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Asia-Pacific

ITU Publications

The economic contribution of broadband, digitization and ICT regulation

Econometric modelling for the Asia-Pacific region

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Foreword

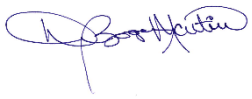
The transformative power of digital technologies and connectivity is empowering people, creating an environment that nurtures innovation, and is triggering positive change in business processes and in the global economy.

The ITU study on the economic contribution of broadband, digitization and ICT regulation provided a global econometric analysis of robust and reliable data resources to measure the impact of fixed and mobile broadband and digital transformation on the economy as a whole. It also analysed the impact of institutional and regulatory variables to the development of the digital ecosystem.

Based on the data and analysis to measure the impact of digitization as a whole, a further need was identified to conduct studies that delved deeper into these effects, focusing on specific regions of the world. By applying the same methodologies and econometric models used for assessing global effects, this study focuses on the impact of broadband, digital transformation and policy and regulatory frameworks on the growth of markets for digital services in the Asia-Pacific region. It also provides evidence of the importance of regulatory and institutional variables in driving digital growth, illustrating that broadband technologies and effective ICT regulation can have positive impacts on the development of national economies and prosperity.

This ITU report suggests that an increase of 10 per cent in mobile broadband penetration would yield a growth of 0.51 per cent in GDP per capita. The impact of policy and regulatory frameworks on the development of digitization was also tested. Importantly, in the case of the Asia-Pacific region, the results also validated the positive impact of the policy and regulatory component in the countries in the region. It was noted that an increase of 10 per cent in the ITU ICT Regulatory Tracker yields a positive increase in the CAF Digital Ecosystem Development Index of 1.875 per cent in the Asia-Pacific countries.

I am delighted that this ever-growing body of research will guide and assist membership in the Asia-Pacific region to design sustainable policies and strategies, and to benefit from the dynamic and exciting broadband ecosystem.



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1 Introduction

The *Economic contribution of broadband, digitization and ICT regulation: Econometric modelling for the Asia-Pacific region* presents a set of econometric analyses that estimate the economic contribution of broadband and digitization, as well as the impact of ICT policy on the development of the digital economy in the Asia and Pacific region. It provides substantial evidence regarding the impact of broadband and digital transformation on the economy and the impact of institutional and regulatory variables on the growth of the digital ecosystem.

This report follows the findings of the ITU global study, published in 2018, on the economic contribution of broadband, digitization, and ICT regulation[1], which was based on a large sample of economies, and demonstrated the following impacts and effects:

- Fixed broadband economic impact is guided by a *returns to scale effect*[2], according to which the economic impact of fixed broadband is greater in high-income country economies than in low-income country economies.
- The economic impact of mobile broadband reflects a *saturation effect*, according to which the mobile broadband contribution is higher in low-income country economies than in mid- and high-income country economies.
- The impact of the digital ecosystem on countries with developed country economies is higher than in developing country economies.
- The regulatory and policy framework has a consistent impact on the development of the digital ecosystem, regardless of the level of development or income.

This evidence was considered significant for policy makers and regulators in particular with regards to two key issues:

- Which technologies should become a policy priority in terms of adoption?
- How to ensure that, beyond broadband adoption, policies are deployed to stimulate the development of the digital ecosystem?

The conclusions generated by this research has prompted calls to conduct studies that delve deeper into these effects, focusing on specific regions of the world. By applying the same methodologies and models used for assessing global effects, this report focuses on the Asia-Pacific region, summarizes the results of the ITU 2018 global study, and presents the results of the analyses for the region.

2 The effects identified on a global scale

This section presents the types of analyses, methodologies and results relied upon for the ITU 2018 global study. Section 3 focuses on countries in the Asia-Pacific region.

The global ITU study cited above focused on testing three effects:

- the economic contribution of fixed and mobile broadband;

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1 Katz, R. and Callorda, F. (2018). *The economic contribution of broadband, digitization and ICT regulation*. Geneva, International Telecommunication Union (https://www.itu.int/en/ITU-D/Regulatory-Market/Documents/FINAL_1d_18-00513_Broadband-and-Digital-Transformation-E.pdf).

2 Generally, the returns to scale effect refers to a reduction in unit cost as the scale of production increases over time, when inputs such as physical capital usage are variable. The ITU report on the impact of broadband on the economy, 2012 (https://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf) states that according to the returns to scale theory, the economic impact of broadband increases exponentially with the penetration of the technology.

- the economic contribution of digitization (a variable that subsumes broadband technology within a larger set of digital ecosystem components); and
- the impact of the policy and regulatory frameworks on the growth of markets for digital services and applications.

The analyses and findings for each of the effects provides the context for the regional models.

2.1 Economic impact of fixed broadband

The structural econometric model in the ITU 2018 global study, composed of four equations[3], generated evidence of the impact of fixed broadband on the economy between 2010 and 2017. The results, based on a model run for a 139 country sample (general fixed broadband model), showed that an increase of 10 per cent in fixed broadband penetration yielded an increase in 0.8 per cent in gross domestic product (GDP) per capita.

The sample was split into three sets (high-, medium-, and low-income countries) to test whether the fixed broadband contribution to GDP increased or decreased depending on the level of economic development:

1. countries with GDP per capita higher than USD 22 000 (50 countries);
2. countries with GDP per capita between USD 12 000 and USD 22 000 (26 countries);
3. countries with GDP per capita lower than USD 12 000 (63 countries).

The results supported the hypothesis that the economic contribution of fixed broadband increases with the level of economic development

- high-income countries: a 10 per cent increase in fixed broadband penetration yields 1.4 per cent increase in GDP growth;
- middle-income countries: a 10 per cent increase in fixed broadband penetration yields 0.5 per cent increase in GDP growth;
- low-income countries: while the coefficient of fixed broadband was similar to that of middle-income countries (10 per cent increase in fixed broadband penetration yields 0.5 per cent increase in GDP growth), the impact was not statistically significant[4].

2.2 Economic impact of mobile broadband

The ITU 2018 global study also shows that mobile broadband has a higher impact than fixed broadband on the world economy. Relying on a structural model run for a 139 country sample (general mobile broadband model), it was estimated that on average an increase of 10 per cent in mobile broadband penetration yielded an increase of 1.5 per cent in GDP. However, using the same three data sets (high-, medium-, and low-income countries) to test the economic impact of mobile broadband *showed that the level of economic contribution of mobile broadband is higher in low-income countries* than in high-income countries, where it had no impact:

- high-income countries: no economic impact was detected;
- middle-income countries: an increase of 10 per cent in mobile broadband penetration yields an increase in 1.8 per cent in GDP;
- low-income countries: an increase of 10 per cent in mobile broadband penetration yields an increase in 2 per cent in GDP.

