THE CONTRIBUTION OF DIGITAL TECHNOLOGIES TO ADDRESS THE PANDEMIC

Dr. Raúl L. Katz

Columbia Institute for Tele-Information

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THIS SEMINAR WILL FOCUS ON FIVE QUESTIONS

- What is the economic impact of digital technologies?
- Can digital technologies mitigate the economic disruption caused by COVID-19?
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THE ECONOMIC CONTRIBUTION OF DIGITAL TECHNOLOGIES IS THE RESULT OF THREE FACTORS

Production of digital goods and services

- Output of industries that are part of the domestic digital ecosystem (telecommunications, IT, media, digital platforms, e-commerce, and collaborative/sharing platforms)
- Typically represents between 4 percent to 8 percent of the Gross Domestic Product (GDP)

Spillovers of digital technology on the economy

- Multiplier effect on the overall economy (productivity gains across business units, gains across players in the value chain, and faster growth among digital players)
- Multiplier effect from digital investments, leading to the development of new business models ("gig" economy)

Consumer welfare from the adoption of digital technology

- Higher standard of living from enhanced empowerment and participation, equal availability of information and services
- Better inclusion of the socially excluded, and more equal availability of social opportunities

DIGITAL TECHNOLOGIES CONTRIBUTE TO JOB CREATION, ALTHOUGH JOBS TEND TO ALSO DISAPPEAR AS A RESULT OF DIGITIZATION

NEGATIVE EFFECTS

- Automation of low skill/highly routinized occupations
- Elimination of tasks requiring low cognitive processing skills
- Polarization of occupational structure

POSITIVE EFFECTS

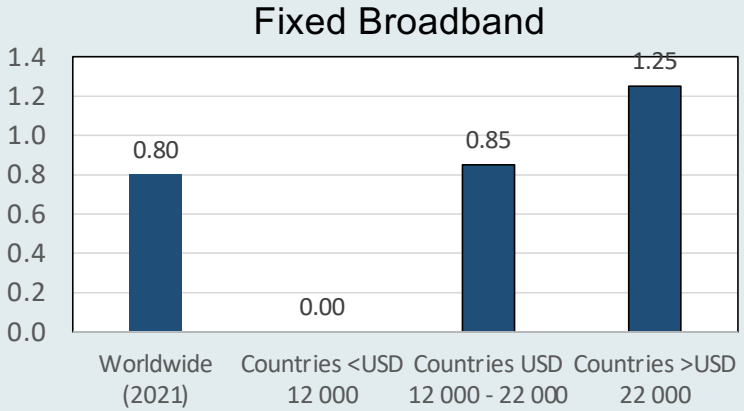
- Increases of the return on capital by the creation of new jobs (the "capitalization" effect
- Preservation of restructured jobs by changing the training requirements
- Creation of employment from the digital sector (new business creation)
- The increase in digitization of production raises a country's national competitiveness, which in turn leads to job creation
- An increase in productivity yielded by the digitization of production leads to a growth in the average income of workers which results in the creation of induced employment

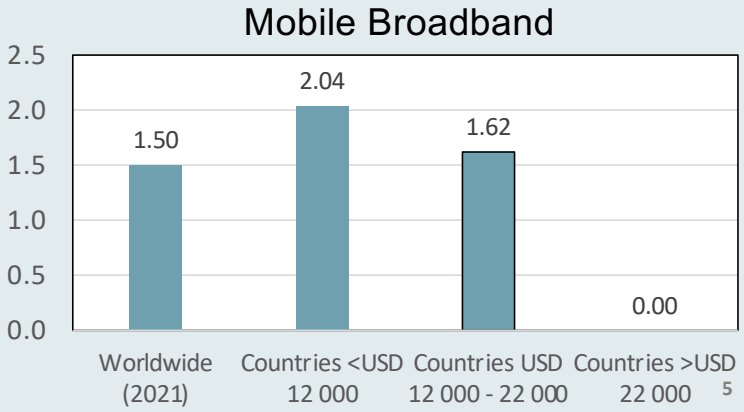
DIGITAL TECHNOLOGIES HAVE PROVEN TO HAVE A CLEAR CONTRIBUTION TO ECONOMIC GROWTH

