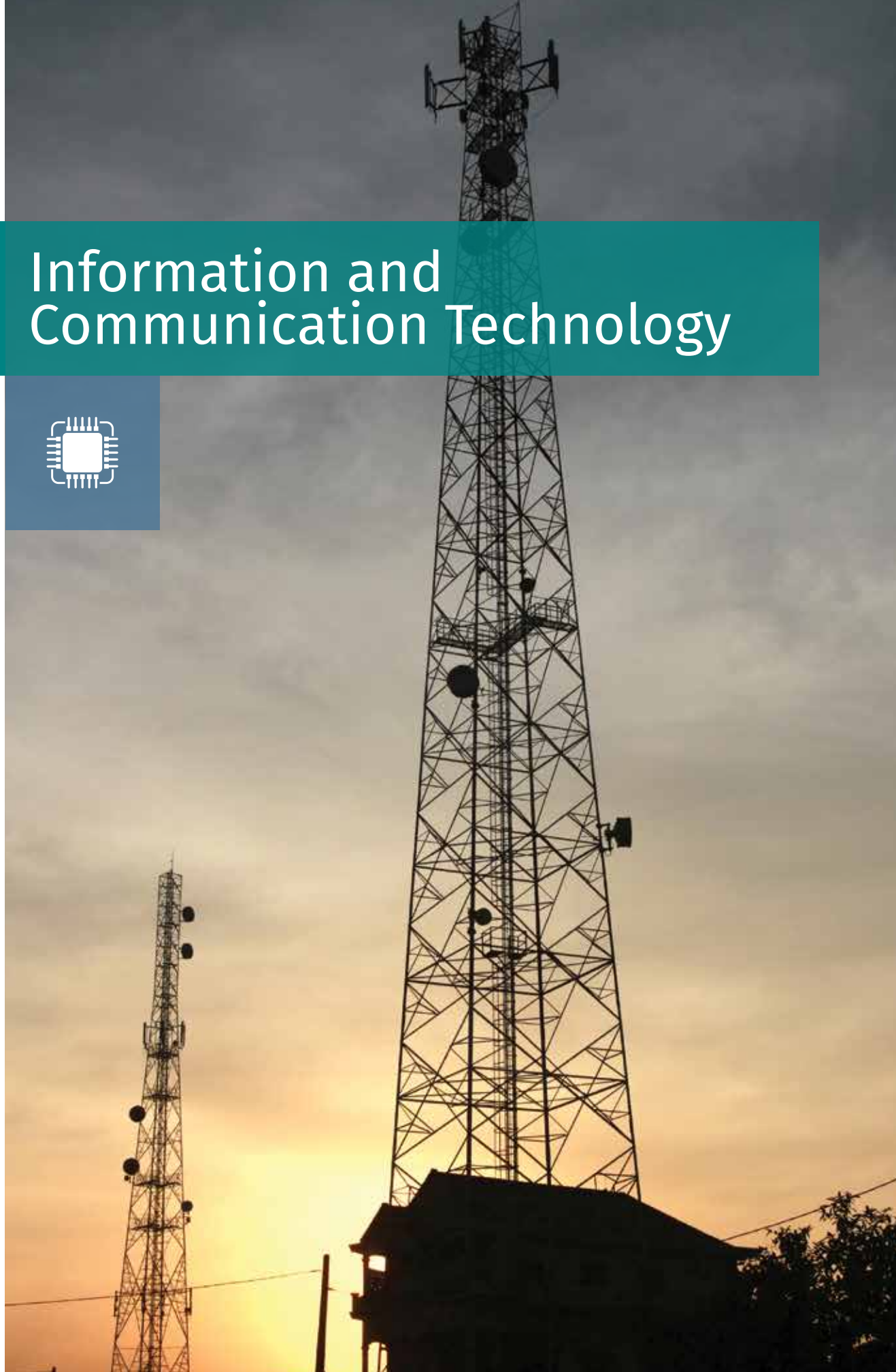
9 Information and Communication Technology



In Kerala, a state in western India, 72% of adults eat fish at least once a day. Further, over one million people are directly employed in the fisheries sector. Between 1997 and 2001, mobile phone service was introduced throughout Kerala. In a short period of time, the adoption of mobile phones by fishermen and wholesalers was associated with a dramatic reduction in price dispersion and the complete elimination of waste. In particular, variation of prices across fish markets declined from 60–70 to 15% or less. Waste, averaging 5–8% of daily catch before mobile phones, was completely eliminated. As a result, fishermen's profits increased on average by 8%.[1]

