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EXPONENTIAL DISRUPTION IN THE DIGITAL ECONOMY

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KEY STATISTICS

- The digital economy is worth US $11.5 trillion globally, equivalent to 15.5 percent of global GDP. **By 2025, the digital economy will be US $23 trillion globally, or 24.3%of global GDP.**[1]
- Over the past three decades, **every dollar invested in dig-ital technologies added US $20 to GDP on average**, 6.7 times higher than non-digital investments which added US $3 for every dollar invested.[2]
- By 2020, **the worldwide public cloud services market is projected to reach US $383 billion**, up from US $209 bil-lion in 2016.[3]
- According to the latest UN ECLAC data, 46% of ICT budgets in Latin America were allocated to cloud computing in 2012, well above the global average of 34%.[4]

[1] Huawei and Oxford Economics (2017), "Digital Spillover: Measuring the True Impact of the Digital Economy" at www.huawei.com/minisite/gci/en/digital-spillover/files/gci_digital_spillover.pdf.
[2] Idem.
[3] Gartner (2017), Press Release "Gartner Says Worldwide Public Cloud Services Market to Grow 18 Percent" at www.gartner.com/newsroom/id/3616417.
[4] UN ECLAC (2014), "Cloud Computing in Latin America: Current Situation and Policy Analysis" at www.cepal.org/en/publications/36740-cloud-computing-latin-america-current-situation-and-policy-proposals.

INTRODUCTION

The Digital Revolution, also known as the Fourth Industrial Revolution, is expected to exceed all previous economic transformations in scale, scope, and complexity.[5] Disruptive technologies are evolving at an exponential pace and driving growth in key industries such as finance, energy, transportation, education, health, and trade. As these technologies become more accessible and affordable, they have the potential to significantly impact growth, labor markets, and income distribution.[6]

The Digital Economy is emerging in Latin America and the Caribbean (LAC), and to ensure the region's medium- and long-term prosperity, countries need to be responsive to the opportunities and risks associated with disruptive technologies. Successfully adapting and harnessing their transformative effects would pay long-term dividends in the economy in terms of growth, innovation and social inclusion.

Adaptation to the new digital economy will require significant infrastructure upgrades and accommodation of regulatory frameworks. **While mobile broadband penetra-tion is expected to reach 66% by 2025 in LAC (61% globally),** increasing inclusion and access to digital infrastructure remains a key challenge.[7] Meanwhile, adaptation of the regulatory environment lags the dramatic pace of technological change.

[5] Schwab, Klaus. "The Fourth Industrial Revolution: What it Means and how to Respond." Foreign Affairs Magazine. December 2015.
[6] Leipziger, Danny and Victoria Dodev (2016). "Disruptive Technologies and their Implications for Economic Policy: Some Preliminary Observations." at https://www2.gwu.edu/~iiep/assets/docs/papers/2016WP/LeipzigerDodevIIEPWP2016-13.pdf.
[7] GSMA. The Mobile Economy 2018. www.gsma.com/mobileeconomy/wp-content/uploads/2018/02/The-Mobile-Economy-Global-2018.pdf.

This paper addresses **five disruptive technologies that are driving massive economic transformation and that will be critical areas for public policy formulation and implemen-tation in the region** in the years ahead: cloud computing, blockchain, big data, artificial intelligence and the internet of things.

DIAGNOSTIC AND TRENDS

1. Cloud Computing

Cloud computing has been one of the most disruptive technological trends of the last decade. It has been a game changer for the way governments, businesses and consumers buy and maintain their ICT infrastructure. Governments and businesses are shifting from hosting their own data centers to having other companies handle it for them, enabling them to focus on their core competencies while also reduc-ing their carbon footprint. **As a result, cloud computing has democratized access to computing power** and advanced technologies that were previously reserved for big companies with deep pockets, reducing long-standing barriers to market entry, and thus helping enable the proliferation of start-ups and the growth and competitiveness of small and medium enterprises (SMEs).

