

Learning from Pioneers: Takeaways for Latin America and the Caribbean from the Digital Transformation Boom in China

**Proceedings from the Fifth Policy and
Knowledge Summit between Latin
America and the Caribbean and China**

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**DISCUSSION
PAPER N°
IDB-DP-727**

December 2019

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<http://www.iadb.org>

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5th LAC-China

Policy and Knowledge Summit

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In 2014, the Inter-American Development Bank and the Chinese Academy of Social Sciences established the Latin America and Caribbean (LAC) and China Policy and Knowledge Summit. This initiative has contributed to expand the collaboration between LAC and China and generated fruitful dialogue between policy-makers from both regions, fostering strategic alliances and collaborative networks of technical expertise. Between 2014 and 2018, five summits have been organized to discuss important areas of mutual interests for the regions: urbanization, leadership in the public sector, productivity and innovation, digital finance, and the digital transformation. These topics continue to be relevant and increasingly gain more interest within the LAC region. The following is a summary of the presentations at the Fifth LAC-China Policy and Knowledge Summit, which focused on the impacts of the digital transformations in China and lessons from the LAC region. This event was held in San José, Costa Rica, October 17 and 18, 2018.

Introduction

The development of technologies such as the internet of things (IoT), robotics, artificial intelligence (AI), and cloud computing, together with technological convergence and increasing connectivity have become enabling factors of disruptive innovations that are transforming market dynamics, economic relations, and production processes on a global level in what is called the Fourth Industrial Revolution, or Industry 4.0. At unprecedented speed, new players with business models based on digital platforms are radically disrupting the healthcare, financial services, and tourism sectors, among others. Incumbent companies are forced to adapt and change their operations and strategies by applying digital technologies to drive innovations at the product, process, and organizational levels.

In China, this digital transformation is already a reality. The country has become a well-known testing lab for new technologies and is exporting innovative digital business models that have emerged in a strengthened ecosystem that already goes beyond the three technology giants, Baidu, Alibaba, and Tencent. The latest McKinsey Global Institute Industry Digitization Index shows that the digitization gap between the United States and China has shrunk by a third in just three years. Part of this success has to do with the large local Chinese market and the society's openness to adopting new technologies. The Chinese government has also played a key role in this process with its tech-friendly strategy, which was implemented through the Made in China 2025 and the Internet Plus policies, and by rolling out new instruments to finance startups, and by establishing an enabling and pro-digitization climate.

Meanwhile, Latin American and Caribbean (LAC) firms are embracing digital transformation at a slower pace, and innovation and digital ecosystems are still incipient. Nevertheless, there is a growing appetite for technology startups from global venture capital investors, and open innovation schemes with a focus on digital transformation are starting to flourish. Countries such as Brazil and Argentina have already developed national plans for new technologies (IoT, big data) and to upskill talent, while others, like Chile, are launching digital transformation programs with public-private platforms focused on strategic sectors.

Continuing with the success of past summits, in 2018, the Fifth Policy and Knowledge Summit between Latin America and the Caribbean and China focused on emerging new business models and technologies in the digital economy. Understanding the role of the government in promoting these processes—by rolling out technology strategies, providing an adequate regulatory framework, and supporting development of a strong pool of skilled people—is essential for society to thrive in the digital

DESCRIPTION

context. The summit shared lessons learned from both regions' experiences, identified opportunities to develop new areas of public interventions to support the digital transformation in the LAC region, and explored new collaboration opportunities between public and private institutions in LAC and China.

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Ana Maria Rodriguez-Ortiz

Once a year, thanks to the Institutional Capacity Strengthening Fund that was created through a contribution from the Government of China to the Inter-American Development Bank (IDB) in 2009, we have the opportunity to organize policy and knowledge summits between LAC and China around challenges of common interest. This fifth summit focuses on digital transformation.

The digital economy offers unique opportunities for countries to confront profound challenges and improve the lives of their citizens and to do so sustainably. Digital technology can accelerate socio-economic and financial inclusion, digitization of companies can improve productivity and promote innovation, and digital transformation of governments offers greater transparency and more efficient, higher-quality services.

Many ingredients are needed to encourage development and adoption of new technologies. It is necessary to develop capacities for innovation, research, and development in businesses and universities, while governments must encourage capacity generation through their own purchasing power and flexible regulatory frameworks that promote innovation without neglecting the protection of citizens. A deep political commitment to change, appropriate infrastructure, and, above all, a critical mass of talent that produces and adopts these solutions in different sectors are all vital elements in achieving digital transformation.

Addressing these tasks requires unprecedented coordination between all the actors of the public, private, and academic sectors, and those who are in this room are active participants in, and architects of, this new change. The idea of this summit is to achieve active dialog among our participants. To assist in doing so, we have asked three initial questions:

OPENING REMARKS

- How can we generate schemes to innovate very quickly in the context of continuous technological change?
- How do we prepare necessary talent if we cannot wait 25 years for that talent to become available?
- How can we take advantage of digital solutions to meet the great challenges of creating sustainable and inclusive development?

I would like to give some examples of how the LAC region has advanced in these areas, which will be complemented by many others you will hear about during our dialogs. However, I do not want to lose the opportunity to point out, for example, the importance of the approval of sub-national, as well as national, plans for digital transformation. An ambitious program was launched in Brazil in 2018 to comprehensively address digital transformation at all levels of government, including not only the internet, but the IoT, AI, and big data as instruments to deal with local challenges. Many other countries have undertaken similar initiatives, such as Argentina, Colombia, Chile, Uruguay, and Costa Rica.

In addition to working through national and sub-national government structures, efforts made in the region to implement innovation ecosystems at the level of cities have become global benchmarks. In 2016 in Medellín, Colombia, where we celebrated the third summit, China awarded the city of Medellín the “lee cuon jou” prize, a kind of Nobel Prize for cities that have made great progress in innovation. Medellín, having accepting that prize, is now striving to become a hub of talent for AI. The city of Campiñas, Brazil, is another very interesting example. Its motto is “we are the force of innovation”—and they are. The city has been able to create an ecosystem with research centers, universities, incubators, startups, and accelerators.

To achieve a digital transition, it is also necessary to attract capital. Costa Rica's initiatives to attract international capital for innovation are a model of success in the field of medical devices, and this is not the only successful case of international investment in technological ventures in LAC. Such investment has more than doubled since 2013, and last year (2018), 25 representatives from major companies that make such investments came to the region.

Another very important topic that should be addressed is the generation of digital solutions for challenges such as climate change. Costa Rica, a green country par excellence, has set itself the goal of being a 100 percent green country in the near future, and in the last few years it has already managed to produce 100 percent of its energy through renewable sources. The country has committed to meeting another important challenge, decarbonization, which has a central place in the national digital transformation agenda.

Progress is being made in LAC, but important challenges certainly remain that must be addressed if the region is to take full advantage of the opportunities offered by the digital revolution. This is why we are here today: China and LAC have both undergone profound transformations during the past 40 years and sharing experiences can benefit all of us.

China has always had a culture that is notable for its capacity for investment and innovation. The four great foundations of an earlier epoch—paper, gunpowder, printing, and the compass—were created in ancient China. The country is again at the frontier of technological transformations in terms of mobile payments, electronic commerce, and AI, demonstrating its great advances in science and technology and its outstanding capacity for innovation.