STRUCTURAL MODEL

Aggregate production function	GDP per capita $_{it}$ = a_1(Capital $_{it}$)+a_2(Education $_{it}$)+a_3 (Broadband Penetration $_{it}$) + e_{it} (1)
Demand function	Broadband Penetration$_{it}$ = b_1(Rural population)$_{it}$ + b_2(Broadband Price)$_{it}$+b_3(GDP per capita)$_{it}$+b_4(HHI)$_{it}$ + e_{it} (2)
Supply function	Broadband Revenue $_{it}$=c_1(Broadband Price)$_{it}$+c_2(GDP per capita)$_{it}$+c_3(HHI Fixed broadband)$_{it}$+ e_{it} (3)
Output function	Δ Broadband Penetration $_{it}$ = d_1 (Fixed Broadband Revenue $_{it}$)+ ε_{4it} (4)

GDP GROWTH IMPACT OF AN INCREASE IN 10% OF BROADBAND PENETRATION





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ANECDOTAL EVIDENCE INDICATES THAT DIGITAL TECHNOLOGIES HAVE BEEN ABLE TO COUNTERACT PART OF THE DISRUPTION GENERATED BY THE PANDEMIC

PANDEMIC

- Lockdowns/shelter in place
- Closing of offices and other places of work
- Disruption of supply chains
- Closing of places of entertainment
- Closing of borders/only essential travel

ECONOMIC LOSSES

- Global recession: -3.3 % in 2020 (deepest since Great Depression)
- Advanced economies hardest hit (-5.8%)
- 90% drop in global airline passenger travel and 30% in cargo traffic
- Unemployment 7.5% in advanced economies and 12% in emerging markets

CONTRIBUTION OF DIGITAL TECHNOLOGIES

- Telecommuting
- Videoconferencing/cloud computing
- Virtualization of supply chains
- Distance learning
- Shift to remote entertainment
- E-commerce
- Telemedicine

OUR ANALYSIS IS AIMED AT TESTING WHETHER ALL COUNTRIES ARE EQUALLY ABLE TO MITIGATE THE ECONOMIC DISRUPTION TRIGGERED BY THE PANDEMIC

MODIFIED FIRST STEP OF STRUCTURAL MODEL

$$Log(GDPpc)_i = \mu_i + \theta Log(GFKF)_{it} + \sigma Log(HK)_{it} + \beta Log(BB\ PEN)_{it} + \delta COVID_{it} + \Upsilon(BB * COVID^2)_{it} + \rho_{i,2020} + \zeta_t + \varepsilon_{it}$$

Impact of COVID: deaths per 100 population

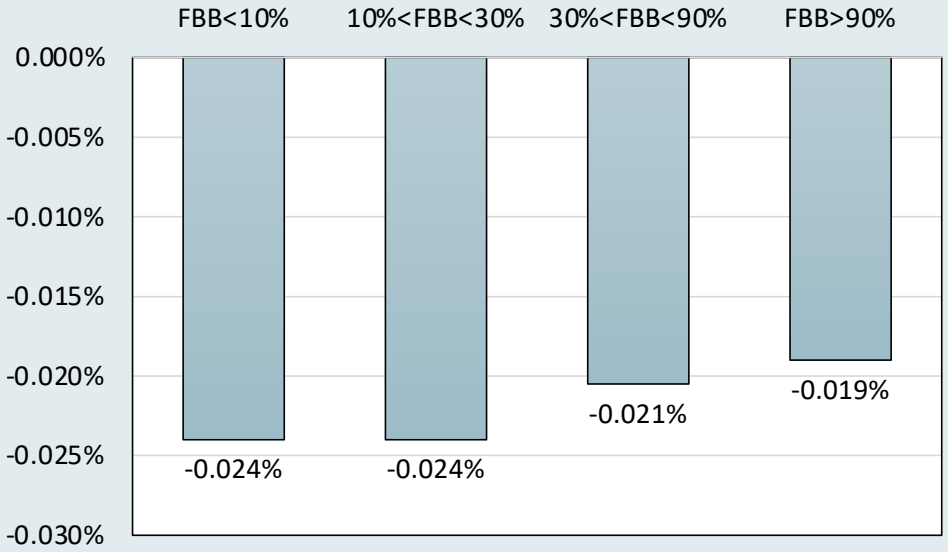
Interaction between broadband and COVID

Broadband HH penetration	Examples
<10%	Afghanistan, Cameroon, Zimbabwe
10%-30%	Indonesia, Paraguay, Namibia
30%-90%	Brazil, Croatia, Lebanon
>90%	United Kingdom, United States, Germany

