Economic and Social Impact of Broadband and Development of Digital Agendas

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The study of the impact of broadband and digital agendas addresses two distinct phenomena across three dimensions:

**BROADBAND**
- Economic impact of infrastructure deployment
- Social and economic spillovers of a general purpose technology
- Economic, social, and political impact of utilization of broadband to transport digitized content

**DIGITIZATION**

**ECONOMIC**
- Economic growth
- Employment
- Productivity

**SOCIAL**
- Poverty reduction
- Consumer welfare

**POLITICAL**
- Transparency
- Political participation
- Administrative efficiency
We will first define the independent variables driving impact and then focus on the three dimensions of impact

- A refined view of the independent variables: fixed broadband, mobile broadband, and digitization
  - Economic impact
  - Social impact
  - Political impact

- Conclusion
Broadband impact assessment needs to differentiate between fixed and mobile technologies

**ECONOMIC**
- Primary platform for enterprise and government usage
- Primary platform for creating/enhancing consumer markets
- Household adoption

**SOCIAL**
- Primary platform for enhancing quality of public services (health, education)

**POLITICAL**
- Primary platform for consumer access to information

**FIXED BROADBAND**
- Primary platform in emerging markets
- Individual adoption

**MOBILE BROADBAND**
While fixed and mobile broadband services are part of a single ecosystem, their diffusion processes are quite dissimilar.
Digitization is the capacity to use broadband and other digital technologies to generate, process, share and transact information

- To achieve a significant impact, digitization has to be widely adopted in the economic and social fabric of a given nation
  - Utilized by individuals, economic enterprises and societies
  - Embedded in processes of delivery of goods and services
  - Relied upon to deliver public services
- For this condition to occur, digitization has to fulfill several conditions
  - Affordable: it has to be sufficiently affordable to allow scalable impact
  - Ubiquitous: it is supported by telecommunications networks and reaching most population of a national territory
  - Accessible: networks need to be accessed by multiple fixed and mobile voice and data devices
  - Reliable: networks have to provide sufficient capacity to deliver vast amounts of information at speeds that do not hinder their effective use
The level of digitization is measured through a composite index which includes infrastructure and utilization metrics

### DIGITIZATION INDEX

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Components</th>
<th>Sub-components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affordability</td>
<td>Residential fixed line cost adjusted for GDP per capita</td>
<td>Residential fixed line tariff (3 minute call to a fixed line at peak rate) adjusted for GDP per capita</td>
</tr>
<tr>
<td></td>
<td>Mobile cellular cost adjusted for GDP per capita</td>
<td>Mobile cellular prepaid tariff (1 minute call off-net at peak rate) adjusted for GDP/capita</td>
</tr>
<tr>
<td></td>
<td>Fixed broadband Internet access cost adjusted for GDP per capita</td>
<td>Monthly residential price for a fixed broadband connection</td>
</tr>
<tr>
<td>Infrastructure reliability</td>
<td>Investment in telecommunications per telecom subscriber (mobile, broadband and fixed)</td>
<td>Mobile investment per capita</td>
</tr>
<tr>
<td></td>
<td>Mobile investment per capita</td>
<td>Broadband investment per capita</td>
</tr>
<tr>
<td>Network Access</td>
<td>Network penetration</td>
<td>Fixed Broadband penetration</td>
</tr>
<tr>
<td></td>
<td>Mobile Phone penetration</td>
<td>Mobile broadband penetration</td>
</tr>
<tr>
<td></td>
<td>Other penetration metrics and coverage infrastructure</td>
<td>PC Population penetration</td>
</tr>
<tr>
<td></td>
<td>Mobile cellular network coverage</td>
<td>Mobile cellular network coverage</td>
</tr>
<tr>
<td>Capacity</td>
<td>International Internet bandwidth</td>
<td>International Internet bandwidth (kbps/user)</td>
</tr>
<tr>
<td></td>
<td>Broadband speed</td>
<td>Broadband speed (% of connections with download speed over 2 Mbps)</td>
</tr>
<tr>
<td>Usage</td>
<td>Internet retail</td>
<td>Internet retail as percent of total retail</td>
</tr>
<tr>
<td></td>
<td>e-Government</td>
<td>E-government Web measure index</td>
</tr>
<tr>
<td></td>
<td>Individuals using the internet</td>
<td>Percentage of individuals using the Internet</td>
</tr>
<tr>
<td></td>
<td>Non-voice services as % of wireless ARPU</td>
<td>Non-voice (data, message, VAS) spending as percentage of wireless ARPU</td>
</tr>
<tr>
<td></td>
<td>Social network visitors</td>
<td>Dominant Social Network Unique Visitors per month Per Capita</td>
</tr>
<tr>
<td></td>
<td>SMS usage</td>
<td>SMS usage per subscriber</td>
</tr>
<tr>
<td>Human Capital</td>
<td>Engineers</td>
<td>Engineers as a percentage of total population</td>
</tr>
<tr>
<td></td>
<td>Skilled Labor</td>
<td>Labor force with more than a secondary education as a percentage of the total labor force</td>
</tr>
</tbody>
</table>