Digital transformation is a reality in China. One-third of the world's 262 unicorn businesses¹ are of Chinese origin, and two of the world's largest technology companies, Alibaba and Tencent, are Chinese. Today, 40 percent of the world's e-commerce transactions take place in China, while 10 years ago only 1 percent of such transactions occurred there. China has also become an important global force in mobile payments, driven mainly by Alibaba's Alipay payment system, which can now be used to pay for almost anything—in physical stores, for taxis, in restaurants, to buy clothes, and even to pay accounts outside the Alibaba system. This has allowed the rapid financial inclusion of billions of Chinese citizens, not only by providing means of payment for people who did not even have a bank account, but also by allowing these same citizens to have access to credit because they have a credit report generated from the data of their current transactions. A few years ago one-third of the country's population did not have a credit history.

This is not the only example of China's leadership in digital transformation. In 2017, 50 percent of global investments in AI startups went to China, compared to only 11 percent in 2016. At present, China receives 40 percent of all investment in AI, while the number of patent filings in China is far greater than in other countries.

China has had extraordinary success in the first, consumer oriented, digital wave. A second wave involving deep transformations is now taking place, this time in industry, based on developing and adopting emerging technologies such as AI, quantum computing, and autonomous vehicles. It is extremely important for LAC to understand how China made its first leap into digital transformation, how it is achieving progress in the second leap, and how to learn from its experiences.

¹ A unicorn is a privately held startup company valued at over US\$1 billion.

I believe that participating in the summit will be a great benefit for us all, not only because we have gathered together here to discuss our experiences and ideas, but also because the relationships that we form here will provide a basis for future discussions. I trust that the exchange of policies and knowledge will generate future actions that contribute to strengthen our capacities to take advantage of this digital wave and to assist in positively and decisively changing the lives of all of our citizens.

Sun Yi

I am honored to have been invited to participate in the Fifth Policy and Knowledge Summit between LAC and China. On behalf of the People's Republic of China and myself, I wish you the best of success. As a Chinese proverb says, "mountains and seas can never keep people with common aspirations apart." In spite of the great geographical distance between us, relations between China and LAC have a long history. Today, China and LAC are in the process of development based on the principles of equality, mutual respect, mutual benefit, and solidarity, and cooperation between us fosters common interests and a brighter future for all of us.

In June 2007, Costa Rica became the first Central American country to establish diplomatic relations with China, and the two countries are sincere friends and reliable partners. China is willing to work jointly with the government of Costa Rica led by President Carlos Alvarado Quesada. Within the framework of the Belt and Road Initiative, China will maintain visits and exchanges to deepen cooperation in various fields, constantly enriching the strategic partnership between China and Costa Rica based on equality, mutual trust, cooperation, and shared necessities.

Exchanges and cooperation between China and LAC are highly significant and promising. The Chinese Academy of Social Sciences is a leading academic institution and one of the most prestigious centers for academic research and investigation in the fields of social sciences and philosophical studies. We hope that more Chinese academic institutions like the Academy will carry out academic exchanges with their counterparts in LAC. They will inspire and learn from each other and provide valuable recommendations to strengthen relations between China and LAC.

Luis Adrian Salazar Solis

During this administration, we want to generate synergy with the private sector, injecting innovative DNA into the processes of knowledge creation and social transformation. We have found a wide variety of allies to assist us in the processes of economic growth and development and have formed especially strong relationships with the industrial and information and communications technologies (ICT) sectors. The most important thing is that each sector contributes to the country's development according to their needs and capacities, a model which will be the principal axis for transformation for the Costa Rica of the next 20 or 30 years.

It is very difficult to foresee what kind of electronic device we will have in our hands 10 years from now. Ten years ago, the idea of making a telephone call and seeing the person we are talking with sounded like having supernatural powers, but today this is completely natural for young people and children in our countries. We very obviously need to plan for a future in which rapid technological change is a constant. Yesterday we

finished the first stage of an initiative that will allow us to assess our capabilities for digital transformation in terms of six areas that characterize an innovative society, ranging from state services (services to citizens) to a phase of Entrepreneurship 4.0, with adequate digital governance and connectivity that can meet the requirements of all these areas.

Activities such as this summit assist us in generating knowledge and serve to reaffirm what Costa Rica wants to be in the coming years. As our president has said, our mission is to turn Costa Rica into an innovation and knowledge creation hub for Latin America, and our government is completely committed to reaching that goal.

We are working to introduce fifth-generation (5G) technology in the Greater Metropolitan Area in the center of the country by 2021, which will provide us with a laboratory to work on value-added development and we have already begun to talk with Intel Corporation about this initiative. We have also started to make more funds available for innovation, technology transfer, and company certifications, and the Ministry of Science and Technology is working to make these funds accessible in coastal and border areas to allow more people to participate in innovation and development initiatives.

I believe that Costa Rica's commitment is shared by our friends from other LAC countries and between us all I believe we can achieve great progress. And for our friends from China who are here today, I would like to thank you and tell you that you have a partner, an ally, in Costa Rica, but above all, a country that wants to be a leader in the digital economy in Latin America.

40th Anniversary of China's Reform and Opening Up Process: From 1978 to the Digital Era

Cai Fang

One of the most important challenges that the Chinese economy faces is achieving a successful transition from high-speed growth to high-quality development. During the past 40 years, China has experienced an annual GDP growth rate of 9.5 percent while simultaneously opening the economy to the outside world. The total value of trade, net exports, and the total volume of foreign direct investment (FDI) have increased dramatically, making China one of the world's largest open economies. The significance of this economic growth can perhaps best be appreciated by considering the historic patterns of economic development in other countries.

Before the industrial revolution began in Europe, economic growth in all societies was limited by the so-called Malthusian trap. Human life spans were short, with people dying in their twenties and thirties, or perhaps in their forties, and economic growth was almost zero. The first country that experienced positive economic growth was the United Kingdom. During the 50-year period between 1880 and 1930, the rate of economic growth in England was less than one percent, but this was the first time in human history that a country had undergone sustained positive growth. In this period, average life expectancy was approximately 50 years, which meant that when an average individual died, he or she had experienced a 56 percent improvement in their standard of living—that is, a 56 percent increase in total GDP per capita.

After the United Kingdom, the next country to achieve sustained economic growth was the United States. In its period of rapid economic growth between 1920 and 1975, a typical individual expected to live 55 years and the annual rate of economic growth was approximately 2 percent, so the standard of living almost doubled during a typical lifetime. Japan, the first country in Asia to undergo economic modernization, had a 4 percent annual economic growth rate between 1950 and 2010, during which time average life expectancy was 60 years and a person with an average lifespan born at the beginning of this period would have seen their standard of living increase by almost 10 times by the time they died. After Japan, China began economic reform, market opening, and rapid growth in the late 1970s and early 1980s. By 2016, this growth had already resulted in an 18-fold improvement in standards of living—that is, per capita GDP increased by 18 times. But individuals born at the beginning of this period are still alive today: a typical Chinese born in 1981 can expect to live to 2049, the 100th anniversary of the People's Republic of China. If the average annual growth rate of 8.9 percent between 1981 and the present were to continue until 2046, this would result in an improvement in standards of living of more than 300 times. It is doubtful that this growth rate will be maintained, but we are doing all that we can to sustain economic growth in China.

The 19th National Congress of the Communist Party of China called for a transition from high-speed growth to high-quality development. The urgent need for such a transition becomes clear when we consider why economic growth has been so rapid in the past 40 years. A highly unique demographic transition occurred during this period. Between 1980 and 2010, the working population between 15 and 59 years of age increased dramatically, while the non-working or dependent population remained constant or decreased slightly. This transition created a window of opportunity for China to realize a demographic dividend.