Almost half of the global population lives in rural areas, where access to communications can be significantly more difficult. Mobile-broadband networks (3G or above) reach 84% of the global population, but only 67% of the rural population worldwide; in Africa, only about 25% of the population is using the internet.[2] In Nepal, Cambodia, Lao PDR, Bangladesh and Myanmar less than 20% of the population is benefiting from the use of mobile internet.[3]

The ability to connect to the internet in remote areas using mobile devices can make a significant difference to farmers in terms of their food security and commercial viability. It can provide them with a wide range of opportunities—from obtaining real-time data on market and transport prices, to information on seed varieties, pests and farming techniques, as well as basic information on the weather and analytical and management tools for production and marketing processes.[4] Ultimately, the use of mobile applications and other information and communication technology-(ICT-) enabled services can stimulate access to markets and increase the income of smallholder farmers by improving agricultural productivity, reducing costs for input suppliers and enhancing traceability and quality standards.[5] For example, Indian farmers using the Reuters Market Light (RML) mobile information service, which reports on market prices, have benefited from an average increase in income of 5–15%.[6]

Telecommunications in Cambodia.
Photo: Chhor Sokunthea / World Bank.

The most significant impediment for smallholder farmers to fully exploit the benefits of ICT in agriculture is the network coverage gap due to a lack of infrastructure and underdeveloped mobile networks. Policies and regulations should aim at closing this gap. One strategy to address these gaps is to establish a universal access fund, which is a multi-source financing mechanism to support ICT infrastructure development in rural areas. In addition, reducing regulatory burdens can encourage private sector investment. Cumbersome regulatory frameworks, such as two-layer licensing requirements, can hinder competition and inhibit the creation of innovative solutions that are responsive to users' needs. This situation can prevent price reductions and the wider use of new, efficient technologies. Transparency creates greater predictability for mobile operators that have to take decisions on huge infrastructure investments and thereby encourages the expansion of networks to remote areas in a more sustainable manner.

What does the ICT indicator measure?

The ICT indicator measures laws, regulations and policies that promote an enabling environment for the provision and use of ICT services, particularly in rural areas. Given the significant capital investments required to provide ICT access in underserved areas,[7] mobile operators often have no incentive to invest in network rollouts to remote areas without regulatory stimuli. As a result, network coverage gaps continue to affect predominantly rural areas where populations, income levels and potential profit margins are relatively low. The ICT indicator measures regulatory good practices that can provide some of these incentives (table 9.1). It focuses on the licensing framework and assesses the type of licensing regime used in a country, the validity of the operating license, the public availability of operating license costs, spectrum allocation strategies and the predictability of renewal conditions for operating and spectrum licenses. Additional data on universal access funds were not scored and are presented in the appendix D.

How do countries perform on the ICT indicator?

The higher quality of the licensing and regulation is associated with higher mobile internet market penetration (figure 9.1).[8] Low-income countries in Sub-Saharan Africa display mobile internet market penetration levels below 20%, as compared to mobile internet market penetration levels above 60% for OECD high-income countries. Due to high capital investments required to expand mobile networks, higher income countries achieve faster universal access to ICT services.

Countries with stronger ICT regulations under the EBA ICT indicator (table 9.2) tend also to perform well on the GSMA's Mobile Connectivity Index,[9] which measures the strength of key enabling factors in a country (infrastructure, affordability, consumer readiness, content) to support universal adoption of the mobile internet (figure 9.2).

This result suggests that an enabling regulatory environment can contribute to better access to ICT services. European Union countries are among the top performers on both the ICT indicator and Mobile Connectivity Index, reflecting the significant harmonization efforts undertaken as part of the Digital Single Market Strategy initiative. The EU policy framework has been directed towards the creation of sound regulatory systems for electronic communications with simplified and inclusive rules that promote competition.[10] The EU member states have transposed the provisions of the Authorization Directive 2002/20/EC into their national laws and regulations.