Source: Katz and Koutroumpis (2013)
The index was calculated for 184 countries, indicating that countries tend to follow four developmental stages.

Source: Katz, Koutroumpis, and Callorda (2013)
We observe also that, while being highly related to broadband, “digitization is measuring something more than broadband adoption”

Source: analysis by the author
The components of the digitization index also measure a country performance across specific areas.

- For all countries, normalized usage sub-index never matches the levels of access sub-indices, which indicate a big challenge across the world.
- For all OECD and middle income countries, the sub-indices affordability and network access tend to be consistently above the digitization index indicating that countries have addressed the access challenge.
- The affordability and capacity sub-indices tend to rapidly drop at low GDP levels.
Having established the distinctions between fixed/mobile broadband and digitization, we now turn to review their respective impact.

- A refined view of the independent variable: fixed broadband, mobile broadband, and digitization
- Economic impact of broadband and digitization
- Social impact
- Political impact
- Conclusion
The economic impact of broadband and digitization is comprised of several effects:

**Broadband**
- Output generated by network deployment (value added, multipliers, "leaked investments")
- Spill-over effects
- Jobs generated by network deployment (direct, indirect, induced)
- Spill-over effects
- Willingness to pay minus price

**Digitization**
- Output generated by direct and indirect effects
- Jobs generated by direct and indirect effects
- Willingness to pay minus price
The infrastructure effect comprises the contribution of investment in network roll-out to GDP and employment.

**Broadband**
- Output generated by network deployment (value added, multipliers, "leaked investments")
- Spill-over effects

**Digitization**
- Output generated by direct and indirect effects

**GDP Growth**
- Jobs generated by network deployment (direct, indirect, induced)
- Spill-over effects

**Job creation**
- Jobs generated direct and indirect effects

**Consumer surplus**
- Willingness to pay minus price
Infrastructure effect: Three types of network construction effects exist

<table>
<thead>
<tr>
<th>EFFECT</th>
<th>DESCRIPTION</th>
<th>EMPLOYMENT EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct jobs and output</td>
<td>• Employment and economic production generated in the short term in the course of deployment of network facilities</td>
<td>• Telecommunications technicians</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Construction workers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Civil and RF engineers</td>
</tr>
<tr>
<td>Indirect jobs and output</td>
<td>• Employment and production generated by indirect spending (or businesses buying and selling to each other in support of direct spending)</td>
<td>• Metal products workers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Electrical equipment workers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Professional Services</td>
</tr>
<tr>
<td>Induced jobs and output</td>
<td>• Employment and production generated by household spending based on the income earned from the direct and indirect effects</td>
<td>• Consumer durables</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Retail trade</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Consumer services</td>
</tr>
</tbody>
</table>
Infrastructure effect: Estimates from several countries indicate that network construction effects and multipliers are significant.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>RESEARCHER / INSTITUTION</th>
<th>STIMULUS INVEST. (US$ million)</th>
<th>NETWORK DEPLOYMENT JOBS ESTIMATE</th>
<th>MULTIPLIERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DIRECT</td>
<td>INDIRECT</td>
<td>INDUCED</td>
</tr>
<tr>
<td>UNITED STATES</td>
<td>Katz (Columbia)</td>
<td>$6,390</td>
<td>37,300</td>
<td>31,000</td>
</tr>
<tr>
<td></td>
<td>Atkinson (ITIF)</td>
<td>$10,000</td>
<td>63,660</td>
<td>165,815</td>
</tr>
<tr>
<td>SWITZERLAND</td>
<td>Katz (Columbia)</td>
<td>~$10,000</td>
<td>~80,000</td>
<td>~30,000</td>
</tr>
<tr>
<td>GERMANY</td>
<td>Katz (Columbia)</td>
<td>$47,660</td>
<td>281,000</td>
<td>126,000</td>
</tr>
<tr>
<td>UNITED KINGDOM</td>
<td>Liebenau (LSE)</td>
<td>$7,463</td>
<td>76,500</td>
<td>134,500</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>Government</td>
<td>$31,340</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOUTH AFRICA</td>
<td>Katz (Columbia)</td>
<td>$6,006</td>
<td>227,000</td>
<td>102,000</td>
</tr>
</tbody>
</table>