When economic growth in the past 40 years is decomposed into different factors, it can be seen that the largest contributor has been capital accumulation, which is also related to population: if there is a very low dependency ratio in the population, it is possible to have a high savings rate, and if the labor supply is unlimited, diminishing returns to physical capital will be delayed. Therefore, with a high savings rate and high returns on investment, there is contribution from capital accumulation. A second major contributor has been the quantity and quality of the labor force, or human capital. In a developing country, new entrants to the labor market always have more years of schooling than their counterparts who are already in the workforce. Therefore, more rapid growth of new entrants into the labor market implies a very rapid improvement in human capital. Another major contributing factor to economic growth is total factor productivity. During the past 40 years, a major part of the improvement in productivity is due to re-allocative efficiency, as the labor force migrated from agriculture, a sector with low productivity, to highly productive non-agricultural sectors.

This discussion shows that all of the sources of rapid economic growth in China are related to population. But China has also encountered a new challenge that can be characterized as growing old before getting rich. It is clear that China is a developing country, but its population is much older and growing older more rapidly than those of other developing countries. This could result in the disappearance of the demographic dividend, with resulting decreases in both the actual economic growth rate and the theoretical potential economic growth rate.

As the Chinese economy moves from fast growth to high-quality development, the rapid increase in the development of technology in the country offers a possible solution to the problems that we face, although actually taking advantage

of this opportunity will be very challenging. In the past year, China's digital economy, including digital industries and digitalized traditional industries, generated a total of ¥27 trillion, accounting for one-third of total GDP and creating jobs for many millions of Chinese citizens. In addition, major Chinese technology companies such as Alibaba and Tencent created many new digitalized traditional jobs that require high levels of worker skills.

Several important issues must be addressed in the future. First, developing a digital economy poses a significant challenge for the educational system. In China, there is a story about a boy who devoted his entire childhood to learning how to kill a dragon, but after he learned the necessary skills he found that dragons never existed. China must work to ensure that workers acquire skills that are actually useful in the workplace. Second, the traditional social protection system must be extended to cover new workers in new jobs associated with the Gig economy. Third, demand for human capital tends to be polarized; while the digital economy creates demand for many workers with higher level skills, it may also create jobs that require very few skills. Finally, we must consider the possibility that automation and robots will take jobs away from our workers and make sure that automation benefits our workforce rather than harming it.

Costa Rica in the XXI Century: New Challenges and Opportunities in a Digital Landscape

Carlos Alvarado Quesada

When Deng Xiao Ping assumed the political reins of his country in 1978, he made the visionary decision to place science,

technology, and the different branches of knowledge at the center of China's development, marking an important political change from previous Chinese policy. This decision is one of the reasons we are gathered here today.

Understanding the crucial role that different sciences and their technological applications play in the development of societies has made the China of 40 years ago and today a clear leader in this area. It is important for Costa Rica and LAC to achieve this same understanding and to strive to advance as China has.

Archimedes of Syracuse was one of the first scientists to view science as something more than an experimental or intellectual art, removed from reality. Instead, he used science for a very specific and concrete purpose—to defend his city. History remembers Archimedes as someone who was able to use mirrors to burn ships from afar and who designed machines to lift enemy boats out of the sea, using science and knowledge for practical purposes. These examples are not presented to advocate warfare—Costa Rica is a pacifist country that does not have an army—but I believe that the principle of applying science to improve peoples' well-being must lie at the foundations of our efforts.

Important practical applications of science need not necessarily take place on a large scale, although scale is important in a global world. I often think of efforts made in the last century by individuals such as Costa Rican Clodomiro Picado, who carried out the first tests of penicillin on plants before Alexander Fleming applied penicillin the way we are familiar with today. Picado later developed all of the snakebite antivenoms, which are used not only in Costa Rica but also in LAC and in Africa. This is cutting-edge scientific knowledge that has transformed and saved the lives of millions of people around the world.

This is what developing science is about. Science only makes sense if the well-being of all people and ethical progress of humanity are at its center. All of us who are here today, and especially all of you that are experts, need to make sure that this happens. Take advantage of all opportunities for knowledge, science, technology, exchange of ideas, and progress by being brave, bold, and humble, recognizing mistakes as a mechanism for learning and progress. Through these meetings with China and other LAC countries, learn about new paths for development, an ethical imperative that we share by the simple fact of being here today.

This is the task that I believe people, and our people, expect us to accomplish. I wish all of us the greatest success in this endeavor.

THE DIGITAL ECONOMY: A TALE OF TWO REGIONS

China's Four-Decade Route to Becoming a Leader in the Digital Economy

Du Yang

The early growth of China's digital economy was made possible not only by technologies originally developed in the United States, but also by elements of traditional Chinese culture. The first of these is the concept of Yi, or thinking about complex situations in the simplest terms possible. This is similar to the concept of simplicity, which is often mentioned in discussions of managing complex Industry 4.0 processes by using intelligent technologies. Another parallel between Yi and using digital technologies can be seen in the idea of Yin and Yang, a

dualism which is very similar to the binary thinking involved in digital computing. It is interesting to note that the first binary calculator in the world was presented to the Chinese emperor more than 300 years ago by Gottfried Wilhelm Leibniz, one of the inventors of calculus, who was deeply interested in Chinese philosophy.

In addition, the Confucian belief that interpersonal relationships are best managed among small groups of people (in a “small world” network) is reflected in the great popularity of “red envelope” services in social networks such as WeChat and Tencent, which make it possible to give credits for future online purchases to family members and friends. These services have contributed greatly to the success of these and other similar companies in the first wave of digitalization of the Chinese economy.

China’s 13th Five-Year Plan lays out strategies to develop the digital economy between 2016 and 2020. To improve telecommunications infrastructure, for instance, major initiatives presented in the plan include prioritizing research into 5G mobile communications and ultra-wide bandwidth technologies, beginning to use 5G technologies commercially, and starting a full-scale upgrade of telecommunications to be compatible with Internet Protocol version 6. These steps are necessary to allow China to leapfrog earlier telecommunications technologies and secure a dominant position in fundamental research and key technologies that provide the foundations of the digital economy.

The Chinese government hopes to promote development in an environment in which economic growth may soon slow to a new normal rate of approximately 5 percent by increasing the quality of what the country produces and the efficiency with which it is produced. Strengthening the digital economy will be a key factor in achieving this transition from quantitative

to qualitative growth. An excellent example of a company that has prospered by improving the quality and efficiency of its production is Qiaoyifang, which produces gauze. Rather than focusing on selling larger amounts of a few types of gauze, the company sells small batches of different types of gauze tailored to the needs of individual clients, a strategy that allowed it to grow rapidly and became one of the top 100 Chinese e-businesses in 2012.

The 13th Plan also includes measures intended to more effectively integrate internet and e-business practices into businesses that have not yet begun to participate fully in the digital economy. The Internet Plus initiative is intended to promote the use of digital technologies to accelerate the formation of strong business value chains, flatten the organizational structure of manufacturers, and transform enterprise formation by reducing costs and stimulating the creation of more innovative businesses in the manufacturing and services sectors.

Didi Driver is an example of the innovative service businesses that are beginning to appear in China's digital economy. This company makes transportation more efficient and economical by allowing people who need a ride to use a smartphone application to communicate with participating drivers who can provide them with the transportation that they require. The financial services sector has also seen enormous growth in the number of internet-based person-to-person (P2P) lending companies, which gather funds from investors and loan them to small- and medium-sized enterprises (SMEs) and individual borrowers. However, it was later found that some of these companies were not managing their resources carefully, making it necessary for the government to strengthen the regulation of their activities. Nonetheless, properly managed digital finance companies can provide vital support for entrepreneurs and small businesses.