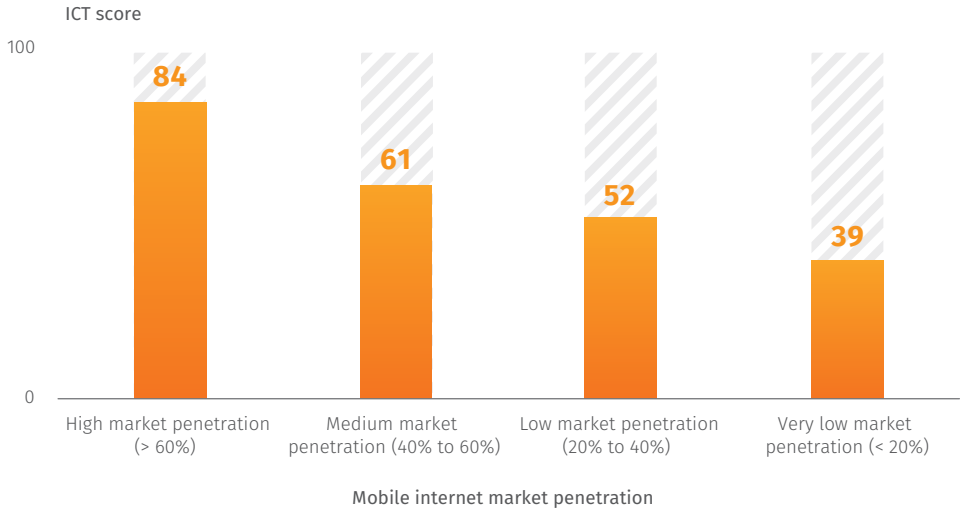
In contrast, countries that have implemented few regulatory good practices perform relatively poorly on the ICT indicator. For example, Ethiopia's low performance is explained by the absence of technology and service neutrality, and the lack of liberalization in the market, among other factors. The Herfindahl-Hirschman Index, measuring market concentration on a scale of 0 (evenly distributed competition) to 10,000 (no competition), for Ethiopia is 10,000,[11] reflecting the absence of

Table 9.1 | What does the ICT indicator measure?

INFORMATION AND COMMUNICATION TECHNOLOGY	• Type of licensing regime • Technology and service neutrality • Validity of operating license • Public availability of operating license costs • Predictability of renewal conditions for operating and spectrum licenses • Allocation of low frequency spectrum and digital dividend • Voluntary spectrum trading • Infrastructure sharing

Source: EBA database.

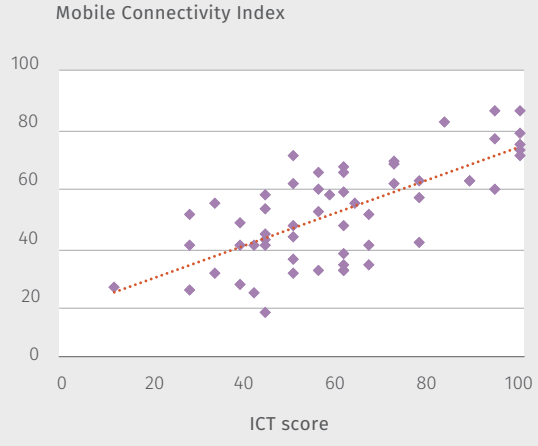
Figure 9.1 | Countries with high mobile internet market penetration also perform better on the ICT indicator



Sources: EBA database; GSMA.

Note: Total unique mobile internet subscribers is expressed as a percentage share of the total market population. The correlation between the mobile internet market penetration and the ICT score is 0.66. The correlation is significant at 1% level after controlling for income per capita.

Figure 9.2 | Countries performing well on the Mobile Connectivity Index have stronger ICT regulations



Sources: EBA database; GSMA.

Note: The correlation between the Mobile Connectivity Index (GSMA) and the ICT score is 0.70. The correlation is significant at 1% level after controlling for income per capita.

Table 9.2 | Where are ICT regulations strongest?

STRONGEST		WEAKEST	
1	GREECE	57	EGYPT, ARAB REP. AND SUDAN
1	NETHERLANDS	59	BURKINA FASO
1	POLAND	59	LAO PDR
1	ROMANIA	59	SRI LANKA
1	SPAIN	62	ETHIOPIA

Source: EBA database.