(*) (Direct + indirect)/direct
(**) (Direct + indirect + induced)/direct
Infrastructure effect: the impact on GDP allows estimating the contribution to domestic production versus “leaked” spending

UNITED STATES: NETWORK CONSTRUCTION EFFECTS OF BROADBAND STIMULUS (in $ millions)

Source: Katz and Suter (2009)
The spill-over effects represent the impact of broadband networks as a general purpose technology, over the whole economy.

**Broadband**
- Output generated by network deployment (value added, multipliers, "leaked investments")
- Spill-over effects
- Jobs generated by network deployment (direct, indirect, induced)
- Spill-over effects
- Willingness to pay minus price

**Digitization**
- Output generated by direct and indirect effects
- Jobs generated direct and indirect effects
- Willingness to pay minus price
Spill-over effects: Research to date confirms the contribution to GDP growth but the amount of impact varies widely.
Spill-over effects: The estimates are consistent with growing evidence of increasing returns to broadband penetration.

INCREASING BROADBAND IMPACT ON GDP GROWTH

Low penetration
- Greece, Portugal, Italy, New Zealand, Austria, Hungary, Spain, Ireland
- Average contribution to GDP growth: 0.008

Medium penetration
- Germany, France, Japan, Belgium, UK, Australia, US, Canada, Luxemburg
- Average contribution to GDP growth: 0.014

High penetration
- Denmark, Norway, Netherlands, Sweden, Switzerland
- Average contribution to GDP growth: 0.023

Source: adapted from Koutroumpis (2009)
Spill-over effects: In Latin America, fixed broadband contribution to GDP growth is also related to penetration levels

GDP IMPACT OF 1% INCREASE IN FIXED BROADBAND PENETRATION

<table>
<thead>
<tr>
<th>Country</th>
<th>Type of Model</th>
<th>Period</th>
<th>Number of observations</th>
<th>Impact Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panama</td>
<td>Structural</td>
<td>2000-10</td>
<td>40</td>
<td>0.045</td>
</tr>
<tr>
<td>Ecuador</td>
<td>Structural</td>
<td>2008-12</td>
<td>17</td>
<td>0.052</td>
</tr>
<tr>
<td>Colombia</td>
<td>Simple regression with controls</td>
<td>2006-10</td>
<td>132</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Sources: Katz and Koutroumpis (2012); Katz and Callorda (2013); Katz and Callorda (2011)
Spill-over effects: Mobile broadband economic impact does not appear to be as strong as fixed broadband broadband

**SENegal: Economic Impact of Wireless Broadband**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mobile Broadband Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Growth (GDP)</strong></td>
<td></td>
</tr>
<tr>
<td>Fixed Capital Stock</td>
<td>0.632***</td>
</tr>
<tr>
<td>Labor Force</td>
<td>0.960***</td>
</tr>
<tr>
<td>Mobile Broadband Penetration</td>
<td>0.022***</td>
</tr>
<tr>
<td>Constant</td>
<td>-21.742***</td>
</tr>
<tr>
<td><strong>Demand (Imbbusers)</strong></td>
<td></td>
</tr>
<tr>
<td>GDPC</td>
<td>-1.565</td>
</tr>
<tr>
<td>Mobile Broadband Price</td>
<td>-6.332***</td>
</tr>
<tr>
<td>Competitive Intensity</td>
<td>-2.719***</td>
</tr>
<tr>
<td>Constant</td>
<td>36.994**</td>
</tr>
<tr>
<td><strong>Supply (Irevenue)</strong></td>
<td></td>
</tr>
<tr>
<td>GDPC</td>
<td>-0.157</td>
</tr>
<tr>
<td>Mobile Broadband Price</td>
<td>0.246***</td>
</tr>
<tr>
<td>Competitive Intensity</td>
<td>-0.252***</td>
</tr>
<tr>
<td>Constant</td>
<td>19.885***</td>
</tr>
<tr>
<td><strong>Output (dmb)</strong></td>
<td></td>
</tr>
<tr>
<td>Mobile Broadband Revenue</td>
<td>11.687</td>
</tr>
<tr>
<td>Constant</td>
<td>-218.389</td>
</tr>
<tr>
<td><strong>Controls</strong></td>
<td></td>
</tr>
<tr>
<td>Year Effects</td>
<td>YES</td>
</tr>
<tr>
<td>Quarter Effects</td>
<td>YES</td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>0.99</td>
</tr>
<tr>
<td>Demand</td>
<td>0.96</td>
</tr>
<tr>
<td>Supply</td>
<td>0.39</td>
</tr>
<tr>
<td>Output</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Less impact than fixed broadband since mobile broadband is not used as intensively in accessing the Internet as fixed broadband.