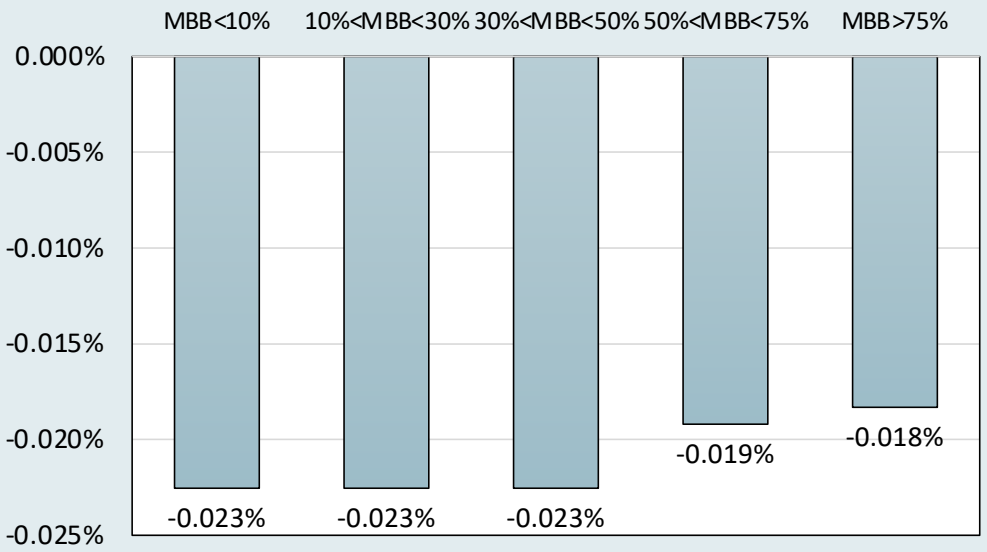
THE RESULTS INDICATE THAT THE MITIGATION OF ECONOMIC DISRUPTION CAUSED BY THE PANDEMIC CAN ONLY BE ACHIEVED AT HIGH LEVELS OF ADOPTION OF DIGITAL TECHNOLOGIES

PERCENTAGE VARIATION IN QUARTERLY GDP PER CAPITA AFTER AN INCREASE OF 1% IN COVID DEATHS PER 100 POPULATION

By level of fixed broadband penetration



By level of mobile broadband penetration



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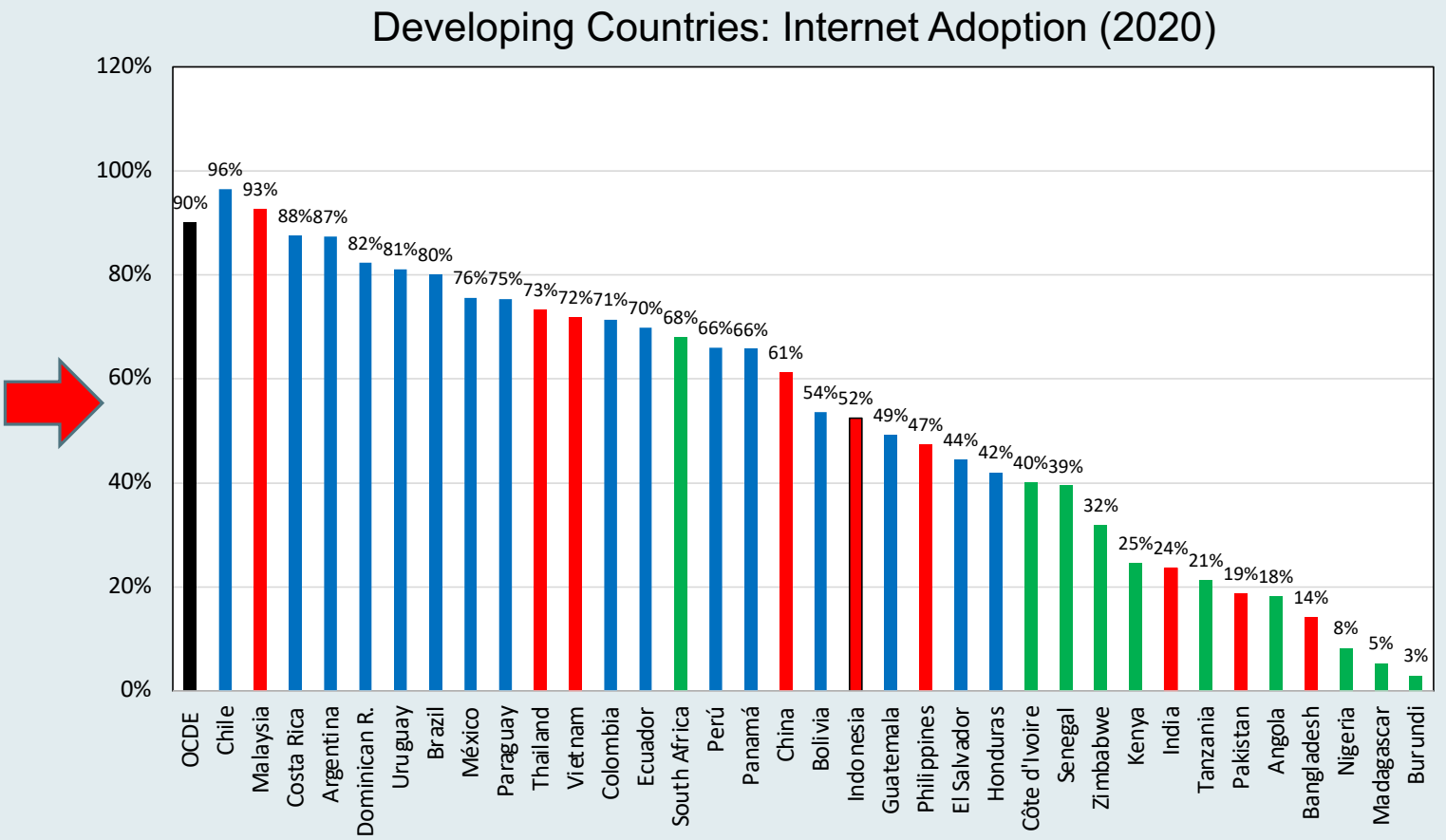
DESPITE THEIR POTENTIAL IMPACT, DIGITAL TECHNOLOGIES ARE NOT EQUALLY DIFFUSED AROUND THE WORLD