Note: Greece, the Netherlands, Poland, Romania, and Spain all perform the same and are thus tied at the 1st position. Burkina Faso, Lao PDR and Sri Lanka all receive the same score.

market competition in the telecommunications sector. In fact, the Ethiopian Telecommunications Corporation has the monopoly on telecommunications services in Ethiopia and there is little incentive to improve connectivity. This situation is reflected in the relatively low number of mobile cellular subscriptions in the country (42.76 per 100 people).[12]

What are the regulatory good practices?

Box 9.1 highlights regulatory good practices and some countries that implement these practices.

General authorization regimes foster competition

Traditionally, a licensing regime has been applied to authorize mobile operators to provide telecommunication services. Due to rapid technological development and the convergence of networks and services, a more open authorization framework is considered to be a good practice (box 9.1). General authorization regimes allow any telecommunication provider to offer electronic communications services, subject to general conditions applicable to all providers in the sector. They take the form of either open, license-exempt entry or simple notification requirements[13] to start a telecommunications business. As a result, general authorization regimes increase competition by reducing barriers to entry and simplifying the regulatory process, and reduce administrative costs for regulators.

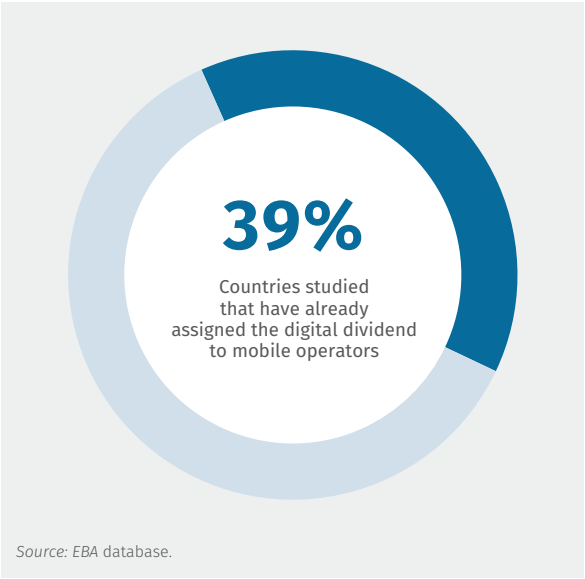
Only 10 countries out of the sample studied implement a general authorization regime (Colombia, Denmark, Georgia, Guatemala, Greece, Italy, Netherlands, Poland, Romania and Spain). In all 10 countries, administrative charges associated with general authorization regimes are publicly available. Furthermore, in most cases (Italy being an exception),[14] the validity of general authorization is indefinite, which eliminates any uncertainty surrounding license renewal. In contrast, individual licenses are prone to regulatory uncertainty and ambiguity over licensing fees, renewal conditions and/or universal access obligations. Twenty-one of the 52 countries that impose individual licenses do not publish online the exact fees associated with obtaining an operating license. In 12 countries the renewal conditions of the operating licenses are also not clearly articulated in the existing regulations, and in 10 countries the validity of the individual operating license is less than 15 years. Such uncertainties regarding fees, renewal conditions and relatively short license terms make infrastructure investments riskier for mobile operators and thus deter investments into rural areas that are more challenging in terms of their commercial viability.

Box 9.1 | What are the regulatory good practices for ICT?

REGULATORY GOOD PRACTICES FOR ICT	SOME COUNTRIES WHICH IMPLEMENT THE PRACTICE
A general authorization regime is in place.	COLOMBIA, DENMARK
A technology and service neutrality principle is applied.	THE NETHERLANDS, SERBIA
The validity of the operating license is more than 15 years.	CAMBODIA, MEXICO
Operating license costs are transparent.	BOSNIA AND HERZEGOVINA, KENYA
Renewal conditions for operating and spectrum licenses are predictable.	TANZANIA, THAILAND
Low frequency spectrum is allocated to mobile operators.	KOREA, REP., VIETNAM
Digital dividend bands are licensed to mobile operators.	ROMANIA
Voluntary spectrum trading is allowed.	CHILE, INDIA
Passive and active infrastructure sharing are allowed.	MALAYSIA, POLAND