*Sources: Katz and Koutroumpis (2014)*
The assessment of digitization economic impact incorporates additional effects related to utilization of the technology.

**Broadband**
- Output generated by network deployment (value added, multipliers, "leaked investments")
- Spill-over effects
- Jobs generated by network deployment (direct, indirect, induced)
- Spill-over effects
- Willingness to pay minus price

**Digitization**
- Output generated by direct and indirect effects
- Jobs generated direct and indirect effects
- Willingness to pay minus price
An endogenous growth model indicates that the Digitization Index has a positive effect indicating a strong effect on economic output.

- Cobb-Douglas function:

\[ Y = A(t)(K_{it})^a (L_{it})^b \]

where:
- \( A(t) \) indicates the level of digitization
- \( K \) corresponds to fixed capital formation
- \( L \) to labor force

\[
\log(GDP_{it}) = a_1 \log(K_{it}) + a_2 \log(L_{it}) + a_3 \log(D_{it}) + \epsilon_{it}
\]

**Source:** Katz, Koutroumpis, Callorda (2012)

**Table:**

<table>
<thead>
<tr>
<th>GDP (GDP_{it})</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Capital Stock (K_{it})</td>
<td>0.1632 ***</td>
</tr>
<tr>
<td>Labor (L_{it})</td>
<td>0.1406 ***</td>
</tr>
<tr>
<td>Digitization Index (D_{it})</td>
<td>0.0814 ***</td>
</tr>
<tr>
<td>Constant</td>
<td>18.23 ***</td>
</tr>
<tr>
<td>Year Effects</td>
<td>YES</td>
</tr>
<tr>
<td>Country Effects</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>783</td>
</tr>
<tr>
<td>R^2 squared</td>
<td>0.9051</td>
</tr>
</tbody>
</table>

*** denote statistical significance at the 1% level
More importantly, digitization has a higher impact on economic development than broadband alone.

10 POINT INCREASE IN DIGITIZATION YIELDS 0.81% INCREASE IN GDP PER CAPITA

- Full economic impact ICT is achieved through the cumulative adoption of all technologies, in addition to the assimilation and usage in the production and social fabric.
- Achieving broadband penetration is only one aspect of required policies; maximization of economic impact can only be achieved through a holistic set of policies ranging from telecoms to computing to adoption of internet and eCommerce.
The broadband impact on job creation takes place once the networks are deployed.

**GDP Growth**
- Output generated by network deployment (value added, multipliers, "leaked investments")
- Spill-over effects

**Job creation**
- Jobs generated by network deployment (direct, indirect, induced)
- Spill-over effects

**Consumer surplus**
- Willingness to pay minus price

**Broadband**

**Digitization**
- Output generated by direct and indirect effects
- Jobs generated direct and indirect effects
- Willingness to pay minus price
Spill-over effects: The contribution of broadband externalities to employment comprises three simultaneous effects

Incremental broadband penetration → + e-business impact on firm productivity → + Macro-economic productivity → - Impact on employment → -

+ Enhanced innovation → + Impact on employment

+ Outsourcing of services → + Displacement to service sector

Note: This causality chain was adapted from a model originally developed by Fornefeld et al., 2008 in a report for the European Commission
**Spill-over effects:** The models do not differentiate between network deployment impact and job creation resulting from spill-overs