[3] For descriptions of models and methodologies see the ITU 2018 global study cited in footnote 1.
[4] The coefficient is not statistically significant due to the lack of proof of causality in that model.

This difference reflects the high levels of access to fixed broadband in high-income countries, while mobile network access to broadband is the only technology available to the majority of consumers in low-income countries. Consequently, the mobile broadband contribution to high-income economies is only marginal and the impact of mobile broadband in low-income countries is extremely important.

2.3 Economic impact of digitization

The ITU 2018 global study tested the economic impact of digitization using an endogenous growth model that linked GDP to the fixed stock of capital, labour force, and the CAF Digital Ecosystem Development Index (see section 3.5). The approach followed in this case tested the economic contribution for a sample of 73 countries worldwide (the general digitization model) and then split the results into two sets of countries: those within the Organization for Economic Co-operation and Development (OECD)[5] and non-OECD countries. According to the general digitization model, an increase of 10 per cent in the CAF Digital Ecosystem Development Index resulted in a 1.3 per cent growth in GDP per capita. When the sample was split between OECD and non-OECD countries, economic impact increased in the OECD countries relative to non-OEECD nations:

- OECD countries: An increase of 10 per cent in the CAF Digital Ecosystem Development Index resulted in a 1.4 per cent growth in GDP per capita.
- Non-OECD countries: An increase of 10 per cent in the CAF Digital Ecosystem Development Index yielded a 1.0 per cent growth in GDP per capita.

Furthermore, a single variable model with country and period fixed effects indicated that digitization also has an impact on labour and total factor productivity. An increase in the digitization index of 10 per cent yielded an increase in labour productivity of 2.6 per cent and in total factor productivity of 2.3 per cent.

2.4 Impact of policy and regulatory framework on digitization development

In the ITU 2018 global study, the contribution to digitization development was tested through a multivariate regression model with fixed effects based on two independent variables: the ITU ICT Regulatory Tracker[6] and a year lag of the same variable for control purposes. The model provided further evidence of the importance of the regulatory and institutional variable in driving digital ecosystem growth. An increase of 10 per cent in the ITU ICT Regulatory Tracker yielded a positive increase in the CAF Ecosystem Development Index of 0.348 per cent in the subsequent time period.

Having presented the types of analyses, methodologies and results relied upon for the ITU 2018 global study, section 3 below focuses on validating the results for the Asia-Pacific region, starting with a brief review of the research literature on economic contribution of broadband in the region.

3 The economic contribution of broadband and digitization and the impact of policy on digitization in the Asia-Pacific region

This section analyses the economic contribution of broadband and digitization for the majority of countries (30) in the Asia-Pacific region, including: Afghanistan, Australia, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Fiji, India, Indonesia, Islamic Republic of Iran, Japan, Lao P.D.R.,

[5] Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Republic of Korea, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States of America.

[6] https://www.itu.int/net4/itu-d/irt/#/tracker-by-country/regulatory-tracker/2017

Malaysia, Mongolia, Myanmar, Nepal, New Zealand, Pakistan, Papua New Guinea, Philippines, Republic of Korea, Singapore, Solomon Islands, Sri Lanka, Thailand, Timor-Leste, Tonga, Vanuatu, and Viet Nam[7]. Countries included in each analysis are indicated at the beginning of each section.

3.1 Review of the research literature

Research on the economic impact of broadband in the Asia-Pacific region often relies on econometric analysis, either cross-sectional or country specific. Within the cross-sectional group, a study by McKinsey & Co (2009) based on a comparison of broadband policies and penetration across selected countries in the Asia-Pacific region concluded that an increase of 10 per cent in broadband penetration would lead to approximately 0.6 to 0.7 per cent increase in GDP growth. The study concluded that the collective gross domestic product (GDP) could generate an additional USD 150 billion to USD 180 billion and could generate more than 6.5 million jobs if the region was on par with the Europe region in broadband penetration.

Similarly, in a study of the contribution of mobile technology to economic growth in a selection of countries in the Asia-Pacific region[8], analysts of Oxford Economics (2016) measured the impact of mobile Internet on labour productivity as well as the increase in the labour participation rate. The first relationship was specified through a Dynamic Generalized Method of Moments, according to which an additional subscription of mobile broadband per 100 inhabitants is associated with a 0.03 per cent increase in labour productivity. On the other hand, a similar increase in one subscription of mobile broadband per 100 population is associated with a 0.006 percentage point increase in labour participation rate. With these two relationships, the study quantified the future impact of mobile Internet technology to GDP growth and job creation.

In a similar vein, GSMA analysts (2017) studied the impact of the mobile economy in selected countries in the Asia-Pacific region[9], by assessing the direct, indirect and productivity contribution to the GDP, and measuring the generation of direct and indirect employment. The direct contribution in 2016, estimated at 1.6 per cent of GDP, was calculated with the value added by infrastructure providers, mobile operators, device manufacturers, distributors, and content and applications developers. The indirect contribution was estimated at 0.6 per cent of GDP, while the productivity impact reached 3 per cent of output. On the other hand, direct employment amounted to 6.4 million jobs, while indirect jobs reached 9.7 million.

The growing availability of country data enabled researchers to develop country-specific models to understand the causal links between broadband and development in the region. For example, a study by Analysys Mason (2015), which focused on the economic impact of fixed and mobile broadband in Thailand, relied on a multiplier approach where the factors were developed by examining prior research results. The authors stipulated that depending on a country's ICT maturity, a 10 per cent point increase in broadband penetration leads to an increase in GDP of between 0.26 per cent and 0.92 per cent. In terms of job creation, the addition of 1 000 new broadband connections results in the creation of up to 33 new jobs. Based on these multipliers, an increase in broadband connections from 52 per cent in 2013 to 133 per cent in 2020 for Thailand was estimated to yield a cumulative GDP increase of USD 23 billion.

Similarly, in a study for the Australian Communications and Media Authority, researchers for the Centre for International Economics (2014) estimated the impact of mobile broadband in Australia. This study was based on a survey of over 1 000 businesses and concluded that between 2006 and 2013, mobile broadband contributed to 4.60 per cent of overall productivity growth. By relying on

[7] These countries (Democratic People's Republic of Korea, Kiribati, Maldives, Marshall Islands, Micronesia, Nauru, Samoa, Tuvalu) were excluded for lack of data.

[8] The study focuses on Brunei Darussalam, Cambodia, Indonesia, Lao P.D.R., Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam.

[9] This study focused on China, India, Indonesia, Japan, Malaysia, Myanmar, Philippines, and Republic of Korea. However, the research methodology is not spelled out in the study.

a general equilibrium model, the study concluded that mobile broadband had increased the growth rate of the Australia economy by 0.28 per cent between 2007 and 2013.