To illustrate the potential impact: Deloitte estimates that between 2010 and 2015, in the five largest countries of the European Union, the adoption of cloud computing has generated an impact of **€ 763 billion on the economy, and the creation of direct and indirect jobs totaling 2.3 million.**[8]

Cloud computing is also paving the way for new disruptive applications as it enables the deployment of other digital technologies, such as big data analytics, artificial intelligence, and blockchain, that in turn underpin innovative and disruptive business models. Exemplary and well-known business models of the new digital economy that have been enabled by cloud computing

[8] European Commission (2017), "Measuring the Economic Impact of Cloud Computing in Europe" at https://ec.europa.eu/digital-single-market/en/news/measuring-economic-impact-cloud-computing-europe.

include: Uber, Airbnb, Ama-zon, Facebook, and MercadoLibre, among many others.

The direct and indirect benefits of cloud computing can be summarized into three areas: 1) economic competitiveness and sustainability; 2) increased speed of enterprise scale-up and greater potential quantity, quality and value of services; and 3) savings in public and private spending on server infrastructure and management time which can be reinvested in core competencies and augmenting technologies.

2. Blockchain

Blockchain is an emerging technology that has the potential to revolutionize business, government and the whole economy, transforming how contracts and transactions are recorded in an increasingly digital and inter-connected world. Blockchain is a database distributed through multiple nodes that make up a network where every record of every transaction is recorded. The innovative element is that the data is grouped in blocks that are continuously linked linearly with each other, ensuring the integrity of the previous blocks using cryptographic techniques. In addition, before being added to the chain, each new block is validated automatically and in real time by all the integrating nodes that are part of the distributed process. Thus, by intrinsic de-sign, the technology **prevents the subsequent manipulation of data stored in the blocks of the chain**, guaranteeing its immutability.

Global spending on blockchain solutions is expected to continue at a compound annual growth rate (CAGR) of 81.2% through 2021, **when revenues will be over US $9.2 billion.**[9] Compared to other regions, Latin America will experience the fastest growth in spending with a five-year CAGR of 152.5% from 2016 to 2021.

[9] IDC (2017), New IDC Spending Guide Sees Worldwide Blockchain Spending Growing to $9.2 Billion in 2021, at www.idc.com/getdoc.jsp?containerId=prUS43526618.

Meanwhile, the global block-chain market is estimated to grow from **US $210.2 million in 2016 to US $2.3 billion by 2021, at a CAGR of 61.5%**[11]

Beyond the technological and economic impacts, block-chain is expected to transform the way the public and private sectors do business. For example, in the financial sector, blockchain could help eliminate intermediaries such as brokers or approval processes. In commerce, the technology allows a simple and scalable integration of digital systems from different organizations into a common database. In government, blockchain has the potential to increase the transparency of governmental processes, enhancing the verifiability and auditability of government transactions and reducing the possibility of corruption by ensuring the immutability of data. The sharing of government data with the public, as well as the disclosure of its complete history, facilitates the verifiability and auditability of transactions. For example, in public procurement, the technology makes it possible to ensure that the procurement process complies with legal requirements, preventing data such as selection criteria or prices delivered by bidders from being manipulat-ed later, thus **reducing the possibility of corruption.**

3. Big Data

The amount of data being generated in the world has ex-ploded in recent years and it is expected to continue its exponential growth in the foreseeable future. After years of being considered an emerging technology, big data has finally hit the mainstream and has become one of the key pillars **enabling digital transformation efforts across public and private sectors globally.**

[11] Research and Markets (2017), Blockchain Market to Grow at a CAGR of 61.5% by 2021 – Analysis by Provider, Application, Organization Size, Vertical & Region – Research and Markets, at www.businesswire.com/news/home/20170425005753/en/Blockchain-Market- Grow-CAGR-61.5–2021--.

Big data is characterized by a high volume (massive amounts of data), velocity (high speed of information generation and flow) and/or variety (mixing of different types of data—structured, unstructured, semi-structured). It may also be characterized by high variability (inconsistent data flows with periodic peaks) and complexity (difficulty to link, match, cleanse and transform data).

On a daily basis, governments generate and collect a large volume of data, such as through their tax collection systems, managing national health systems, pensions and subsidy payments, recording traffic data, among other activities.[12] By linking existing data sources from different authorities and analyzing possible correlations, patterns, and trends in data, governments can not only gain insight into how to improve the delivery of citizen services, but also how to enhance the fairness of public policy by improving enforcement of the law. For example, in taxation, big data and analytical tools **could help to reduce tax evasion and fraud** by detecting sus-picious patterns in financial data.