### ECUADOR: IMPACT OF BROADBAND ON JOB CREATION

<table>
<thead>
<tr>
<th>Function</th>
<th>Variables</th>
<th>Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in unemployment Rate</td>
<td>Broadband Penetration</td>
<td>-0.105 *</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>0.758 ***</td>
</tr>
<tr>
<td>Change in employment rate</td>
<td>Broadband Penetration</td>
<td>0.056 ***</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>2.559 ***</td>
</tr>
<tr>
<td>Year fixed effects</td>
<td></td>
<td>Yes (2008-2011)</td>
</tr>
<tr>
<td>Canton fixed effects</td>
<td></td>
<td>Yes (Quito, Guayaquil, Cuenca y otros)</td>
</tr>
<tr>
<td>Observations</td>
<td></td>
<td>47</td>
</tr>
<tr>
<td>$R^2$</td>
<td>Unemployment Rate</td>
<td>92.41 %</td>
</tr>
<tr>
<td></td>
<td>Employment rate</td>
<td>98.46 %</td>
</tr>
</tbody>
</table>

*** 1% Statistical significance ** 5% Statistical significance * 10% Statistical significance

Source: Katz, and Callorda (2013)
The digitization impact on job creation also takes place once the networks are deployed.

**Broadband**
- Output generated by network deployment (value added, multipliers, "leaked investments")
- Spill-over effects

**Digitization**
- Output generated by direct and indirect effects

**GDP Growth**
- Jobs generated by network deployment (direct, indirect, induced)
- Spill-over effects

**Job creation**
- Jobs generated direct and indirect effects

**Consumer surplus**
- Willingness to pay minus price
- Willingness to pay minus price
According to the models, a 10 point increase in digitization leads to a -.82% change in unemployment rate.

- Dependent Variable: unemployment rate
- Independent variable: digitization index ($D_{it}$)
- Control variables: Fixed Capital Formation ($FC_{it}$), Direct Foreign Investment ($IED_{it}$), population enrolled in secondary schools (proxy of workforce qualification) ($ED_{it}$), financial services as percent of imports ($IFS_{it}$)

\[
\log(\text{Unemployment}_{it}) = a_1 \log(FC_{it}) + a_2 \log(IED_{it}) + a_3 \log(ED_{it}) + a_4 \log(IFS_{it}) + a_4 \log(D_{it}) + \epsilon_{it}
\]

Source: Katz y Koutroumpis (2012)
As in the case of GDP growth, digitization has a higher impact on job creation than broadband.

**BROADBAND, DIGITIZATION AND EMPLOYMENT**

- **Contribution to job creation of 10 point increase in variable**

  - **US - Metro Areas**: 0.30
  - **Germany-High**: 0.06
  - **Germany-Low**: 0.03
  - **Mexico**: 0.38
  - **Argentina**: 0.29
  - **Brazil**: 0.46
  - **Chile**: 0.02
  - **DIGITIZATION**: 0.82

  **10 POINT INCREASE IN DIGITIZATION YIELDS 0.82% DECREASE IN UNEMPLOYMENT RATE**

**Broadband Studies**

- Full deployment and assimilation of ICT has a much larger impact on employment because it contributes to more jobs in the ICT sector (software development, Business Process Outsourcing, equipment manufacturing and parts supplies).
- In addition, the impact of assimilation of ICT through enhanced usage has spill-over impact on other sectors of the economy (in particular, trade, financial services, health care).
The consumer surplus estimates are not included in the GDP broadband contribution

**Broadband**
- Output generated by network deployment (value added, multipliers, "leaked investments")
- Spill-over effects

**Digitization**
- Output generated by direct and indirect effects

**GDP Growth**
- Jobs generated by network deployment (direct, indirect, induced)
- Spill-over effects

**Job creation**
- Jobs generated direct and indirect effects

**Consumer surplus**
- Willingness to pay minus price
- Willingness to pay minus price
**Consumer surplus**: utility gain of broadband that can be purchased at a price lower than what consumers are willing to pay

- Benefits that broadband technology (DSL, cable modem, Fttx) yields in relation to dial-up
- Benefits derived from increased broadband penetration (access to new services and information)
- Price declines as a result of competition, technology trends, and productivity gains

Consumer surplus = Willingness to Pay - Price of service
Having examined the economic impact of broadband and digitization, we now turn to reviewing their social impact.