A microeconomic study of ICT impact on firm productivity in Japan (Motohashi, 2003) based on observations of 9 500 companies, and relying on a Cobb Douglas production function, concluded that using intra firm broadband networks exhibited 1.0 per cent higher in Total Factor Productivity growth rate. Coincidentally, a study by Jitsuzumi (2009) concluded that if the potential of ubiquitous networks is fully utilized, the real GDP growth rate will be about 1 to 1.1 points higher than otherwise.

In an econometric analysis of mobile penetration in India, Kathuria (2010) stipulated that Indian states with high mobile penetration can be expected to grow faster than those states with lower mobile penetration rates, by 1.2 percentage points a year more on average for every 10 per cent increase in the penetration rate. The corresponding correlation between per capita income and other ICT indicators across states were also positive but not as large: between fixed and per capita income, it is 0.8, for Internet and per capita income, it is 0.66, while for broadband and per capita income, it is 0.62.

Finally, according to a four equation model[10] (similar to the one implemented in this ITU report) Katz and Koutroumpis (2012) estimated that in the case of the Philippines, a 1 per cent increase in mobile broadband connections yielded 0.036 per cent of GDP growth. Based on this coefficient, mobile broadband is estimated to have contributed an annual 0.32 per cent of GDP. This represented 6.9 per cent of all GDP growth for the economy during the past decade, given that GDP in the Philippines grew at a compound annual average rate of 4.6 per cent. In addition, given the acceleration of mobile broadband penetration since 2005, the impact of the technology had almost doubled, reaching 0.61 per cent of GDP and representing 7.3 per cent of all economic growth in the Philippines. This result further reinforced the increasing returns to scale hypothesis for network infrastructures.

3.2 Hypotheses

Considering the evidence generated in the research literature and the ITU 2018 global study that preceded the Asia-Pacific region analysis, different types of effects could be stipulated in some countries in the Asia-Pacific region:

- high impact of fixed broadband for high-income countries;
- low impact of mobile broadband for middle-income countries;
- high impact of digitization for high-income countries.

In addition to testing the economic impact of broadband (fixed and mobile) and digitization, the impact of policy and regulatory frameworks on the development of digitization was also tested.

[10] State-of-the-art econometric models currently in use consist of four equations: an aggregate production function modelling the economy and, subsequently, three functions: demand, supply and output. Originally developed by Roller and Waverman (2001) and implemented by Koutroumpis (2009), Katz and Koutroumpis (2012a; 2012b), and Katz and Callorda (2014; 2016; 2018).

3.3 Economic impact of fixed broadband in the Asia-Pacific region

The estimation of the economic contribution of fixed broadband in the Asia-Pacific region relied on the same structural model used in the ITU 2018 global study and in the estimation of effects in other regions. The model consists of four equations: an aggregate production function modelling the economy and, subsequently, three functions: demand, supply and output.

Data

To test the hypothesis of fixed broadband economic impact presented above, a database of the countries mentioned above was built, containing time series for all the required variables between 2011 and 2017. The data sources are the International Telecommunication Union, the World Bank, and Ovum (see Annexes A and B for sources of data).

Model results and discussion

Table 1 presents the model results for 18 countries in the Asia-Pacific region: Australia, Bangladesh, Cambodia, China, India, Indonesia, Islamic Republic of Iran, Japan, Malaysia, New Zealand, Pakistan, Philippines, Republic of Korea, Republic of Nepal, Singapore, Sri Lanka, Thailand, Viet Nam[11].

Table 1: Economic impact of fixed broadband (Asia-Pacific region)

GDP per capita (purchasing power parity (PPP))	
Fixed Broadband Subscribers Penetration	0.16321 ***
Capital	0.06453 *
Education	0.32973 **
Fixed Broadband Subscribers Penetration	
Fixed Telephone Subscribers	0.26323 ***
Rural Population	-0.06317
GDP per capita	0.76166 ***
Fixed Broadband price	-0.06035
HHI Fixed Broadband	-0.11748 **
Revenue Fixed Broadband	
GDP per capita	0.42119 ***
Fixed Broadband price	1.02013 ***
HHI Fixed Broadband	-0.15685
Fixed Broadband Adoption Growth	
Revenue Fixed Broadband	-0.60433 ***
Observations	463
Number of countries	18

[11] Some countries in the region were not included because they either exhibit less than 2% household adoption of fixed broadband, or they lack data on industry structure (a key variable in the structural model).

Country Fixed Effects	Yes
Year and quarter Fixed Effects	Yes
Years	2011-2017
R-Squared first model	0.9978

***, **, * significant at 1%, 5%, and 10% critical value respectively

As expected, according to the fixed broadband general model, this technology has had a significant economic contribution in the Asia-Pacific region during the last six years (2011-2017). An increase of 10 per cent in fixed broadband penetration yields an increase in 1.63 per cent in GDP per capita. Capital formation and education have also had a positive impact on GDP growth. It is important to note that the exclusion of countries with less than 2 per cent household fixed broadband adoption confirms the return to scale hypothesis.
The Asia-Pacific region results for fixed broadband are positive and statistically significant, and higher than the impact for high-income countries in the global sample (1.63 vs 1.40) (see Table 2 and 13).

Table 2: Economic impact of fixed broadband for high-income countries (Global model compared to the Asia-Pacific region)

	Global ITU study - High-income countries	Asia-Pacific region
GDP per capita (PPP)		
Fixed Broadband Subscriber Penetration	0.14047 ***	0.16321 ***
Capital	0.30257 ***	0.06453 *
Education	-0.11711 ***	0.32973 **
Fixed Broadband Subscriber Penetration		
Fixed Telephone Subscribers	0.39270 ***	0.26323 ***
Rural Population	0.04370 ***	-0.06317
GDP per capita	0.15746 ***	0.76166 ***
Fixed Broadband Price	0.22080 ***-	-0.06035
HHI Fixed Broadband	-0.21266 ***	-0.11748 **
Fixed Broadband Revenue		
GDP per capita	-0.48618 ***	0.42119 ***
Fixed Broadband Price	1.46762 ***	1.02013 ***
HHI Fixed Broadband	-0.81781 ***	-0.15685
Fixed Broadband Adoption Growth		
Fixed Broadband Revenue	-0.82810 ***	-0.60433 ***
Observations	1,364	463
Number of countries	50	18

	Global ITU study - High-income countries	Asia-Pacific region
Country Fixed Effects	Yes	Yes
Year and quarter Fixed Effects	Yes	Yes
Years	2010-2017	2011-2017
R-Squared first model	0.9848	0.9978

***, **, * significant at 1%, 5%, and 10% critical value respectively

NOTE: The global model was built starting in 2010 given that by then most countries had exceeded the 5 per cent adoption threshold.