China is also making strong efforts to move beyond stimulating employment in traditional companies toward developing widespread entrepreneurship and innovation. E-commerce platforms can assist in this process by allowing individuals to engage in non-traditional flexible employment, which can provide workers with higher incomes by allowing them to offer services such as application development directly to clients. Jack Ma, the founder and CEO of Alibaba, recently began to offer free virtual stores through the Alibaba platform, removing financial barriers to entry into the digital economy for individuals and small businesses who wish to offer innovative products and services through the internet. The size, technological sophistication, and visibility of Alibaba is a great advantage for the individuals and businesses that take advantage of this opportunity; Alibaba's market value of more than US\$238 billion is larger than the national GDP of Scotland or the 2013 GDP of the Chinese city of Shenzhen, which contains one of the densest concentrations of high-technology companies in the country.

Finally, the Chinese government is emphasizing the provision of more and more efficient public services. The internet portal of the province of Guangdong, for instance, not only offers access to the services of government institutions and departments, but also provides web pages for businesses and individuals, as well as social networking services. Together with China's increasing emphasis on developing smart cities supported by technologies such as the IoT and big data analysis, these efforts are making the government more accessible to citizens and improving the quality of life of its inhabitants.

A Look at LAC Competitiveness in the New Digital Economy

Gonzalo Rivas

When studying the digital landscape in LAC, we often find that perceptions of progress are closely linked to increases in the use of cellular technology. In fact, we are confronting a far greater challenge and a much greater transition; we are now living in a new industrial revolution in which many different kinds of technologies are converging and are being used in areas such as AI, robotics, and big data. This poses many new challenges, and we must understand what we have to do to take advantage of the great opportunities that this technology offers us.

There are at least five elements to keep in mind:

1. **Agility** is the ability to react to sudden changes. We need agile governments that can react to such changes, and agile companies that can take advantage of opportunities and face challenges posed by new competitors.
2. **The borders** of the sectors that we are used to dealing with are beginning to merge. For example, medicine and health can no longer be seen as being separate from engineering, technology, and the digital world; however, we still tend to think in a sectorial way.
3. **Talent and creativity.** Accelerated change requires constant updating of knowledge and skills to find employment.

4. **Interconnectivity** because today everything is interconnected and enormous amounts of data are being generated and used daily. This creates endless opportunities that come with huge risks as well.
5. **The final** element is **collaboration**. The new world challenges us to change the way we act. Governments can no longer act alone but must cooperate with citizens, and companies must collaborate with consumers and with governments.

When looking at LAC, we might think that it is not doing badly in this new world because the gap in the number of internet users between LAC and OECD countries is decreasing. However, a closer look at the data clearly shows that important problems remain to be resolved.

The first problem is that this conclusion is based on an average for the entire region. The penetration of internet use in Argentina is 93 percent, but in Nicaragua and Honduras that figure is close to 30 percent, meaning 70 percent of the population of those countries is not accessing the internet. Beyond simple access, it is also important to consider the quality and speed of internet connections, which are one-third of those in OECD countries. More seriously, a lack of digital literacy means that 50 percent of those who have access to mobile broadband in LAC don't use it because they don't know how to.

The fact that the quality of internet connections in LAC is much lower than that of more developed countries is important because obtaining the greatest impact from applications that we can use in areas such as advanced manufacturing, technology for health, and interactive 3D video requires higher bandwidth

and much higher speeds than are currently available in the region. Unfortunately, while a powerful financial institution can easily obtain a dedicated fiber-optic internet connection from a telecommunications provider, smaller companies cannot, and gaps between larger and smaller companies, and between sectors, can result in countries that are developing internally at different rates. The critical point here is that telecommunications providers invest where they can make a profit, serving large clients and focusing on especially dynamic areas. In LAC that means cellular telephony, communication, and training. However, critical areas such as health, energy, manufacturing renovation, and logistics may not be as interesting to these providers.

How do we get telecommunications companies to invest if inadequate infrastructure means that there are no applications that use advanced telecommunications? It is critically important to develop demand by getting important actors to take better advantage of the potential of this technology.

Governments can have an important impact on demand for connectivity by making their services accessible online. In Uruguay, for example, citizens can carry out 100 percent of their procedures with the government online. However, in Panama, which has extraordinary connectivity, it is very difficult to access government services online. Governments must use telecommunications to develop better relationships with citizens by making their interactions with the government easier.

Governments can also use this technology to improve their management. In Peru, AI is being used to improve tax collection by making it easier to detect tax fraud. However, we know that the private sector in LAC does not invest much in innovation, and the level of use of technology in the sector is much lower than is seen in other regions in the world.

As a result, the importance of collaboration is receiving increased attention in LAC. We are seeing, for example, that governments can serve as innovation drivers and that using innovative public procurement tools can stimulate entrepreneurial startups to develop creative solutions for major problems that affect citizens.

In Uruguay, the national innovation agency challenged the private sector to provide mobile solutions to allow citizens to use their cell phones for payments, rather than using tickets or cards that must be recharged. Once citizens are paying for transportation services with their phones, knowing where they are going makes it possible to offer discounts and tours, and the government can gather data that can be used to improve the quality and efficiency of its services.

Such solutions are not directly developed by the governments but are the result of collaboration with innovators in the private sector who benefit when the government is a buyer. In LAC, governments represent approximately 20 percent of GDP. Innovation can occur when governments are willing to change, understand that not all problems have to be solved in-house, and become involved in the innovation ecosystem by developing collaborative relationships with solutions providers with the agility to react.

In Costa Rica, the revolution brought about by the explosive development of the medical instruments industry requires a crucial partner: the Ministry of Health. If the ministry can integrate challenges into its relationship with suppliers, the world will see that change is taking place in Costa Rica and that innovation and world-class entrepreneurship can be carried out there.

To participate fully in the digital economy, businesses and governments need people who know how to make use of it and how to adapt organizations to meet the challenges that it poses. At the same time, university education is being challenged by institutions that offer specialized certificates or nano masters' degrees (see *Panel 2: Setting the Stage* for more information about nanodegrees) in eight months instead of three years and can place 100 percent of their students in jobs. More traditional educational systems must recognize this new phenomenon. Some universities in Europe already accept course credits earned in such institutions.

Governments must also become more agile in their role as regulators. For instance, in the transportation sector, Uber made it necessary for governments to consider what should be done with taxis, while the use of drones raises issues of privacy and responsibility when a crash causes injuries or damage.

Governments are realizing that they cannot manage all of this alone and that they must cooperate with other sectors and actors. The IDB is supporting experiments to investigate the effects of such cooperation in Mexico and Colombia, but developing other spaces for experimentation in regulation, as well as in areas such as mobility and energy, is still far in the future in LAC.

Large companies, another great driver of change in LAC, are also beginning to incorporate a culture of open innovation. They have begun to understand that they must interact with smaller start-up companies and other innovators that can provide solutions for the problems that they face. There are already more than 2,000 startups participating in challenges and innovation spaces linked to large companies in the telecommunications and other sectors.

Finally, it is important to note that while Silicon Valley is still supporting development of applications in areas such as training, interest in using digital technologies in areas that are more relevant to society, such as health, energy, production, and logistics, is growing much more rapidly. This change in emphasis brings us to the issue of goals for sustainable development.