- A refined view of the independent variable: fixed broadband, mobile broadband, and digitization
- Economic impact of broadband and digitization
- Social impact of broadband and digitization
- Political impact
- Conclusion
Broadband has been found to increase average monthly income

ECUADOR: IMPACT ON MONTHLY INCOME (US$ 353.45)

<table>
<thead>
<tr>
<th></th>
<th>US$ (Over two years )</th>
<th>Percent increase (over two years)</th>
<th>Annual increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in individual income for the total sample</td>
<td>US$ 25.76</td>
<td>7.48%</td>
<td>3.67%</td>
</tr>
<tr>
<td>Increase for individuals that already owned a computer</td>
<td>US$ 38.36</td>
<td>8.00%</td>
<td>3.92%</td>
</tr>
<tr>
<td>Increase for individuals that already were Internet users</td>
<td>US$ 51.86</td>
<td>10.27%</td>
<td>5.01%</td>
</tr>
</tbody>
</table>

While the overall effect is larger for men than for women, gender difference disappears if Internet was used before broadband had been adopted.

Source: Katz and Callorda (2013)
The causal links between broadband and poverty reduction are of four types

- **Infrastructure construction**: Broadband deployment requires additional labor for infrastructure construction, operator’s new commercial offices, and technical personnel for installation and maintenance
  - The new demand for labor in a market with an unemployment rate that is already below 5% generates a shift in the demand curve for workers, leading to an increase in equilibrium wages
  - The rise in wages through this channel may reflect a need for better compensation for those workers who, given the low unemployment rates, should receive better wages to meet or exceed their reservation wage

- **Improved labor productivity**: Classic labor economics literature shows that wages in competitive markets equal marginal productivity. As a result, higher labor productivity should yield higher wages

- **Skill “signaling”**: Research shows that the effect of broadband deployment is greater for computer and Internet users. Thus, the introduction of broadband allows workers with digital literacy skills to signal their computer knowledge to potential employers and then use those skills in the workplace in return for a higher wage

- **Reduced search costs**: the introduction of broadband can also help reduce the time required for an effective job search, leading to a reduction in unemployment periods and generating an increase in the migration of underemployed workers to full-time positions, which, in turn, results in higher labor income.
Digitalization also appears to be related to quality of life and other welfare indicators.
For example, digitalization is directly correlated with quality of life.

DIGITIZATION AND QUALITY OF LIFE (2012)

(65 countries)

The higher the Digitization Index, the higher is the Quality of Life Index.

A correlation for 65 countries indicates that 1 point increase in the Digitization Index leads to an increase of 0.59 points in the Quality of Life Index.

While it is not possible to establish a causal relation, the correlation of both indices is clear.

Sources: Gallup (2011); Katz y Koutroumpis (2012)
By reducir inequality, digitization also increases in tandem with the Human Development Index.

**Equation:**

\[ y = 0.2946 \ln(x) - 0.3563 \]

**R²:** 0.9288

**Sources:** United Nations (2012); analysis by the author
Having reviewed the social impact of broadband and digitization, we now turn to the political impact.

- A refined view of the independent variable: fixed broadband, mobile broadband, and digitization
- Economic impact of broadband and digitization
- Social impact
- Political impact
- Conclusion
Digitization is correlated with several dimensions of political development.
For example, the higher the digitization index, more intense is political participation.

Data used: Participation Index is the result of combining a dichotomous system and a three-point score for 60 indicators comprising a democracy index. The participation index is based on 60 questions of the 60 that comprise the democracy index.

Sources: The Economist; analysis by the author
In addition, digitization also contributes to institutional transparency.

Note: the Transparency Index developed by Transparency International is calculated by averaging transparency surveys conducted by the World Bank, The Economist, the IMD (Geneva), the World Economic Forum and Freedom House.

Sources: Transparency International; analysis by the author
Finally, digitization is correlated with efficiency of government administrations

Note: The e-Government Index measures the quality and utility of government sites to provide information, promote participation and provide public services

Sources: UNESCO; analysis by the author
In conclusion...

- A refined view of the independent variable: fixed broadband, mobile broadband, and digitization
- Economic impact of broadband and digitization
- Social impact
- Political impact
- Conclusion
The development of broadband and digitization is linked to economic progress, welfare and political development

- Digitization contributes to economic growth, thereby impacting social welfare
- Digitization also has a positive effect on social inclusion and contributes to various dimensions of the political system
- Based on this evidence, the key objective of Latin American and Caribbean countries is to increase their digitization in order to maximize its economic, social and political impact

Source: Katz, Koutroumpis and Callorde (2013)