatizations, inefficient spectrum management, excessive taxation of the sector and monopoly control of international gateways. At the same time, the absence of global consensus in dealing with the next-generation issues – such as privacy, cybersecurity, censorship and internet governance – is resulting in more circumspect and diverse approaches to internet policy.

The challenges facing internet stakeholders today are as much about how networks are used (demand) as how they are built (supply). Global interconnectedness introduces new vulnerabilities in areas where coordination mechanisms are weak, still evolving or based on non-government models. Threats to cybersecurity and censorship are undermining confidence and trust in the digital economy and increasing costs to businesses and governments, resulting in economic losses.

Coordinated efforts at global level and at national level are needed in developing policies, standards and regulations to ensure a high degree of competition. Similarly, greater attention should be paid to ensure sufficient re-skill and up-skill strategies, to leverage and keep pace with technological change. Promoting and ensuring fair and equal access to higher educational levels to a larger share of the population is key to fostering digital literacy but also importantly, to developing other complementary competences. Finally, public institutions must be accountable and commit to achieve long-term goals.

2. Our Recommendations

Our recommendations are formulated as follows: 1) at the G20 level, general principles should be set for emerging economies, supporting their economic development to close the digital divide globally, thus reducing gaps between poor and rich countries; (2) at the national level, governments should elaborate general policy guidelines and take action to reduce socio-economic inequalities across national populations. These guidelines should also clearly indicate specific measures and strategies to design innovation-friendly policies that every country should follow to sustain their economic growth.

1. G20 level

The following guiding principles should be defined by the G20 for emerging economies. As mentioned, the purpose is to close the digital divide globally and reduce gaps between poor countries and rich countries.

- Physical access to internet or digital infrastructure is necessary but not sufficient to reap the full benefits potentially stemming from digital technologies. Other complementary actions must be taken, such as skill training, affordability, innovation policy, multi-level governance and institutional accountability.
- The focus should be shifted, both in resource allocation and policy agenda-setting, from “providing infrastructure and access” to “encouraging usage of the existing infrastructure to add or create value”. This added value includes economic, education and life improvements.

- In the same vein, the focus should be shifted, both in resource allocation and policy agenda-setting from “hardware” to “human-ware”, i.e. from “digital technology development” to investing in human capital, for instance by “enhancing digital skills training” in the short term, and “increasing the share of the highly educated population in a country” in the longer term.
- Digital responsibility should be advocated, which means that internet technology or ICT in general should be used in a way to improve human life, equality and inclusive prosperity; not to be used as just a commercial means for profit-making.

2. Country level

When it comes to country-level guiding principles, the purpose is to overcome disparities across the various socio-economic segments of the population and between national territories.

- Market creation: developing policies and providing economic incentives to promote innovations that will entail market creation, which in turn will help 1) close the gap of digital divide, 2) increase the new employment opportunities and 3) eventually improve living conditions.
- Industry level efforts: innovation and collaboration should be highly promoted to create technologies that support the efforts of overcoming digital divide. For example, a \$20 smartphone will be a game changer in mobile internet access.
- Education: develop policies to adapt the education system to changing labour markets and encourage digital skill training for everyone at an affordable price.
- Affordability: deregulate the telecommunications industry and develop a friendly environment for digital services to flourish, at least at the consumer application level, to foster multiple applications and encourage the use of the internet and ICT to create and add values to the society.