3.4 Economic impact of mobile broadband in the Asia-Pacific region

The fixed broadband model, like the structural model used to test the economic contribution of mobile broadband, comprises an aggregate production function modelling the economy and, three subsequent functions, demand, supply and output.

Data

To test the economic impact of mobile broadband hypothesis presented above, a database was built for the following 24 countries: Afghanistan, Australia, Bangladesh, Cambodia, China, India, Indonesia, Islamic Republic of Iran, Japan, Lao P.D.R., Malaysia, Mongolia, Myanmar, Republic of Korea, Republic of Nepal, New Zealand, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, Thailand, Vanuatu, Viet Nam. The database contains time series for all the required variables between 2011 and 2017 for observations with an adoption rate higher than 4 per cent of the population. The data sources are the International Telecommunication Union, the World Bank, and GSMA (see Annexes A and B for sources of data).

Model results and discussion

The model was run for all 24 countries in the Asia-Pacific region (listed above) for seven years (2011-2017), yielding statistically significant results, and thereby confirming the effects identified in the global model. The results are as presented in Table 3.

Table 3: Economic impact of mobile broadband (Asia-Pacific region)

GDP per capita (PPP)	
Mobile Broadband Unique Subscribers Penetration	0.05091 ***
Capital	0.01831
Education	0.41805 ***
Mobile Broadband Unique Subscribers Penetration	
Mobile Unique Subscribers Penetration	1.34777 ***
Rural Population	-0.04220 **
GDP per capita	0.11848 ***
Mobile Broadband Price	0.02943
HHI Mobile Broadband	-0.11985 ***

Revenue Mobile Broadband	
GDP per capita	1.49669 ***
Mobile Broadband price	-0.16775
HHI Mobile Broadband	-0.11985 ***
Mobile Broadband Adoption Growth	
Revenue Mobile Broadband	-0.79806 ***
Observations	633
Number of countries	24
Country Fixed Effects	Yes
Year and quarter Fixed Effects	Yes
Years	2011-2017
R-Squared first model	0.9982

***, **, * significant at 1%, 5%, and 10% critical value respectively

According to the mobile broadband model for the 24 selected countries in the Asia-Pacific region, an increase of 10 per cent in mobile broadband penetration yields an increase of 0.51 per cent in GDP per capita. The importance of fixed capital formation is not statistically significant although it presents a positive sign. Similarly, education remains as important as in the fixed broadband model. In the aggregate, mobile broadband appears to have a lower economic impact than fixed broadband (1.63 per cent versus 0.51 per cent increase in GDP per capita as a result of 10 per cent increase in broadband penetration).

This sample includes the most developed countries in the region, which as evidenced in the ITU 2018 global study, appears to yield a lower economic impact than fixed broadband. This finding is also confirmed when comparing the Asia-Pacific region model results with those of the ITU 2018 global study (general mobile broadband model.

Table 4: Economic impact of mobile broadband (Global sample compared to the Asia-Pacific region)

	Global	Asia Pacific
GDP per Capita (PPP)		
Mobile Broadband Unique Subscribers Penetration	0.15022 ***	0.05091 ***
Capital	0.21490 ***	0.01831
Education	0.05569 ***	0.41805 ***
Mobile Broadband Unique Subscribers Penetration		
Mobile Unique Subscribers Penetration	1.6797 ***	1.34777 ***
Rural Population	-0.03596 ***	-0.04220 **
GDP per capita	0.05968 ***	0.11848 ***
Mobile Broadband price	0.00728	0.02943

	Global	Asia Pacific
HHI Mobile Broadband	-0.37128 ***	-0.11985 ***
Revenue Mobile Broadband		
GDP per capita	0.08839 ***	1.49669 ***
Mobile Broadband price	0.11020 **	-0.16775
HHI Mobile Broadband	-2.12035 ***	-0.11985 ***
Mobile Broadband Adoption Growth		
Revenue Mobile Broadband	-1.14176 ***	1.49669 ***
Observations	3,858	633
Number of countries	139	24
Country Fixed Effects	Yes	Yes
Year and quarter Fixed Effects	Yes	Yes
Years	2010-2017	2011-2017
R-Squared first model	All	0.9982

***, **, * significant at 1%, 5%, and 10% critical value respectively

As depicted in Table 4, the global sample model, which includes a larger percentage of developing countries than the Asia-Pacific region model, indicates a higher coefficient of mobile broadband economic contribution.

To test the hypothesis that impact of mobile broadband is higher in emerging economies, the high-income countries were excluded (Australia, Japan, New Zealand, Singapore and Republic of Korea) from the Asia-Pacific region sample. In this case, an increase of 10 per cent in mobile broadband penetration yields an increase in 2.43 per cent in GDP[12] (see table 5).

Table 5: Economic impact of mobile broadband (Asia-Pacific region mid- and low-income countries)

GDP per Capita (PPP)	
Mobile Broadband Unique Subscribers Penetration	0.24389 ***
Capital	0.02877
Education	0.30639
Mobile Broadband Unique Subscribers Penetration	
Mobile Unique Subscribers Penetration	1.19652 ***
Rural Population	0.02148
GDP per capita	0.04730
Mobile Broadband price	0.03705

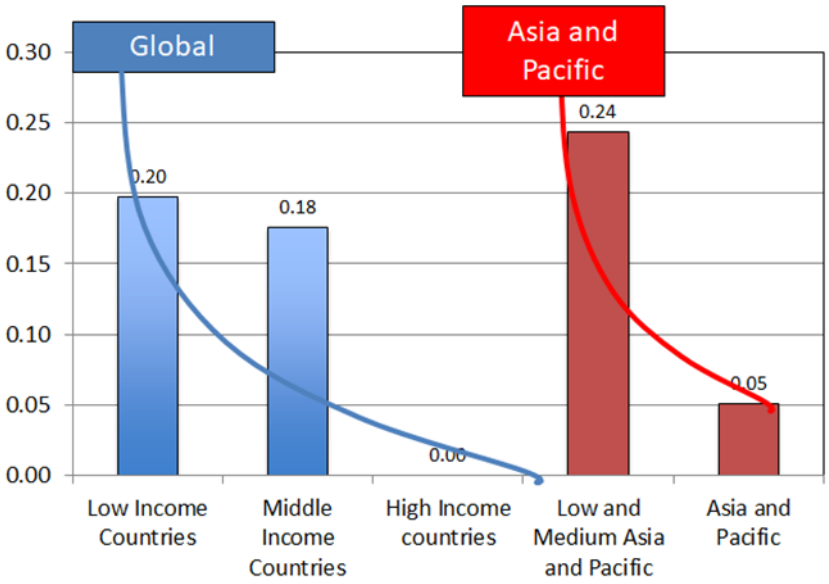
[12] In this model we only consider observations with adoption rate higher than 12% of population. In that point, the growth rate of the technology reduces significantly the variance.