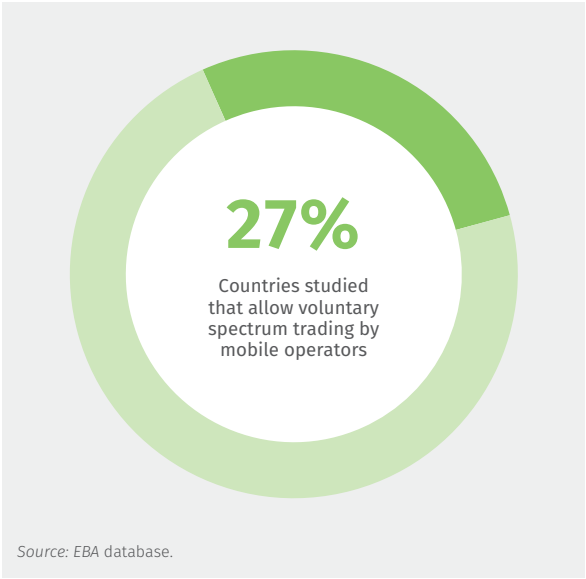
Source: EBA database.

Figure 9.3 | Digital dividend promotes greater coverage for rural areas



Source: EBA database.

Figure 9.4 | Voluntary spectrum trading facilitates better allocation and more efficient use of resources



Source: EBA database.

Promote greater coverage for rural areas through efficient spectrum management

To provide mobile services, telecommunication network providers have to obtain permission from the government to use radio frequencies or electromagnetic spectrum waves to operate within a network. Efficient spectrum management by the government incentivizes private sector investments to rollout networks to rural and remote areas. If mobile operators are permitted to use digital dividend bands, deployment costs are reduced, as fewer base stations are needed to cover the same geographic area. As such, good spectrum management that allows for a digital dividend to be licensed to mobile operators is useful for rural areas where population density is low and rollout costs are high.[15] Among the 62 countries studied, only 24 have licensed the digital dividend spectrum to mobile operators (figure 9.3). No countries studied in the East Asia and Pacific or the Sub-Saharan Africa regions have licensed the digital dividend to mobile operators. In contrast, all OECD high-income countries have licensed a digital dividend to mobile operators.

In addition to digital dividend use, good spectrum management also allows for voluntary spectrum trading, "a mechanism whereby rights and any associated obligations to use spectrum can be transferred from one party to another in the market." This process can facilitate more efficient allocation and use of scarce spectrum resources, and foster innovation and the introduction of new services. The countries studied have various regulatory approaches towards spectrum trading, although generally voluntary spectrum trading is associated with higher levels of development. Only 17 of the 62 countries allow the practice, including all 8 OECD high-income countries (figure 9.4). No low-income countries and no countries located in the Sub-Saharan Africa region have implemented voluntarily spectrum trading. The countries that do not allow voluntarily spectrum trading are operating in less open telecommunication markets and in many cases do not implement the principle of technology and service neutrality that allows any service to be provided and any technology to be deployed within suggested frequency bands.

Conclusion

The type of licensing framework and efficiency of spectrum allocation can play important parts in encouraging the private sector to invest and rollout mobile networks in remote areas. The experience of EU countries suggests that greater liberalization of the telecommunications sector, including the introduction of general authorization regimes, supports ubiquitous connectivity. Efficient spectrum management is another regulatory stimulus than can provide benefits to mobile network operators through lower deployment costs and innovation opportunities, and to the end user in terms of greater access to ICT services.

NOTES

1 Jensen 2007.

2 ITU 2016.

3 GSMA 2015.

4 World Bank 2016.

5 World Bank 2012.

6 Vodafone Foundation 2015.

7 Kendal and Singh 2012.

8 GSMA Intelligence Database 2016. https://www.gsmaintelligence.com/. Mobile internet market penetration=total unique mobile internet subscribers expressed as a percentage share of the total market population. Mobile internet means any activity that consumes mobile data (for example, mobile applications for farmers).

9 There is a strong positive correlation between Mobile Connectivity Index (GSMA) and the EBA ICT score (0.70). The correlation is significant at 1% level after controlling for income per capita.

10 See European Commission (2016), *Telecoms*, https://ec.europa.eu/digital-single-market/en/telecoms.

11 See GSMA Intelligence Database (2016), https://www.gsmaintelligence.com/.

12 See World Bank Open Data (2015), http://data.worldbank.org/.

13 In a simple notification system, "[s]ervice providers are required only to provide the regulator with notification of the start and termination of the provision of services or the operation of a network" (InfoDev and ITU 2016).

14 The validity of simple notification in Italy is 20 years.

15 Picot et al. 2009.

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