- 49 per cent of the world population does not use the Internet
- The larger clusters of non-users are located in Africa (71 per cent), Asia and Pacific (55 per cent) and Arab States (45 per cent)
- Furthermore, 19 per cent of the population in advanced economies are also non-users
- Part of the digital divide can be explained by the lack of network infrastructure: 15.3 per cent of the world population is not yet covered by 4G networks while 30.1 per cent of is unserved by fixed broadband
- The network coverage gap is even larger for state-of-the art technology: 83.9 per cent of world population is not covered by 5G, while 83.1 per cent of households have not adopted fiber optics
- A large portion of the rural population remains unserved by broadband networks: twenty-nine percent of the world's rural population is not served by 4G networks, while the unserved value for the urban population is only five percent
- The unserved rural population is even higher for Africa (78 per cent), Arab States (56 per cent) and Eastern Europe (56 per cent)

THE INTERNET IS ONE OF THE FUNDAMENTAL LEVERS TO FACE THE PANDEMIC IN DEVELOPING COUNTRY HOUSEHOLDS

Internet use under pandemic conditions

- Massive shift to telecommuting
- Distance learning to face school closings
- Isolation mitigant to face quarantine
- Possibility of acquiring goods via e-commerce
- Access to health care information



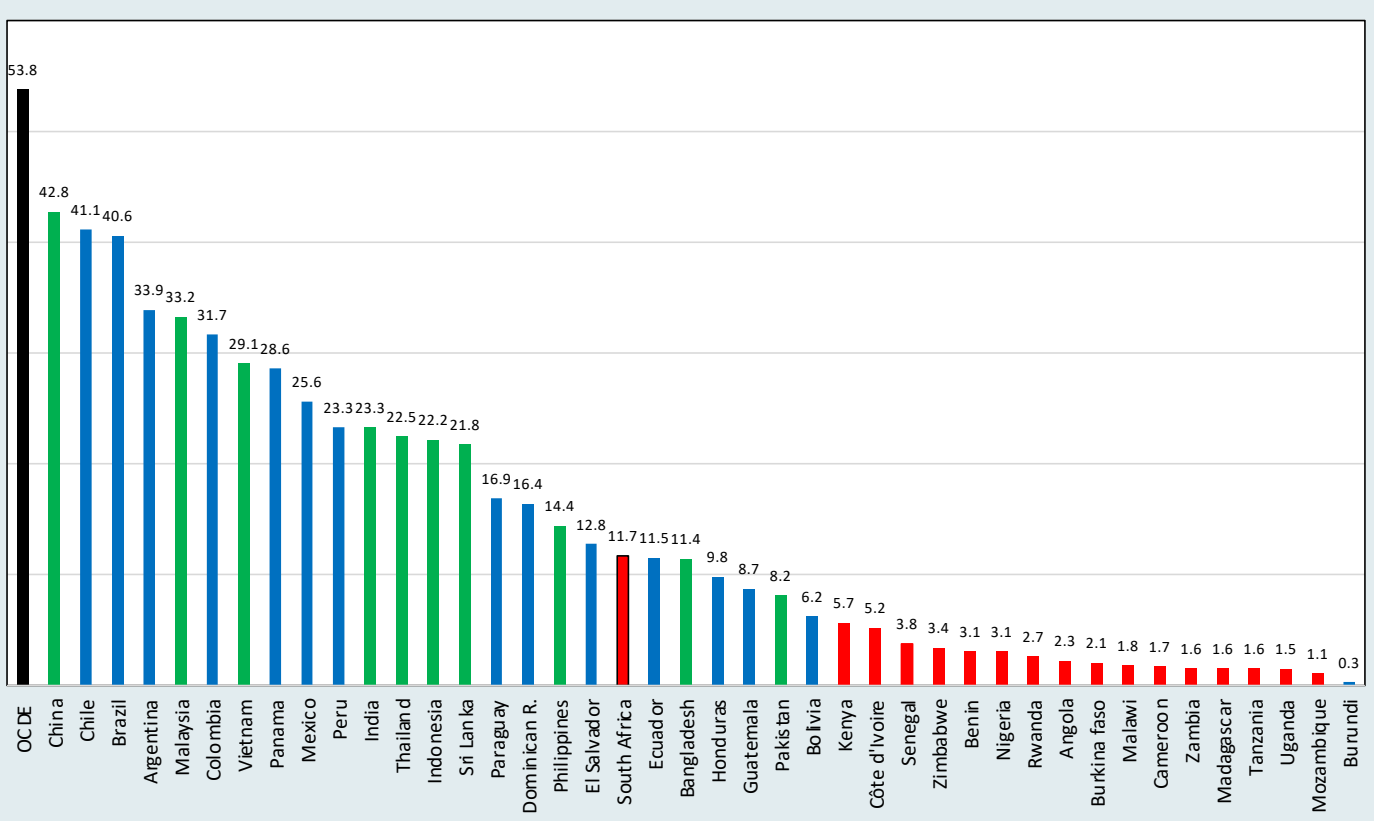
Note: The latest data provided by the ITU are from 2018 or 2019 depending on the country. The data from 2020 have been extrapolated based on last year's growth rate with information from the ITU.
Source: International Telecommunications Union; Telecom Advisory Services analysis

HOWEVER, MOST COUNTRIES IN THE DEVELOPING WORLD DEPICT A LOW LEVEL OF DIGITAL HOUSEHOLD RESILIENCE, WHICH WILL REQUIRE A LONG-TERM EMPHASIS ON USAGE TRAINING

Digital Household Resilience Index

- Composite index
- Min-max normalization
- 30% weight for each indicator and 10% fintech

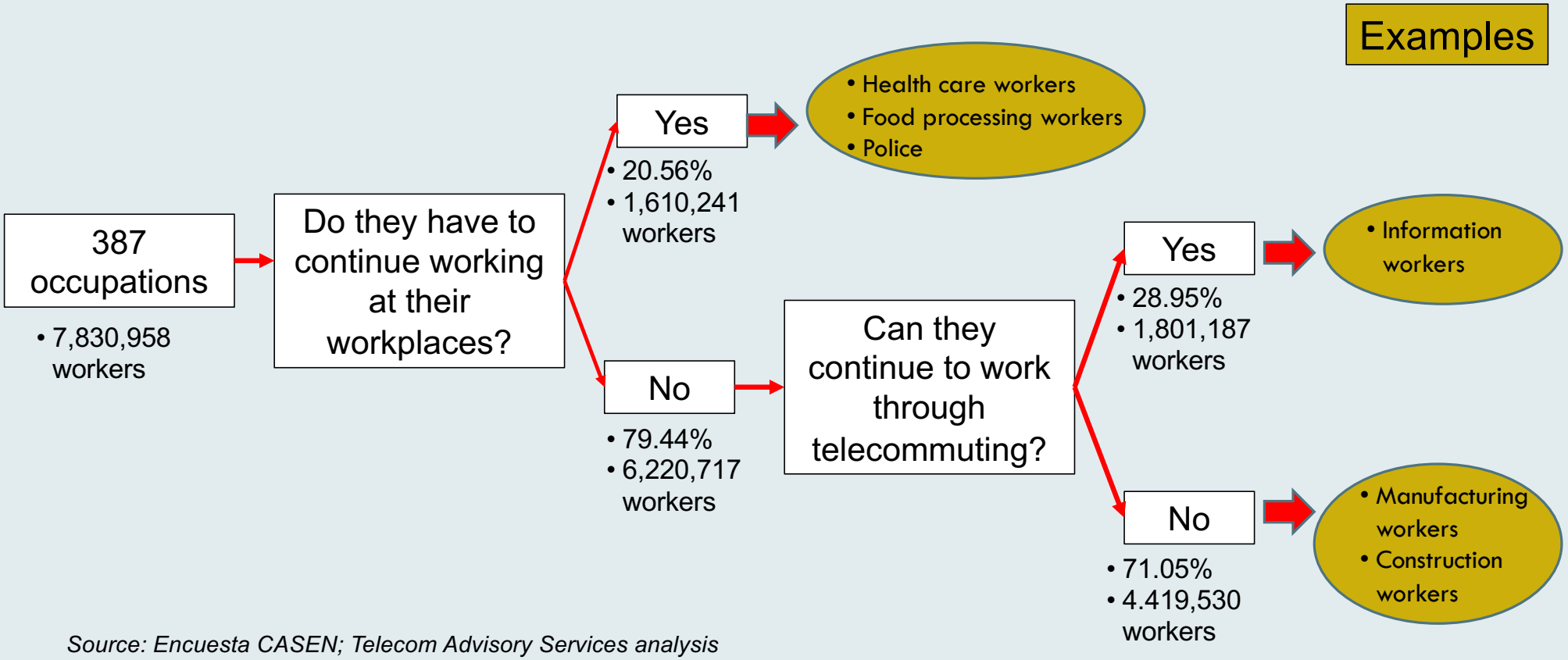
- Number of Healthcare apps downloaded per population (Source: App Annie)
- Number of Educational apps downloaded per population (Source: App Annie)
- Number of Fintech platforms per 1,000,000 population (Source: Crunchbase)
- E-commerce as percentage of total retail trade (Source: Euromonitor)