HHI Mobile Broadband	0.05752 ***
Revenue Mobile Broadband	
GDP per capita	1.53028 ***
Mobile Broadband price	-0.38190 **
HHI Mobile Broadband	-1.46858 ***
Mobile Broadband Adoption Growth	
Revenue Mobile Broadband	-0.32794 ***
Observations	398
Number of countries	18
Country Fixed Effects	Yes
Year and quarter Fixed Effects	Yes
Years	2011-2017
R-Squared first model	0.9955

***, **, * significant at 1%, 5%, and 10% critical value respectively

When high-income countries in the Asia-Pacific region are excluded from the sample, the mobile broadband contribution coefficient increases from 0.51 to 2.43. A comparison of level of impact for the global sample and for Asia-Pacific region is shown in Figure 1.

Figure 1: Economic impact of mobile broadband (Global sample vs. Asia-Pacific region 2017)



Source: ITU

As depicted in Figure 1, the structural model compared to both data samples yields similar saturation effects, confirming the mobile broadband hypothesis.

3.5 Economic impact of digitization in the Asia-Pacific region

In addition to measuring the impact of a single communications technology-broadband-, the economic contribution of digitization, as measured by the CAF (Corporación Andina de Fomento) Digital Ecosystem Development Index[13] (Katz and Callorda, 2018e) was also tested. The hypothesis to be tested in this case is whether the economic contribution of digitization increases in high-income countries relative to emerging economies. For this purpose, the endogenous growth model, which links GDP to the fixed stock of capital, labour force, and the CAF Digital Ecosystem Development Index as a proxy of digital technology progress, was run for 30 countries in the Asia-Pacific region.

Data

The CAF Digital Ecosystem Development Index was calculated for Afghanistan, Australia, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Republic of Korea, Fiji, India, Indonesia, Islamic Republic of Iran, Japan, Lao P.D.R., Malaysia, Mongolia, Myanmar, Republic of Nepal, New Zealand, Pakistan, Papua New Guinea, Philippines, Singapore, Solomon Islands, Sri Lanka, Thailand, Timor-Leste, Tonga, Vanuatu, Viet Nam.

In addition, the model included independent variables for fixed capital formation (source: World Bank), GDP per capita (source: IMF), and tertiary school enrolment, as a proxy for labour quality (source: World Bank).

Model results and discussion

The model was first run for 30 countries[14] over seven years (2011-2017), which resulted in 210 observations, and included fixed effects by year (see table 6).

Table 6: Economic impact of digitization (Asia-Pacific region)

Variable	Coefficients
Previous GDP	0.46987 *** (0.06445)
Digitization	0.18906 *** (0.05987)
Capital	0.08080 (0.05338)
Labour	0.33793 (0.33050)
Constant	3.75917 *** (0.58804)
Observations	210
Year fixed effects	Yes

***, **, * significant at 1%, 5%, and 10% critical value respectively

[13] The CAF Digital Ecosystem Development Index developed with funding from CAF Development Bank for Latin America.

[14] Afghanistan, Australia, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Fiji, India, Indonesia, Islamic Republic of Iran, Japan, Lao P.D.R., Malaysia, Mongolia, Myanmar, New Zealand, Pakistan, Papua New Guinea, Philippines, Republic of Korea, Republic of Nepal, Singapore, Solomon Islands, Sri Lanka, Thailand, Timor-Leste, Tonga, Vanuatu, Viet Nam.

According to the model, an increase of 10 per cent in the CAF Digital Ecosystem Development Index results in a 1.89 per cent growth in GDP per capita. Therefore, an increase in the Digital Ecosystem Development Index from 50 to 51 will yield an increase of per capita GDP of 0.38 per cent (accounting both for direct and indirect effects on output).

The coefficient of economic impact of digitization in the Asia-Pacific region model is 40 per cent higher than the impact of the OECD model developed in the ITU 2018 global study, except that this result is not as robust as that developed for the global sample because of the reduced number of observations (see table 7).

Table 7: Economic impact of digitization, 2017 (Asia-Pacific region compared to OECD)

Variable	Asia-Pacific region	OECD
Previous GDP	0.46987 *** (0.06445)	0.6783 *** (0.0311)
Digitization	0.18906 *** (0.05987)	0.1351 * (0.0711)
Capital	0.08080 (0.05338)	0.2105 *** (0.0291)
Labour	0.33793 (0.33050)	-0.0736 (0.0502)
Constant	3.75917 *** (0.58804)	2.3371 *** (0.3823)
Observations	210	374
Year fixed effects	Yes	Yes

***, **, * significant at 1%, 5%, and 10% critical value respectively

3.6 Impact of policy and regulatory framework on digitization in the Asia-Pacific region

The following analysis relies on the ITU ICT Regulatory Tracker as the independent variable to test its impact on the CAF Digital Ecosystem Development Index. For this purpose, as in the ITU 2018 global study cited above, two models were developed: the first tests the correlation between the ICT Regulatory Tracker and the CAF Digital Ecosystem Development Index. The underlying premise is that higher regulatory performance is directly related to the development of the digital economy:

$$\text{Dig. Index}_{it} = \beta_1 \text{Reg. Index}_{it} + \text{Year F. E.} + \text{Country F. E.} + e_{it}$$

Beyond measuring the correlation between both variables, the second model was developed with lagged variables:

$$\text{Dig. Index}_{it} = \beta_1 \text{Reg. Index}_{it} + \beta_2 \text{Reg. Index}_{it-1} + \text{Year F. E.} + \text{Country F. E.} + e_{it}$$

Finally, the variables were converted to logarithms to test causality of change in the values of both indices:

$$\ln(\text{Dig. Index}_{it}) = \beta_1 \ln(\text{Dig. Index}_{it-1}) + \beta_2 \ln(\text{Reg. Index}_{it-1}) + \text{Year F. E.} + \text{Country F. E.} + e_{it}$$

Data

The models in this case rely on the ICT Regulatory Tracker and the CAF Digital Ecosystem Development Index for the period between 2008 and 2017 for Afghanistan, Australia, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Fiji, India, Indonesia, Islamic Republic of Iran, Japan, Lao P.D.R., Malaysia, Mongolia, Myanmar, New Zealand, Pakistan, Papua New Guinea, Philippines, Republic of Korea, Republic of Nepal, Singapore, Solomon Islands, Sri Lanka, Thailand, Timor-Leste, Tonga, Vanuatu, Viet Nam. The CAF Digital Ecosystem Development index includes an institutional and regulatory pillar, which had to be excluded from the calculations in order to avoid co-linearity. Once the index was recalculated, it was possible to test the impact of the ICT Regulatory Tracker on digitization.