Chile and Peru are beginning to use technology to address health-related issues. Therefore, there is an opportunity for Costa Rica, a green country that aspires to be a leader in environmental technology, to start using technology in a much more deliberate way through public and private coordination to meet the de-carbonization challenge.

We can learn a lot from China. The quantum change that it has achieved in a very short time is remarkable, but it has been made possible not only because China has a very large market, but also because it has quickly adapted to changing conditions. The issue of knowledge and research capacity is also important. Of the 100 most promising research institutions in the world, 50 are Chinese, while the highest-ranked Latin American institution occupies position 200.

It is extremely important to take advantage of technology by adapting our ways of acting and mobilizing governments among other strategies, but we must also invest in research, science, and advanced human capital formation.

Costa Rica in the Digital Economy: New Challenges, New Opportunities

Vanessa Gibson

CINDE, the Agency for the Promotion of Foreign Direct Investment, has been collaborating with the government of Costa Rica for approximately 36 years. When Costa Rica decided to establish the agency, it was focused on attracting investment in non-traditional sectors, particularly in high technology.

There are now more than 295 companies established in the country, and the value proposition that has attracted these companies is not the size of the local market so much as the great value of our human talent.

During the past 35 years, Costa Rica has moved from being an agricultural country (although it still has a very important agricultural sector) to one that produces medical devices as its main industrial export. After Mexico, Costa Rica is the main exporter of such devices, which has transformed the economy in important ways.

Costa Rica now exports more than 4,000 products to the rest of the world. However, corporate services, a highly dynamic sector, represents the largest volume of exports in value. There are almost 170 corporate services companies already present in the country, which is a point in the country's favor, but one of the most important factors that leads companies to locate offices in Costa Rica is that it is a multilingual location. The languages that are most in demand are English, Portuguese, French, and German.

Corporate services companies have already generated 98,000 direct jobs and 50,000 indirect jobs and are generating 7,000 new jobs every year, which indicates the great importance of maintaining our capacity to generate workers with the skills they require.

In summary, Costa Rica has transformed itself over time by making the transition from an import-based model to an export promotion model and inserting itself in global value chains. However, the country still faces a significant challenge in staying relevant in the new economy and in the digital era.

Today we are at a turning point as global flows of FDI decrease and competition for the funds that remain increases. In this situation, defining what the country's added value is—what its value proposition is—becomes increasingly important. Having attracted significant investments in the life sciences, corporate services, and advanced manufacturing sectors places us in direct competition with large companies and countries throughout the world, in spite of our small size.

The most important characteristics on which companies have been basing their decisions on where to locate are related to talent, which is the resource that best characterizes us. However, the questions that companies ask today are very different from those that they asked when we first began to systematically attract FDI.

Companies are no longer asking where to locate their next plant or new offices because, thanks to the digital age, they can carry out many of the activities related to the globalization of their products and services in only a few locations or in some cases can even totally digitalize them. Therefore, the country's value proposition must be reformulated.

This is a race against the clock that must be won. How quickly can we transform, adapt, and channel the resources that are already in the labor market? How are we going to create the human resources that are demanded in today's labor market when jobs are being transformed and in some cases are still in the process of being defined?

The borders between different industries and sectors are eroding. It is possible that a strategy that has until now focused on attracting companies in the medical devices or services industries will not necessarily allow us to maintain our position in the future if there is a strong technology-based convergence that erases boundaries between industries and even within the companies themselves.

Costa Rica is therefore reformulating its value proposition. Based on the results of our analysis, there are certain global niches that will determine our future investment promotion strategy that have a great deal to do with the availability of materials, particularly in the cases of the circular economy, additive manufacturing, precision life sciences, Cleanntec, and Agtec. We also require a new approach to the agricultural sector in the context of precision agriculture.

This convergence is already under way in Costa Rica. Companies from different sectors are now communicating and creating points of contact and cooperative work arrangements, which can strengthen innovation, research, and development. In this context, the benefits that Costa Rica provides are changing. Though our value continues to lie in our human talent, the dynamic is very different from the traditional benefits of location, conditions, and incentives, focusing more on topics related to innovation.

It is therefore necessary to rethink our human development strategy. A global strategy has been jointly formulated with these companies, since one of the great challenges of having multinational companies in the country is that we must coordinate our activities on two different levels.

First, we have to maintain the presence of companies and form a direct connection with the global strategy of corporations. Progress in this area has been made on a development strategy whose key focus is improving the quality of the country's specialized human resources. Second, Costa Rican workers must rethink the value they provide to the labor market as a result of digitalization and automation. A strategy is currently being developed to provide individuals with information about the skills and abilities that will be required in the future.

We have identified 12 skill areas where we must develop knowledge and experience. Meeting this challenge requires rethinking our educational models to accommodate rapid changes in demand for skills, since companies may announce a new process or project with a totally different set of knowledge and expertise requirements at any time.

Closing gaps in the availability of the training and certifications that now form the basis of the labor market must be done quickly if we are to take advantage of international opportunities. We have therefore aligned ourselves with companies that are leading global digital transformation to identify key content and certifications and to determine how to make them available in the country. We have also developed contacts and alliances with local and international academic institutions, and several of the research and innovation centers with which we have been working have already prepared programs for talent development in Costa Rica.

The country's and the region's value proposition is changing as a result of digital transformation. Diversification in everything related to technology, and the convergence of technology and industry, provides Costa Rica with an important opportunity. A group of major companies that are global leaders in research, development, and transformation is already present in the country, and we can become a natural laboratory in which they can experiment with new business and manufacturing models, as well as with new products and services.

In this context, we are considering the creation of a new brand, presenting Costa Rica as a “live centered hub,” where quality-of-life solutions for individuals can be designed, experimented with, and developed. This would require having a reskilling strategy aimed at solving problems caused by a relative scarcity of skills and an insufficient number of workers to meet market demand; challenges that must be solved not only in Costa Rica, but in the region as a whole.

We will continue to face challenges, and it is possible that in the near future flows of FDI will be evaluated not simply in terms of amounts invested, but rather in terms of cross-border employment. Costa Rica must therefore continue to make strong efforts to maintain its relevance in terms of the capabilities of its human resources.

OPEN INNOVATION AND NEW BUSINESS MODELS IN THE DIGITAL ECONOMY

Setting the Stage: Policy and Regulatory Framework to Support the Internet Economy in China

Wang Huimin

The digital economy has grown continuously and rapidly in China, reaching ¥27.2 trillion and representing 32.9 percent of GDP in 2017. It consists of two main components: digital industrialization and industrial digitalization. Industrial digitalization is currently the most important component, accounting for 77.2 percent of the digital economy, which has penetrated every industry, most notably in the services sector, followed by the industrial sector and, to a lesser degree, the agricultural sector.

These statistics suggest that there is still room for growth of the digital economy in China. E-commerce, an essential part of this economy, has recently grown rapidly in the country, reaching a value of ¥29.2 trillion in 2017. There are two main models in e-commerce: business-to-business (B2B) and business-to-consumer (B2C). In 2017, B2B accounted for more than 70 percent of Chinese e-business, with a trade volume of ¥22 trillion. Promoting further development of B2B can lead to efficient transformation and upgrading of traditional industries.

The Chinese government has also recognized the significance of cross-border e-commerce by introducing a series of policies and measures to support its development. As an integral part of e-business, cross-border e-commerce is growing more quickly than domestic e-business. Although the government still faces problems with obtaining reliable data on cross-border B2B, the

best data currently available indicate that cross-border e-business achieved year-over-year growth of 80 percent in 2017, and annual average growth of cross-border retail sales was above 50 percent for three consecutive years.