In the private sector, big data and analytics helps enterprises enhance their productivity and boost sales, and drives the creation of new business models. By combining data from internal as well as external sources and applying big data and analytical techniques, enterprises are better equipped to monitor, manage, diagnose, predict, and optimize their performance. For example, in talent management, big data and analytical tools help enterprises **measure the impact of performance incentives**.

Worldwide commercial purchases of big data and analytics-related hardware, software, and services are expected to maintain a compound annual growth rate (CAGR) of 11.9% through 2020 when revenues will be more than $210 billion,

[12] Munné R. (2016) Big Data in the Public Sector. In: Cavanillas J., Curry E., Wahlster W. (eds) New Horizons for a Data-Driven Economy. Springer, Cham.

according to forecasts by the International Data Corporation (IDC). Compared to other regions, Latin America and the Caribbean will experience the fastest growth in spending with a five-year CAGR of 16.2% from 2015 to 2020.[13] The big data market is expected to grow from US $28.65 billion in 2016 to US $66.79 billion by 2021, at a high CAGR of 18.45%.[14]

To capture the full potential of big data in Latin America and the Caribbean, several issues will have to be addressed. At the government level, regulatory frameworks and policies related to privacy, security, intellectual property, and even liability need to be considered to ensure that rights of individuals as well as companies are protected. At the organizational level, not only must the right technology and talent be put in place, but the organizational environment must also be optimized for the use of big data.

4. Artificial Intelligence

Artificial intelligence (AI) can be characterized as computerized systems that have been designed to interact with the world by emulating human capabilities and intelligence behaviors such as visual perception, speech recognition, information assessment and action decisions. AI's expanded capabilities have been driven by three factors: the availability of big data, improved machine learning and algorithms, and more powerful computers.[15] Specific examples of applied "Narrow AI" include simulated strategic games, automated

[13] IDC (2017), Big Data and Business Analytics Revenues Forecast to Reach $150.8 Billion This Year, Led by Banking and Manufacturing Investments, According to IDC, at www.idc.com/getdoc.jsp?containerId=prUS42371417.
[14] Markets and Markets (2017), Big Data Market by Component (Software and Services), Type (Structured, Semi-Structured and Unstructured), Deployment Model, Vertical, and Region (North America, Europe, Asia-Pacific, Latin America & Middle East and Africa) – Global Forecast to 2021, at www.marketsandmarkets.com/Market-Reports/big-data-market-1068.html.
[15] Executive Office of the US President, National Science and Technology Council (2016), "Preparing for the Future of Artificial Intelligence" at obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf.

language translation, image recognition, self-driving cars, facial recognition, and robotics in manufacturing, among others.[16]

The ability of AI tools to automate processes depends on five key considerations: 1) u**nderstanding the nature of the problem** that is being resolved, i.e. understanding whether predictions or causal inferences must be made to solve a problem; 2) considering the t**ypes of data required** to address the problem; 3) **ensuring the availability of large volumes of training data** that will allow the algorithms to develop their predictive capacities prior to deployment; 4) **evaluating the quality of the data** that is integrated across the relevant data-bases; and 5) **protecting AI tools** from hackers by designing systems and data flow processes that have built-in privacy safeguards.[17]

Although research indicates that only five percent of occupations can be completely automated using current technology, **almost all occupations will undergo some type of change.**[18] For LAC, however, the estimate is that 50 percent of jobs can be automated since they are concentrated in labor-intensive manufacturing, natural resource extraction, and medium-skill administrative services.[19] It is imperative that the public and private sectors in LAC work together to address these labor market shifts in a way that promotes expansion of the digital economy and innovation, while ensuring

[16] Idem.
[17] Brookings Institute (2017), Kevin C. Desouza, Rashmi Krishnamurthy, and Gregory S. Dawson, "Learning from Public Sector Experimentation with Artificial Intelligence" at www.brookings.edu/blog/techtank/2017/06/23/learning-from-public-sector-experimentation-with-artificial-intelligence/.
[18] McKinsey Global Institute (2017), "Where will Latin America's Growth Come From?" at www.mckinsey.com/~/media/mckinsey/global%20themes/employment%20and%20growth/how%20to%20counter%20three%20threats%20to%20growth%20in%20latin%20america/mgi-discussion-paper-where-will-latin-americas-growth-come-from-april-2017.ashx.
[19] IDB (2017), Integration and Trade Journal: Volume 21: No. 42: August 2017: "Robot-lución: The Future of Work in Latin American Integration 4.0" at publications.iadb.org/handle/11319/8487.

inclusive economic development for those vulnerable to such changes.