Model results and discussion

As in the prior section, a correlational analysis between both indices was initially run (results are presented in table 8).

Table 8: Correlation between the ICT Regulatory Tracker and the CAF Digital Ecosystem Development Index (Asia-Pacific region)

CAF Digital Ecosystem Development Index (without the regulatory pillar)	Coefficient (standard deviation) Asia-Pacific region
ICT Regulatory Tracker	0.43486 (0.02353)***
Constant	4.64202 (1.29862) ***
R-square	0.5332
Fixed effects for year and country	Yes
Countries	30
Observations	330
Years	2007-2017

***, **, * significant at 1%, 5%, and 10% critical value respectively

In order to test for the causal link, a control of a one-year lag of the ICT Regulatory Tracker was also added (see table 9).

Table 9: Impact of lagged ICT Regulatory Tracker on the CAF Digital Ecosystem Development Index (Asia-Pacific region)

CAF Digital Ecosystem Development Index (without regulatory sub-index)	Coefficient (Standard deviation) Asia-Pacific
CAF Digital Ecosystem Development Index (without regulation pillar)	0.21101 (0.04695)***
ICT Regulatory Tracker (t-1)	0.24801 (0.04157)***
Constant	4.33466 (1.45038) ***

CAF Digital Ecosystem Development Index (without regulatory sub-index)	Coefficient (Standard deviation) Asia-Pacific
R-squared	0.5585
Fixed effects for year and country	Yes
Groups	30
Observations	330
Years	2008-2017

***, **, * significant at 1%, 5%, and 10% critical value respectively

In this model, it was found that an additional point in the ICT Regulatory Tracker yields 0.21101 points higher in the CAF Digital Ecosystem Development Index (without the regulatory sub-index) in the same period and 0.24801 higher in the subsequent period, which by adding both effects yields a total coefficient of 0.45902.

Considering that the two previous models tested the correlation between both indices, the variables were converted to logarithms to assess change. Additionally, the CAF Digital Ecosystem Development Index was recalculated without the regulatory and the competition pillars (given the potential co-linearity with the ICT Regulatory Tracker is high) (see table 10).

Table 10: Impact of lagged ICT Regulatory Tracker on the CAF Digital Ecosystem Development Index (Asia-Pacific region)

Log CAF Digital Ecosystem Development Index (without the regulatory and competition pillars)	Coefficient (Standard deviation) Asia-Pacific region
Log CAF Digital Ecosystem Development Index (without regulation and competition pillars) (t-1)	0.03179 (0.00162)***
Log ICT Regulatory Tracker (t-1)	0.18752 (0.02372)***
Constant	1.61231 (0.07790) ***
R-Squared	0.7526
Fixed effects for year and country	Yes
Groups	30
Observations	330
Years	2008-2017

***, **, * significant at 1%, 5%, and 10% critical value respectively

In this case, it is possible to prove the hypothesis: an increase of 10 per cent in the ICT Regulatory Tracker yields a positive increase in the CAF Digital Ecosystem Development Index of 1.875 per cent in the subsequent time period.

In order to further test the relationship between the regulatory and the digital ecosystem indices, a set of alternative correlations between pillars was also run (see Table 11).

Table 11: Correlations between ICT Regulatory Tracker and CAF Digital Ecosystem Development Index pillars (Asia-Pacific region)

Pillars	ICT Regulatory Tracker	ICT Regulatory Tracker (without Competition)	Regulatory authority component	Regulatory mandate component	Regulatory regime component	Competition framework component
CAF Digital Ecosystem Development Index	0.4757 (0.0328) ***	0.4777 (0.0358) ***	0.4135 (0.0540) ***	0.4746 (0.0436) ***	0.5128 (0.0257) ***	0.4024 (0.0421) ***
Infrastructure of Digital Services	**0.6528 (0.0495) *****	**0.6808 (0.0537) *****	0.5918 (0.0816) ***	**0.6679 (0.0653) *****	**0.7330 (0.0394) *****	0.5685 (0.0617) ***
Connectivity of Digital Services	0.5327 (0.0370) ***	0.5449 (0.0401) ***	0.4741 (0.0610) ***	0.5444 (0.0489) ***	0.5885 (0.0282) ***	0.4504 (0.0474) ***
Household digitization	0.4699 (0.0345) ***	0.4774 (0.0375) ***	0.4435 (0.0559) ***	0.4748 (0.0454) ***	0.5107 (0.0276) ***	0.3978 (0.0436) ***
Digitization of production	**0.6457 (0.0475) *****	**0.6759 (0.0512) *****	0.5909 (0.0775) ***	**0.6656 (0.0625) *****	**0.7179 (0.0372) *****	0.5166 (0.0610) **
Digital Competitive Intensity	0.3566 (0.0283) ***	0.3325 (0.0312) ***	0.2645 (0.0454) ***	0.3257 (0.0372) ***	0.3572 (0.0245) ***	0.3020 (0.0353) ***
Development of Digital Industries	0.2642 (0.0239) ***	0.2496 (0.0263) ***	0.2256 (0.0382) ***	0.2551 (0.0308) ***	0.2680 (0.0212) ***	0.2262 (0.0290) ***
Digital factors of production	0.4594 (0.0336) ***	0.4469 (0.0369) ***	0.3768 (0.0553) ***	0.4465 (0.0444) ***	0.4958 (0.0270) ***	0.3925 (0.0426) ***

***, **, * significant at 1%, 5%, and 10% critical value respectively

NOTE: The values in bold have correlations higher than 0.60

A second set of regressions shows that the regulatory regime component of the ICT Regulatory Tracker appears to be the main path of impact of the CAF Digital Ecosystem Development Index (see Table 12).

Table 12: Impact of the ICT Regulatory Tracker components on the CAF Digital Ecosystem Development Index pillars (Asia-Pacific region)

	CAF Digital Ecosystem Development Index	Infrastructure of Digital Services	Connectivity of Digital Services	Household digitization	Digitization of production	Digital Competitive Intensity	Development of Digital Industries	Digital factors of production
Regulatory authority component	0.0768 (0.0698)	0.1196 (0.1086)	0.0708 (0.0769)	0.1352 (0.0758) *	0.1347 (0.1020)	0.0650 (0.0671)	0.0250 (0.0589)	0.0128 (0.0748)
Regulatory mandate component	-0.1621 (0.0930) *	-0.2704 (0.1447) *	-0.1661 (0.1024)	-0.1875 (0.1009) *	-0.2535 (0.1359) *	-0.1736 (0.0894 *	-0.0268 (0.0785)	-0.0104 (0.0997)
Regulatory regime component	0.5361 (0.0388) ***	0.7889 (0.0604) ***	0.6179 (0.0427) ***	0.5245 (0.0421) ***	0.7554 (0.0567) ***	0.3845 (0.0373) ***	0.2591 (0.0327) ***	0.5188 (0.0416) ***
Constant	2.1329 (0.1161) ***	1.3189 (0.1805) ***	2.3402 (0.1278) ***	2.1567 (0.1259) ***	0.9998 (0.1696) ***	2.9962 (0.1116) ***	1.9717 (0.0979) ***	1.9961 (0.1244) ***
R-squared	0.5688	0.5346	0.5925	0.5302	0.5513	0.3974	0.3316	0.5159

***, **, * significant at 1%, 5%, and 10% critical value respectively

Table 12 indicates that the regulatory regime component has a positive and significant impact on every pillar of the CAF Digital Ecosystem Development Index[15]. This could indicate that the regulatory regime could be the components that has a higher impact on digital development[16] in the Asia-Pacific region.