As a result of the importance that the Chinese government places on the digital economy, it has issued more than 60 policies related to this subject in the past three years, including the Internet Plus strategy, which promotes deeper integration between e-business and conventional industries to assist in their transformation and upgrading. Another important measure is the national big data strategy, intended to strengthen the use of big data by building and upgrading infrastructure to further integrate and share data resources and to improve data protection. Additional guidelines, such as Made in China 2025, Internet + Advanced Manufacturing, and Guidelines for Developing the Industrial Internet, as well as other measures to promote cross-border e-business and form new growth poles for foreign trade, have also been introduced by the government. In the past three years, the government has established 35 comprehensive cross-border e-commerce pilot zones and provided them with innovative systems and management modules to create a sound environment to increase cross-border e-business.

Although the highest rate of digital penetration is taking place in the services sector, China has also witnessed the rapid growth of e-business in the industrial sector, where some traditional manufacturers have had notable success in digitally transforming themselves. One interesting example is Haier, a well-known home appliance manufacturer in China. The president of the company, Ruimin Zhang, was very aware of the developing internet. He transformed this traditional manufacturer into an intelligent manufacturing enterprise, focusing on customer needs by building an open, innovative platform called

COSMOPlat, which provides services not only to Haier but to other SMEs. As opposed to the traditional concept of providing customized services to a fortunate few, this unique platform uses information technology to scale up production and provide customized services for many clients, making it a leader in advanced manufacturing and a role model for others. In 2017, this platform had 320 million users in 3.9 million enterprises and had a trading volume of more than ¥313 billion. With 12 Haier internet factories, this platform not only supports its own operations but also helps other SMEs in various sectors by providing them with solutions and allowing them to adopt internet concepts to transform themselves into digital enterprises.

A second case is CotteYolan, a traditional clothing producer. A small-scale business with an advanced idea, CotteYolan created a large database for the clothing sector to support production and provide customized services at scale. Many Haier senior managers visited CotteYolan, which is why the two enterprises share many ideas about digitalization. In addition to serving as an example for Haier, CotteYolan provides training through organized business visits for approximately 70,000 people from enterprises worldwide, including Alibaba, Tencent, Panduit (USA), Lectra (France), and 1881 (Italy).

This small clothing company was the leading example of a successful e-commerce adopter when evaluations of such companies were carried out in 2015. It spent 10 years creating a large database with a customization platform that allows customers from around the world to communicate with designers and to purchase products with features tailored to their needs. A visit to its factory shows that the entire manufacturing process is driven by an underlying database that stores information about customer demand on the platform to promote intelligent production, and by doing so lowers production costs by

30 percent and increases efficiency by 30 percent, leading to increased profits. Providing customized services also increases the added value of products and strengthens the company's brand, an operating model that is very attractive to other enterprises around the world. Similar to Haier, this company helps 30 other Chinese SMEs in other sectors to analyze problems and seek solutions based on this concept to achieve digital transformation. This business model has been widely adopted among SMEs in more than 30 sectors.

It is interesting to consider China's approach to innovative policies and regulatory measures for cross-border e-commerce. For instance, the creation of 35 trial zones for cross-border e-commerce mentioned previously was undertaken because e-commerce is a new business model and the impacts of new regulatory and policy initiatives to govern this type of commerce are not necessarily clear before they are executed. Therefore, as a first step, the government's Customs, Tax, and Foreign Exchange Department implemented measures in the Hangzhou Cross-border E-commerce Trial Zone. The results of this initial implementation were used to produce improved versions of the system and its regulations, which were then applied in other 12 trial zones. Since the levels of development of cross-border e-commerce vary between cities, the government also approved the creation of an additional 22 trial zones in other cities, guided by previous experience and best practices.

In the trial zones, six systems, including information sharing, social logistics, and risk prevention and control, were implemented to create a harmonious and fast-growing cross-border business environment in Hangzhou. Adopting information sharing as the main guiding concept, Chinese customs created a single-window system for international trade across the country that interconnects cross-border e-business with government departments

such as customs, taxation, and foreign exchange. In a later stage, a comprehensive service platform for cross-border e-commerce was set up to connect enterprises, and the platform was connected to the single-window system to achieve barrier-free information exchange between enterprises and the government.

China is making progress in implementing digital customs clearance, and the customs service platform can accumulate data just as enterprise platforms do. The country needs to make full use of that kind of data to improve, redesign, and optimize processes. This data can provide information about the authenticity of trade and credit ratings of enterprises, for instance, allowing fast-track clearances for creditworthy enterprises.

Great efforts are being made in the single-window system to lower the costs of financing for SMEs, which are a barrier for most businesses. Attempts are also being made to integrate cross-border e-business by transforming and upgrading traditional industries. Currently, the industrial chain of cross-border e-business has expanded beyond transactions, payments, and logistics. Domestic financing, credit guarantee, and digital marketing services have been included in the scope of cross-border e-commerce to build a marketing system for overseas clients.

Likewise, SMEs are encouraged to develop foreign trade business, including selling domestic products abroad and purchasing foreign products. The single-window platform allows SMEs to focus on design and production, outsourcing some foreign trade-related work to other professional companies. In addition to B2B and B2C, other new cross-border e-commerce models are emerging, such as business-to-business-to-consumer (B2B2C) and manufacturer-to-consumer (M2C), which directly target customers. The customized services discussed previously are an example of direct interactions between manufacturers and consumers.

The well-known Alibaba platform is often considered to be an outstanding example of B2C. The domestic e-commerce platform encompasses B2C and B2B, while foreign trade is carried out through B2B and B2C importing and exporting, and all activities benefit from financial, cloud computing, and intelligent logistics services to drive the development of SMEs based on the use of data.

Corporate Venturing in LAC: A New Innovation Paradigm

Claudio Barahona

On a global level, the types of companies with the highest stock market valuations have changed notably within the past 10 years, from long-established companies such as Exxon, General Electric, Petro China, and Royal Dutch Shell, to newer high-technology companies such as Apple, Google Alphabet, Microsoft, Facebook, and Amazon. Traditional market leaders have lost value because they did not have the ability to innovate rapidly and capture the wave of the digital revolution, and thus they are now being threatened with disruption by newer and more agile companies.

Large corporations are now realizing that they cannot continue to use traditional strategies and that, if they do not learn how to constantly innovate and reinvent themselves, it will be difficult for them to survive. However, this should not be regarded so much as a problem but rather as a challenge or an opportunity. If these corporations can take advantage of technologies such as AI, blockchain, and the IoT and can combine them with increasingly widespread high-speed connectivity, including 5G, they can once again compete on a more equal footing.

We can understand the situation that large corporations are in by visualizing them as elephants. Elephants are large, strong, live many years, and move at a deliberate pace, usually in herds. In contrast, smaller and more agile startups can be thought of as gazelles, which live in far larger herds, are more delicate, and live shorter lives, but can also move much more quickly than elephants (of course, some startups [gazelles] may grow through time to become elephants like Amazon, Alibaba, or Mercado Libre). It would be ideal if corporate elephants could somehow learn how to become more agile from gazelle companies and both cooperate with and benefit them without trampling them.