Source: Telecom Advisory Services analysis

ADDITIONALLY, A LARGE PROPORTION OF THE LABOR FORCE CANNOT CONTINUE TO WORK UNDER LOCKDOWN CONDITIONS

CHILE: TELECOMMUTING IMPACT ANALYSIS METHODOLOGY



Source: Encuesta CASEN; Telecom Advisory Services analysis

THE ANALYSIS OF TELEWORKING LEVELS BY EDUCATIONAL AND INCOME LEVELS INDICATES THE DISPROPORTIONATE IMPACT OF THE PANDEMIC ON THE MOST VULNERABLE SOCIAL GROUPS

	Total	By educational level				By income level				
		No education	Primary education	Secondary education	Tertiary education	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
Workers that continue to work at their workplaces	1,610,241	169,614	384,599	676,925	369,701	192,495	342,862	392,459	407,535	274,586
Workers that do not work at their workplace but can telecommute	1,801,187	29,828	98,872	429,245	1,234,063	61,732	149,758	267,170	436,918	885,610
Workers that do not work at their workplace and cannot telecommute	4,419,530	516,194	1,098, 905	1,819,559	957,042	604,999	985,042	1,080,271	1,056,496	673,520

Source: Encuesta CASEN; Telecom Advisory Services analysis

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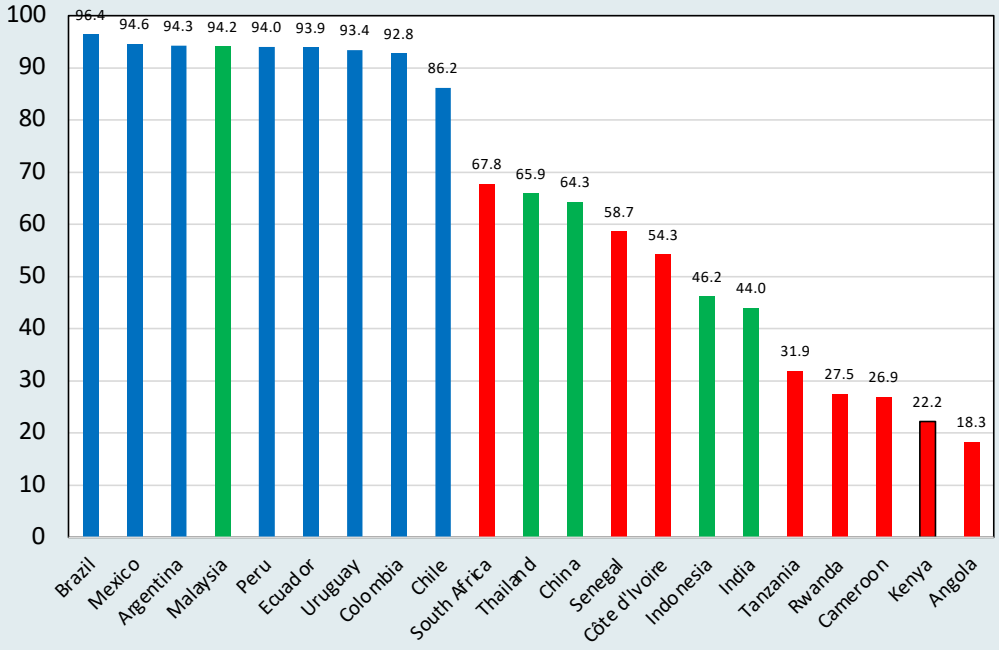
DIGITIZATION IS A CRITICAL COMPONENT OF THE EFFICIENT OPERATION OF A SUPPLY CHAIN