4 Conclusion

This regional analysis on the Asia Pacific region has validated the findings of the ITU 2018 global study on the economic contribution of broadband and digitization as well as the impact of regulation and policy on the digital economy development, based on the following considerations:

- Fixed broadband economic impact is guided by a return to scale effect, according to which the economic impact of fixed broadband is higher in more developed countries than in less developed countries.
- The economic impact of mobile broadband depicts a saturation effect, according to which its contribution is higher in less developed than in more developed countries.
- The impact of the digital ecosystem on high-income economies is higher than in developing countries.
- The regulatory and policy framework has an impact on the development of the digital ecosystem.

[15] The regulatory regime component includes indicators such as type of licenses provided to offer telecommunication services, obligations to publish interconnection offers by operators, monitoring of quality of service, infrastructure sharing for mobile operators permitted and/or mandated, unbundled access in local loop, spectrum secondary trading allowed, and number portability.

[16] While the second component of the ICT Regulatory has sometimes a negative sign, the coefficient of regulatory regime is always bigger and positive.

An assessment of the research literature on the Asia-Pacific region provided some validation of the findings on the ITU 2018 global study. Considering the evidence generated in the research literature and the global study that preceded this analysis, we stipulated different types of effects for each sub-region in the Asia-Pacific region:

- Impact of fixed broadband: The impact should be higher considering the weight that high-income economies (Australia, Japan, New Zealand, Republic of Korea, Singapore) have in the Asia-Pacific region, while it would be lower in the rest of countries if the high-income economies were to be excluded.
- Impact of mobile broadband: The impact should be lower considering the weight of high-income economies (Australia, Japan, New Zealand, Republic of Korea, Singapore) have in Asia Pacific. However, if high-income economies are excluded from the sample, the impact should be higher.
- Impact of digitization: The impact should be high considering high-income economies in the Asia-Pacific region (Australia, Japan, New Zealand, Republic of Korea, Singapore).

The evidence yielded by the econometric analysis amply confirms these hypotheses (Table 13).

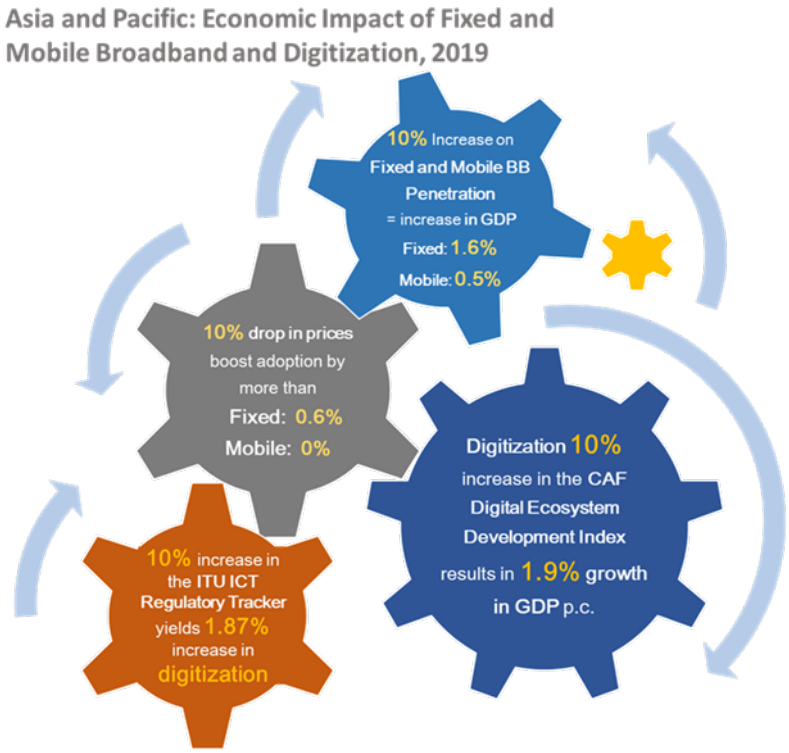
Table 13: Summary of results of econometric models (Asia-Pacific)

Hypotheses	10 % increase impact on GDP per capita growth			
	Asia-Pacific totals	Asia-Pacific low- and medium-income countries	Global Study high-income countries	Global Study low-income countries
Economic impact of fixed broadband	1.63	0.00	1.40	0.00
Economic impact of mobile broadband	0.51	2.43	0.00	1.98
Economic impact of digitization	1.89		1.35 (OECD countries)	1.04 (non-OECD countries)

- Impact of fixed broadband: The contribution of the total sample for the Asia-Pacific region is comparable to the high-income ITU 2018 global study results due to the weight of high-income economies in the Asia-Pacific region, while it has zero impact in both low-income groups.
- Impact of mobile broadband: The Asia-Pacific region low- and medium-income countries have a higher contribution coefficient than the total for all Asia-Pacific countries, which is consistent with the ITU 2018 global study.
- Impact of digitization: while results are less reliable due to sample size, the impact in the Asia-Pacific region is as high as countries in the ITU 2018 global study.

The conclusions Asia-Pacific region analyses are depicted in Figure 2.

Figure 2: Main findings for the Asia-Pacific region



Source: ITU

The analysis of the impact of policy and regulatory framework on the growth of markets for digital services and applications aimed to test the impact of regulation and regulatory authorities on the development of the digital economy. As illustrated in the previous sections, all models were run for the Asia-Pacific region. In this case, the results also validated the positive impact of the policy and regulatory variable. An increase of 10 per cent in the ICT Regulatory Tracker yields a positive increase in the CAF Digital Ecosystem Development Index of 1.875 per cent for the Asia-Pacific region in the subsequent time period.

A second set of regressions shows that of all the components of the ICT Regulatory Tracker, the regulatory regime component appears to be the main path of impact of the CAF Digital Ecosystem Development Index. This analysis provided further evidence of the importance of the regulatory and institutional variable in driving the growth of the digital ecosystem.