One of the ways in which such cooperation can be carried out is through corporate venture capital investment, which is increasingly common on a global level. In 2018, corporate venture capital represented 20 percent of global venture capital. In other words, in contrast to traditional venture capital investment made by specialized investment firms, large corporations are increasingly investing in start-up companies. In only one year (2016–17), the number of corporations making venture capital investments grew by 40 percent, and this trend will continue in the future. Furthermore, almost 70 percent of the Forbes Top 100 companies are working with start-up companies, either through corporate venture capital investment, making some other type of investment in these companies, assisting them in business accelerators, or sponsoring hackathons.

A recent study by PRODEM, assisted by the IDB and major corporations, including Movistar, a major telecommunications brand, investigated the more general area of corporate venturing in LAC, which includes not only corporate venture capital investment, but also many other ways in which corporations can be assisted by small start-up businesses in developing innovative solutions for the challenges they face.

The PRODEM study found that there were 155 corporations working with more than 2,000 LAC startups. Almost half (49 percent) of the initiatives studied had been operating for two years or less, and an additional 45 percent had been operating for between three and six years, indicating that this type of investment has only recently begun in the region. However, the practice has spread to many sectors. The corporations making these investments are not only banks and technology companies, but also breweries and tourism companies, as well as companies operating in the construction, retail, energy, and health sectors, among others.

The principal motivation of 82 percent of these corporations for working with startups was to develop their capacities for innovation. A further 11 percent made direct investments in an innovative company, with Chile and Brazil as leaders in this area. In Central America, many of these initiatives are highly focused on corporate social responsibility or marketing.

I would like to mention several initiatives to illustrate the wide range of LAC corporations that are increasing their capacity for innovation by working with smaller companies. In Chile, Masisa, a forestry and wood products corporation, has created a small business incubator to support innovative projects related to its own products. In Mexico, Grupo Bimbo, a baked products conglomerate, has created its own corporate venture capital arm, as have Cinépolis, which operates a chain of movie theaters, and Cemex, a building materials company. An especially interesting example from Argentina is Mercado Libre, which was originally a small startup itself, but grew to be perhaps the most valuable company in the national stock market. It has created a venture capital fund and has invested in several new digital startups, as has Globant, an Argentinean software development company.

Finally, I would like to offer a few insights for policymakers about corporate venturing from the point of view of large corporations. First, governments should not expect to motivate corporations to participate in corporate venturing by involving them in bidding for public funds to carry out specific projects. Smaller businesses and universities may be used to this approach, but large corporations are not; they have their own investment capabilities and are most interested in learning more about corporate venturing and what other corporations are doing in this area.

Second, corporations do not engage in corporate venturing simply to obtain financial returns. They often think of interactions with innovative third parties as a way to gain an important strategic advantage by learning more about how their industry is changing and how opening up to work with startups can help them become more competitive in their markets.

Third, let them be large corporations. They want to do business, not do favors to develop an innovation ecosystem, and they are used to moving at their own speed. Policymakers must think of ways to transform an ecosystem into an industry, to increase the availability of investment capital, and to promote the creation of startups and co-working arrangements, to create a playing field that corporations will be comfortable with.

Finally, help corporations that have not yet begun to engage in corporate venturing to do so. Help them learn more about what companies are doing in this area and, if they are carrying out research and development (R&D), help them understand that progress in this area can be made through corporate venture capital investments. I think that discussions of public policy are often focused on how much companies invest in R&D but tend to neglect the fact that another way for a company to innovate

successfully is to acquire startups that have already carried out their own R&D. We should therefore search for ways to promote direct corporate investments in startups, not by giving money to the corporations for such investments, but by encouraging them to take risks and dare to invest in smaller innovative companies.

New Data-Based Business Models: A Case from Costa Rica

Carlos Araya

The company that we founded four years ago is working to incorporate a theory of information that can represent beliefs and behaviors into our systems, an innovative approach that uses leading-edge science and technology to produce important practical results.

We have a distinguished team of data scientists and make use of the Google Engine big data platform running on multiple processors in a cloud computing center. Our approach has been more focused on rationality than on intelligence. Basically, we believe that rationality is for machines and intelligence is for human beings, a perspective that is closely related to recent findings in psychology and behavioral economics.

Daniel Kahneman, who together with other researchers won the Nobel Prize in economics in 2003, wrote a book in 2011 called *Thinking Fast and Slow*, in which he proposes that humans think in two general ways, which for lack of better names he referred to as System 1 and System 2. Humans use System 1 thinking when we walk, talk, drive a car, or carry out any other pattern-oriented activity; System 2 thinking is invoked when we have to think deeply about a situation that is outside the patterns we have al-

ready learned. For example, when you are driving on a highway and another vehicle suddenly stops in front of you, time seems to slow down as you think about what to do.

Almost all of the algorithms now in use (e.g., in self-driving cars or systems that answer chats automatically) are based on machine learning, which corresponds to the System 1 pattern of human thinking. There are very few systems currently available that are based on System 2 thinking. We believe we have developed the first system, or one of the first systems, that can be applied on an industrial scale that can reason and solve problems that the system was not previously trained or configured to solve.

We have developed a system that, as opposed to other systems that are now on the market, does not simply use machine learning or AI systems to produce tables or graphics that a person has to interpret to try to find patterns that explain a phenomenon. Our system goes further, using the output from these machine learning algorithms as input to a reasoning system (which we call the Reasoner) whose results help people solve much more complex problems. This advance is in some ways similar to the manner in which brains have evolved, keeping some basic elements of earlier brains but adding new elements that allow more complex reasoning.

Our system first represents numerical or non-numerical data in multidimensional spaces, and then, in what is our greatest innovation, allows these information spaces to be transformed into symbolic logic using what is called Possible Worlds Semantics. This allows us to take information spaces that represent customer behavior or transactions in a marketplace and translate them into a symbolic system that permits us to carry out reasoning by solving equations using formal symbolic logic.

By doing so, we have created a system that can represent the behaviors and beliefs of individuals or clients and that can be shown to satisfy the postulates that philosophers, especially epistemologists, consider a rational system should have, even when the information on which reasoning is based changes. If our system is dealing with a complex information space and new information is supplied that contradicts this representation, the system adapts in a completely rational way.

The system works with historical data, uses machine learning algorithms, and creates models of the expected behavior of subjects based on the same Theory of Mind that humans use when we mentally attribute principles of rationality or intelligence to members of our families, our partners, or our co-workers.

Basically this describes a system that learns from situations such as talking to a call center representative or visiting a web site, and adapts itself as situations change. We worked with Boston Consulting in the United States to develop a system for a restaurant chain, and by analyzing data from 25 million visits of 2 million customers, the system was able to predict what customers would buy two times more accurately than the standard “last visit” models used by Pizza Hut and other restaurant chains. The system accurately predicts orders 85 percent of the time within one standard deviation, and works so well that when it has processed 60 percent of a client’s transaction, it knows what the client’s average transaction will be.

We have also developed a system that allows companies to raise their service rate by 4 percent; it will enter production in LAC soon. It can carry out big data analysis, machine learning with 20 variables or more, operations research, and optimization, and, in cases that cannot be solved with these tools, it uses its reasoning capabilities.

Our company has also focused on the problem of food waste. The Food and Agriculture Organization of the United Nations recently published several interesting studies that found that around 1.3 billion tons of food are being wasted every year, worth about US\$900 billion—an enormous problem and an enormous market. We believe that our technology can be used to help solve this problem. As a first step, we built a system that can help reduce the amount of waste food produced in a restaurant to 50 percent or 70 percent of its original level, and save the restaurant between \$15,000 and \$20,000 per month. This system is now being implemented in several restaurant chains.