5. Internet of Things

With broadband internet penetration rapidly increasing, connection costs decreasing, and Wi-Fi application expanding, it is becoming easier to connect any device to the internet. These include watches, cellphones, headphones, cars, and the possibilities are endless. Soon, hundreds of billions of connected devices will extend the digital economy to every sector, disrupting existing business processes and models. International Data Corporation envisions a trajectory from less than 20 billion devices today, to 30 billion in 2020, to 80 billion in 2025; and by 2025, there will be 152,200 new connected devices every minute.[20]

Worldwide Internet of Things (IoT) spending is expected to sustain a compound annual growth rate (CAGR) of 14.4% through the 2017–2021 forecast period, surpassing the US $1 trillion mark in 2020 and reaching US $1.1 trillion in 2021. Latin America is expected to achieve the fastest overall growth in IoT spending among all geographic regions, with an estimated five-year CAGR of 28.3%.[21] The IoT market is expected to grow from US $170.57 billion in 2017 to US $561.04 billion by 2022, at a CAGR of 26.9%.[22]

In the public sector, IoT could help society and improve governance by increasing the efficiency of public service

[20] Forbes (2016), IoT Mid-Year Update From IDC And Other Research Firms, at www.forbes.com/sites/gilpress/2016/08/05/iot-mid-year-update-from-idc-and-other-research-firms/#7a632e6955c5.
[21] International Data Corporation (2017), IDC Forecasts Worldwide Spending on the Internet of Things to Reach $772 Billion in 2018, at www.idc.com/getdoc.jsp?containerId=prUS43295217.
[22] Markets and Markets (2017), Internet of Things (IoT) Market by Software Solution (Real-Time Streaming Analytics, Security Solution, Data Management, Remote Monitoring, and Network Bandwidth Management), Service, Platform, Application Area, and Region – Global Forecast to 2022, at www.marketsandmarkets.com/Market-Reports/internet-of-things-market-573.html.

provision. **By using the sensor data gathered by IoT-enabled devices such as smart meters and traffic lights, governments gain insights into citizens' needs and are enabled to imple-ment changes quickly and effectively.** For example, in public transport, using data from distributed GPS tracking devices could enable real-time monitoring of buses and provide pas-sengers with better information on wait times.

In the private sector, IoT has the potential to improve the operational efficiency of businesses by reducing costs and generating new revenue. For example, in the agricultural sector, a network of sensors distributed over the field could help monitor temperature and humidity levels and control irrigation systems. In the area of logistics, sensors could help monitor the usage and condition of fleets and inform refueling and maintenance decisions. In health care, networks of various sensors offer the capability to monitor patients' behaviors and symptoms in real time and at relatively low cost, enabling physicians to make better diagnoses.

Though the future of IoT is promising and its potential benefits numerous, **the speed of its adoption in LAC depends on the availability of adequate infrastructure platforms as well as the development of suitable legal and regulatory frameworks.**

THE ROLE OF THE PRIVATE SECTOR

To leverage the benefits of these new technological developments and unleash the full potential of the digital economy, the private sector and governments in LAC need to join forces to develop an enabling digital ecosystem which addresses several key areas, including:

1. **Increasing private investment**, especially in connectivity infrastructure that allows for equitable access;
2. **Designing appropriate regulatory frameworks** that provide incentives for innovation and mitigate unintended consequences;
3. **Investing in human capital** to ensure availability of the skills required to scale these new technologies and pave a smooth transition for those switching from automated or legacy technology jobs to new economy jobs;
4. **Adjusting public procurement systems and processes;**
5. **Leveraging disruptive technologies** to develop locally relevant and useful content and applications for users; and
6. **Supporting innovative startups** from incubation through scale-up.