Annex A: List of data sources for models testing the economic impact of fixed and mobile broadband

Indicator	Source
GDP per capita (PPP)	IMF
Fixed broadband subscriber penetration	ITU- OVUM
Capital- Gross capital formation (percentage of GDP)	World Bank
Education- School enrolment, tertiary (per cent gross)	World Bank
Fixed telephone subscribers	ITU
Rural population (per cent of total population)	World Bank
Fixed broadband price	ITU
HHI fixed broadband	OVUM
Fixed broadband revenue	ITU- OVUM
Mobile broadband unique subscriber penetration	GSMA
Mobile unique subscriber penetration	GSMA
Mobile broadband price/ARPU	ITU- GSMA
HHI mobile broadband	GSMA
Mobile broadband revenue	GSMA

Annex B: Indicators in the Digital Ecosystem Development Index and data sources

Pillar	Sub-pillar	Indicator	Source
Infrastructure	Investment	Telecommunications investment per capita in current prices – five year average (USD PPP)	World Bank; ITU
	Quality of service	Average fixed broadband download speed (Mbit/s)	Akamai
	Quality of service	Average mobile broadband download speed (Average Mbit/s)	Akamai
	Quality of service	Fixed broadband connections with download speed higher than 4 Mbit/s (percentage)	Akamai
	Quality of service	Fixed broadband connections with download speed higher than 10 Mbit/s (percentage)	Akamai
	Quality of service	Fixed broadband connections with download speed higher than 15 Mbit/s (percentage)	Akamai
	Quality of service	Fibre optic broadband connections as a percentage of total fixed broadband connections	ITU; FTTH; OECD
	Quality of service	International broadband bandwidth per Internet user (bit/s)	ITU
	Coverage	Fixed broadband coverage (% of households)	Eurostat, CAF Ideal; OECD
	Coverage	2G coverage	ITU
	Coverage	3G coverage	ITU
	Coverage	4G coverage	ITU
	Service infrastructure	IXPs per 1 000 000 population	Packet Clearing House; UNCTAD
	Service infrastructure	Number of secure servers (per 1 000 000 population)	World Bank
	Service infrastructure	Number of satellites (per 1 000 000 population)	N2yo.com

Pillar	Sub-pillar	Indicator	Source
Connectivity	Affordability	Monthly fixed broadband subscription as percentage of GDP per capita	ITU
	Affordability	Monthly mobile broadband Smartphone subscription (500 MB cap, prepaid) as percentage of GDP per capita	ITU
	Affordability	Monthly mobile broadband PC subscription (1 GB cap, post-paid) as percentage of GDP per capita	ITU
	Affordability	Monthly pay TV subscription as percentage of GDP per capita	Business Bureau; CAF; PwC; TAS
	Penetration	Fixed broadband penetration (connections per 100 households)	ITU
	Penetration	Mobile broadband penetration (connections per 100 population)	ITU
	Penetration	Unique mobile broadband users (per 100 population)	GSMA
	Penetration	Pay TV penetration (connections per 100 households)	Business Bureau; CAF; PwC; TAS; ITU; Convergencia
	Ownership	Penetration of computers (% of households)	ITU
	Ownership	Smartphone users (per 100 population)	GSMA
	Ownership	Percentage of population with access to electric energy	World Bank
Household digitization	Internet use	Percentage of population using the Internet	ITU
	Internet use	Penetration of dominant social network (users per 100 population)	OWLOO
	Internet use	Mobile data ARPU as percentage of total ARPU	GSMA
	E-government	E-government index	ONU
	E-commerce	Internet commerce as percentage of total retail commerce	Euromonitor
	Telemedicine	National health policy (binary variables)	WHO
	OTTs	Video on demand penetration (per cent households)	PWC

Pillar	Sub-pillar	Indicator	Source
Digitization of production	Digital infrastructure	Per cent enterprises with Internet access	UNCTADstat; TAS; Eurostats
	Digital supply chain	Per cent enterprises using Internet for electronic banking	UNCTADstat; TAS; Eurostats
	Digital supply chain	Per cent enterprises using Internet for purchasing inputs	UNCTADstat; TAS; Eurostats
	Digital distribution	Per cent enterprises that sell products over the Internet	UNCTADstat; TAS; Eurostats
	Digital processing	Per cent workforce using the Internet	UNCTADstat; TAS; Eurostats
	Digital processing	Per cent workforce using computers	UNCTADstat; TAS; Eurostats
Competitive intensity	Competition level	HHI fixed broadband	Convergencia; Regulators; TAS
	Competition level	HHI mobile broadband	GSMA; Regulators
	Competition level	HHI pay TV	Convergencia; Dataxis; Ofcom; TAS; Reguladores
	Competition level	HHI mobile telephony	GSMA; Regulators
Digital industries	Exports	High technology exports (USD per capita in current prices)	World Bank
	Exports	ICT services exports (USD per capita in current prices)	World Bank
	Weight of digital industries	Digital ecosystem sales as a percentage of GDP	PWC; TAS; ITU
	Weight of digital industries	Telecommunications operators revenues per capita (USD in current prices)	ITU
	Weight of digital industries	Computer software spending (per cent of GDP)	INSEAD
	Internet of Things	M2M connections (per 100 population)	ITU; OECD
	Content production	Wikipedia pages edited per month (per million population between 15 and 69 years old)	INSEAD

Pillar	Sub-pillar	Indicator	Source
Factors of digital production	Human capital	Education years expectancy (years)	World Bank; UNESCO
	Human capital	Tertiary school enrolment (per cent population)	World Bank; UNESCO
	Schools	Per cent educational establishments with Internet access	UNESCO; CEPAL
	Schools	Computers per students ratio	UNESCO; CEPAL
	Innovation	USPTO patents per country (per 1 000 000 population)	USPTO
	Innovation	Intellectual property revenues (USD per capita PPA in current prices)	World Bank
	Investment in innovation	R&D spending (per cent of GDP)	World Bank; UNESCO
	Economic development	GDP per capita (USD current prices)	IMF
	Economic development	Electric energy consumption (kWh per capita)	World Bank
Institutional and regulatory	Cyber-security and piracy	Per cent of non-licensed installed software	BSA, The software alliance
	Cyber-security and piracy	Commercial value of non-licensed software (as per cent of GDP)	BSA, The software alliance
	Government role	Per cent of regulatory agency attributions based on ITU regulatory tracker	ITU; TAS
	Government role	Per cent of regulatory agency functions based on ITU regulatory tracker	ITU; TAS
-	-	Population	World Bank
-	-	Exchange rate PPP	IMF
-	-	Number of households	ITU
-	-	GDP per capita for first quintile (USD in current prices)	IMF; World Mundial

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