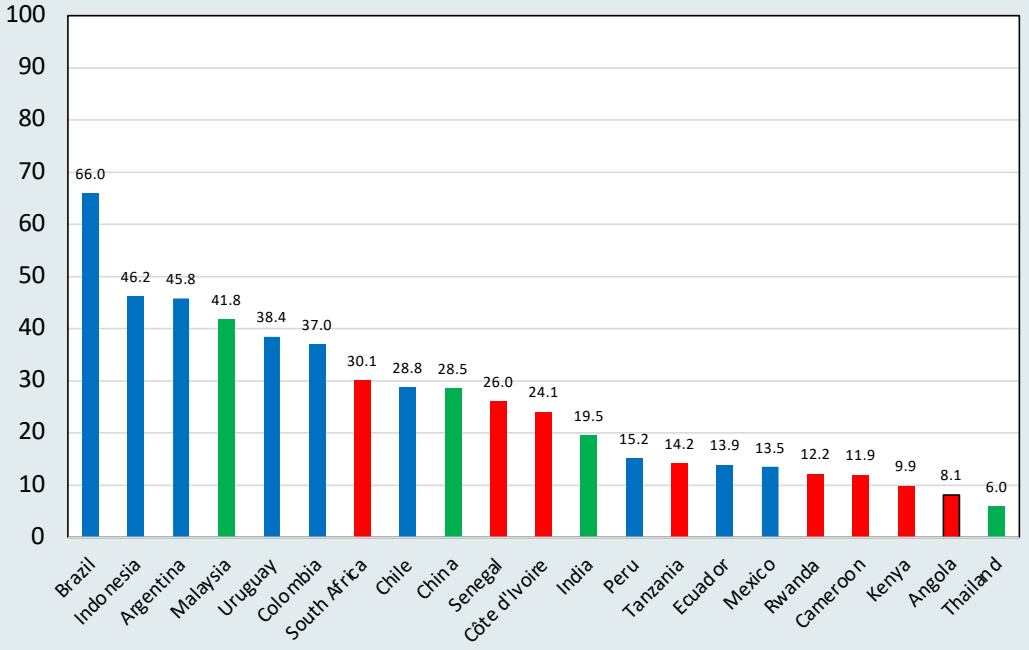
- Manufacturers need to have conducted their digital transformation to handle digital purchase orders of inputs and they have to be ready to interact with logistics firms for their delivery
- Transportation firms need to dispose of tracking information to monitor cargo in transit
- Logistics freighters have to be ready to interact with port operators and customs agencies to handle the automated processing of foreign trade documentation, inspection, etc.
- Port operations have to be sufficiently digitized to be have to route trucks and speed up upload and download operations
- The last mile of urban distribution has to have the capacity to address traffic congestion
- In sum, all stakeholders in the logistics chain have to have an advanced level of digitization to be able to interact among themselves

ENTERPRISE TECHNOLOGY ADOPTION IN DEVELOPING COUNTRIES IS HIGH RELATIVE TO ASSIMILATION OF TECHNOLOGY IN SUPPLY CHAIN OPERATIONS

Developing Countries: Percent of Enterprises connected to the Internet (2018)



Developing Countries: Percent of Enterprises using the Internet to acquire inputs (2018)



Note: The difference between countries is mainly due to differences in survey sampling approaches (e.g. inclusion or not of microenterprises)
Sources*: Argentina.* INDEC; *Brasil.* CETIC.; Chile. Ministerio de Economía, Fomento y Turismo. División de Política Comercial e Industrial*; Colombia.* Ministerio TIC y Cámara de Comercio de Bogotá*;* Ecuador. Instituto Nacional de Estadística y Censos. Perú: Instituto Nacional de Estadística e Informática; *Estimación TAS en base a datos de Eurostat and UNCTAD;* Telecom Advisory Services analysis.