References

1. Cullen, R. (2001), “Addressing the digital divide”, Online information review, 25(5), 311-320.
 2. EU (2014), Digital agenda for Europe (<https://ec.europa.eu/digital-single-market/en>).
 3. Facebook (2016), “State of Connectivity 2015: A Report on Global Internet Access” (<https://fbnewsroomus.files.wordpress.com/2016/02/state-of-connectivity-2015-2016-02-21-final.pdf>).
 4. G20 (2015a), G20 Leaders’ Communiqué, Antalya Summit, 15-16 November 2015 (<http://www.mofa.go.jp/files/000111117.pdf>).
 5. G20 (2015b), G20 Skills Strategy (<http://g20.org.tr/wp-content/uploads/2015/11/G20-Skills-Strategy.pdf>).
 6. G20 (2016), G20 Leaders’ Communiqué, Hangzhou Summit, 4-5 September (<http://www.thepresidency.gov.za/content/g20-leaders'-communique,-hangzhou-summit>).
 7. Goldin, C.D. and L.F. Katz (2009), The race between education and technology Cambridge, MA: Harvard University Press.
 8. Hilbert, M. (2011), “Digital gender divide or technologically empowered women in developing countries? A typical case of lies, damned lies, and statistics”, Women’s Studies International Forum, 34(6), 479-489 (<http://www.martinhilbert.net/DigitalGenderDivide.pdf>).
 9. Huawei (2016a), Digital Enablement (<http://www.huawei.com/minisite/digital-enablement/>).
 10. Huawei (2016b), Global Connectivity Index 2016, White Paper (<http://www.huawei.com/minisite/gci/en/>).
 11. McKinsey (2014), China’s digital transformation (<http://www.mckinsey.com/industries/high-tech/our-insights/chinas-digital-transformation>).
 12. Mezue, Bryan C., Clayton M. Christensen and Derek van Bever (2015), “The Power of Market Creation: How Innovation Can Spur Development”, Foreign Affairs, January/February.
 13. Poushter, Jacob (2016), “Smartphone Ownership and Internet Usage Continues to Climb in Emerging Economies”, Pews Research Center, 22 February.
 14. State Information Center of China (2013), Digital Divide in China 2013 Report (<http://www.sic.gov.cn/News/287/2782.html>).
 15. World Bank (2016), World Development Report 2016: Digital Dividends (<http://www.worldbank.org/en/publication/wdr2016>).
 16. World Economic Forum (2014), Delivering Digital Infrastructure Advancing the Internet Economy (<http://reports.weforum.org/delivering-digital-infrastructure/acknowledgements/>).
 17. World Economic Forum (2016), Digital Transformation of Industries: Digital Enterprise (<http://reports.weforum.org/digital-transformation-of-industries/wp-content/blogs.dir/94/mp/files/pages/files/digital-enterprise-narrative-final-january-2016.pdf>).
 18. Xinhuanet (2016), Highlights of proposals for China’s 13th Five-Year Plan (http://news.xinhuanet.com/english/photo/2015-11/04/c_134783513.html).
 19. Zickuhr, Kathryn and Aaron Smith (2012), “Digital differences”, Pew Research Center, 13 April.
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Existing Initiatives & Analysis

Implementation Overview (1)

- Develop a policy framework to analyse the development of digital technology and digital divide.
- Digital technologies lower the cost of economic and social transactions. They promote innovation, boost efficiency and inclusion.
- Connectivity is vital, but not enough to realize the full development benefits. Digital investments need the support of other social factors, for instance adequate market rules, social digital skills and accountable institutions.
- Market competition, public-private partnerships and effective regulation of Internet and mobile operators encourage private investment that can make access universal and affordable. Public investment will sometimes be necessary and justified by large social returns.

Existing Agreements (2)

G20 2015 Antalya Communiqué

G20 Leaders commit to bridge the Digital Divide, but lacks any explicit references to digital skills. (G20 Leaders, 2015a)

G20 2016 Hangzhou Communiqué

(Paragraph 14) - The G20 leaders continue their commitment to foster favourable conditions to address the digital divide.

Existing Policies and Monitoring (2)

Digital Agenda for Europe

Launched in May 2010, the digital agenda for Europe is aimed at boosting Europe's economy by delivering sustainable economic and social benefits from a digital single market.

China's 13th Five-Year Plan

Launched in March 2016, China's 13th Five-Year Plan has recognised the importance of China developing new industries based on the Internet and e-commerce. The Plan encourages the integration of the internet with traditional sectors of the economy and promotes Internet-based innovations.

Analysis and Data (1)

Next Steps

For next steps, we will apply the policy framework discussed in the Policy Brief to analyse the digital infrastructure development and digital divide both in China and in Europe. A comparative analysis will be conducted to identify lessons learnt and provide evidence-based policy recommendations. Three research reports we consider related to our Policy Brief are listed below: 1. World Economic Forum (2014) Delivering Digital Infrastructure Advancing the Internet Economy (<http://reports.weforum.org/delivering-digital-infrastructure/acknowledgements/>). 2. Huawei (2016a), Digital Enablement (<http://www.huawei.com/minisite/digital-enablement/>). 3. Huawei (2016b), Global Connectivity Index 2016, White Paper (<http://www.huawei.com/minisite/gci/en/>).