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PUBLIC AND PRIVATE SECTORS, WITH THE SUPPORT OF CIVIL SOCIETY, MUST COLLABORATE AND WORK TOGETHER TO PROMOTE THE ENHANCEMENT OF CERTAIN COMPONENTS OF THE DIGITAL ECOSYSTEM

- Accelerate the deployment of a large number of base stations for mobile broadband, reducing the permit requirements for the deployment of antennas
- Temporarily allocate additional spectrum to mobile operators to face traffic spikes
- Require video streaming service providers to reduce traffic volume generated from high-definition content
- Consider the need to increase unlicensed spectrum in the upper 5 GHz and 6 GHz bands in order to resolve Wi-Fi router bottlenecks.
- Promote platform development innovation in order to improve supply chains. Key activities include stimulating technology companies to develop platforms that can improve the efficiencies between logistics providers and transportation service providers
- Encourage enterprises to further digitize business processes in order to increase the percentage of the workforce that can work remotely
- Invest in the training of the most vulnerable population groups in order to decrease unemployment rates
- Address some of the digital divide factors by providing devices (PCs, tablets, Wi-Fi modems, subsidized broadband service) to vulnerable consumers, and combine with distance learning training on e-education and telemedicine

HOWEVER, THE EVIDENCE GENERATED SO FAR PROVIDES ADDITIONAL GUIDANCE FOR SOME FORWARD-LOOKING ACTIONS

- Governments and regulators in the developing world, need to evaluate initiatives that should reverse the declining capital spending trend and lead to stimulation of telecommunications investment to ensure continuous roll-out of networks
- The importance of ICT in mitigating part of the economic damage of pandemics raises the need for governments to reduce demand side barriers (affordability, digital literacy, local content development) and stimulate adoption of mobile broadband
- The high value of fixed broadband as a mitigant of pandemic-induced economic disruption raises the urgency of countries with underdeveloped fixed connectivity to explore approaches to foster the roll-out of networks, with an initial emphasis in high density urban concentrations

IT IS CRITICAL THAT COUNTRIES BEGIN IMMEDIATE WORK ON A DIGITAL RESILIENCE PLAN TO ADDRESS FUTURE PANDEMIC DISRUPTION

- Conduct a comprehensive diagnostic of country resilience
  - Infrastructure (deployment, service quality, Stress testing of current infrastructure deployed)
  - Components of digital divide (urban vs. rural, income groups, large enterprises vs. SMEs)
  - Assessment of applications and usage levels across social groups
  - Evaluation of level of digitization of production (by sector and enterprise size, entailing both technology adoption and assimilation in business processes)
  - Resilience of state operations (administrative processes and delivery of public services)
- Develop a plan to address shortfalls at each potential points of failure
  - Infrastructure deployment (backbone and distribution networks, spectrum availability – licensed and unlicensed)
  - Initiatives to address all components of digital divide
  - Training and stimulation of consumer apps
  - Concurrent efforts with private sector to stimulated digital transformation of production
  - Initiatives to address shortfalls in state operations

ADDITIONAL RESEARCH

- Katz, R., Jung, J. and Callorda, F. (2020) "Can digitization mitigate the economic damage of a pandemic? Evidence from SARS". *Telecommunications Policy* 44. retrieved in: https://www.sciencedirect.com/science/article/abs/pii/S0308596120301361?via%3Dihub
- Katz, R., Callorda, F. and Jung, J. (2020). *The impact of automation on employment and its social implications: Evidence from Chile*. Retrieved in: http://www.teleadvs.com/wp-content/uploads/The-impact-of-automation-on-employment-and-its-social-implications-Evidence-from-Chile.pdf
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- Katz, R. and Callorda, F. (2020). *How broadband, digitization and ICT regulation impact the global economy*. Geneva: International telecommunications Union. Retrieved in: https://www.itu.int/en/publications/ITU-D/pages/publications.aspx?lang=en&media=electronic&parent=D-PREF-EF.BDR-2020
- Katz, R. (2021). *Economic impact of COVID-19 on digital infrastructure*. Geneva: International telecommunication Union. Retrieved in: https://www.itu.int/en/publications/ITU-D/pages/publications.aspx?parent=D-PREF-EF.COV_ECO_IMPACT-2020&media=electronic

COLUMBIA INSTITUTE FOR TELE-INFORMATION

For further information please contact:

Raul Katz, raul.katz@teleadvs.com, +1 (845) 868-1653

Telecom Advisory Services LLC
139 West 82nd Street, Suite 6D
New York, New York 12581 USA