We intend to continue applying our technology to help our clients address problems that were too complex to solve before the advent of big data. Rather than replacing workers with technology, the primary purpose of our systems is to assist workers by providing recommendations that will allow them to improve the ways in which they carry out their activities.

TALENT FOR THE DIGITAL ECONOMY

Setting the Stage: New Approaches to Digital Upskilling and What's Next

Sebastian Barahona

Udacity believes that the best way to support the digital transformation of traditional sectors and foster digital entrepreneurship in LAC is reskilling and upskilling. The problem that faces all of us is how to do so at scale and cost effectively.

We are an online education company that focuses on teaching targeted skills to everyone that wants to participate in the new economy. We want to bridge the talent gap in the tech sector by helping people advance in their present careers, start a new career, or change their career, or build tech companies or create startups. We were founded in 2011 by a former professor at Carnegie Mellon and Stanford who was also a senior executive vice president at Google, responsible for the Google X project. While at Stanford, he uploaded materials for a class on AI and within a few days the class had more than 150,000 people registered worldwide, with many of them finishing the course. After this experience, he realized that there was huge potential for online education and he left Google to start Udacity in 2011. Two years later, he realized that traditional massive open online courses suffered from very low completion rates, low graduation rates, and a lack of engagement on the part of students. So, he reorganized Udacity around the concept of nanodegrees.

There are three things that make our nanodegrees special. First, we took a less academic, more practical and industry-focused approach; our nanodegrees are built by and for businesses. When we create a nanodegree, we have an advisory board that

meets regularly, and we ask companies participating on the board what skills they are not able to find in the labor market. Based on the results of those conversations, we build our curricula around technical fields such as big data, AI, machine language, digital marketing, and digital business.

Second, we believe in project-based learning. We realize that our online education must guarantee that students actually participate in our courses and learn the content provided, so students must complete a set of projects to receive their nanodegree certificate. Work done on these projects receives personalized feedback from our network of project reviewers and the students learn by doing.

Third, we focus on getting people jobs. We recently launched career-oriented services, including personal reviews and interview preparation, to help students get the jobs they want. We also have a series of tech companies around the world working as partners who help us bridge the gap between supply and demand.

In 2015, Udacity was growing extremely rapidly, becoming a unicorn company, and also began to expand outside of the U.S. market to China, India, Brazil, and Europe. In Brazil, we translated most of our content from English to Portuguese, and, very importantly, started to provide support in Brazilian Portuguese for students and made sure that project reviewers were native speakers. We adjusted the value equation, reducing the price of a nanodegree by about 50 percent compared to U.S. prices to be more in line with Brazilian reality. After testing some of our nanodegrees that were popular in the United States, we realized that Brazil presented us with different challenges and needs for content. For instance, more introductory courses were required in Brazil as opposed to more advanced programs in the United

States. In response, we created new content specific to Brazil and formed local partnerships with several major corporations, such as Telefonica, to help the students get the jobs they wanted.

Our results in Brazil have been impressive. Brazil is now the country with the second-largest number of students participating in our courses, with a compound annual growth rate of 107 percent and more than 8,000 students paying for nanodegrees at this moment. This is especially impressive given that Brazil is going through one its deepest economic recessions. However, studies have shown that there are currently 100,000 to 200,000 job openings in the country and there is very high demand from businesses for technically trained workers. This is what is driving our growth.

We are working to expand to other countries in LAC. Some of the steps we are going to take in Spanish-speaking countries are very similar those that we took in Brazil, adjusting our content to produce close to 100,000 nanodegree students in the next five years.

How Is Medellín Becoming a Digital Talent Hub?

Elkin Echeverri

Medellín is implementing a transformation agenda aimed at establishing a true knowledge economy. This is not optional, it is a necessity. We have no desire to return to things as they were. Fortunately, there are good reasons to believe that we are succeeding in our efforts.

Andrew Ng is a legend in the world of AI and the ex-Chief Scientist of Baidu. He has criticized existing venture capital funds for being too slow to invest in AI. He created his own fund to invest in this area and has received strong financial support from other well-known venture capital funds, such as Sequoia in California. His fund is currently making a number of investments in AI-related areas and is seeking talented workers and entrepreneurs who can assist in forming new businesses to transform our economies with the assistance of AI. One of the first places that this fund investigated was Medellín. Three weeks ago, Andrew and his associates visited us in Medellín and concluded that we have enormous potential based on our ability to provide talent and on the city's ecosystem.

Accenture was looking for a place to establish its next advanced technology center, focusing on digital transformation and AI; it chose Medellín. The company will require at least 2,000 workers in the next two years and might need as many as 4,000 workers if the city can provide that many within that period. In its first six months of operations, we have already supplied 300 workers, and we are especially pleased with their policy that 50 percent of their work force in Medellín should be women.

It is estimated that 35 percent of people working in business process outsourcing and information technology outsourcing will be replaced by robotic process automation and machine learning by 2021. The Digital Americas Pipeline Initiative conducted a search for locations that could supply the human resources necessary to assist in implementing business process automation and decided to create a center in Medellín in partnership with Ruta. The center will require 1,900 employees by 2020. The fact that this center will be exporting services is significant, but this is not the only reason that it is important to us. We also see it as an anchor that is increasing the sophistication

of the companies that operate here and of the products and services that we will export in the future.

Kiwi is a company that is a leader in using autonomous robots to make deliveries to homes and offices. It has already made more than 6,000 deliveries on the Berkeley campus of the University of California, as well as in the cities of Berkeley and Palo Alto. Its first development center is in Berkeley, but it has now opened an engineering center in Medellín. The company is important to us not only because it produces autonomous vehicles, but also because it provides us with knowledge about using advanced technologies in hotels, shopping centers, and many other types of businesses.

An innovative approach is being used to supply Kiwi with employees in Medellín. The company initially wanted 10 to 15 people who knew how to program autonomous vehicles, and Kiwi and Ruta N issued a challenge to find workers with these skills. We were confident that the development community would respond well. The first exercises in this competition were satisfactorily completed by 135 people, of whom the 40 individuals who performed best will be receiving a course designed by Kiwi and provided by Udacity to train autonomous vehicle engineers. The 10 students who perform best in that course will be hired. This approach—a challenge followed by training whose details are specified by the employer—totally alters the way human resources are traditionally provided.

In Medellín we are working to provide human resources based on the demand for workers rather than on the available supply of workers. In other words, while the traditional educational system has always been oriented toward supply, we have reversed this and are providing people with the skills that the companies are asking for. We complement this approach by

issuing challenges to individuals seeking employment. We are fully aware that the demand for different types of skills is highly dynamic, which means that it is necessary to constantly monitor the skills that are in most demand.

We are working to integrate training in different areas. In the past, a great deal of money was spent on training workers in English and then in technical areas, but this isn't the best way to do it. It is much more efficient to teach technical skills in English. Our goal is to provide training in both hard and soft skills, delivered with a well-defined objective in mind.

We believe that providing talent should be regarded as a flow, not an event, not immediately filling a list of vacant positions, but using an ongoing process that requires an appropriate strategy. If a company says that it needs a certain number of people in six months and a certain number more in a year, we will immediately provide the number of workers that are needed in the short term and begin working to find or create the workers that will be needed in the future. On the other hand, we don't talk about planning for employee retention; this is something that must be managed as it happens.

Colombia is fortunate to have a large talent pool. However, we should not be content with what we already have; we must work hard to increase it. The strategy of Ruta N focuses on creating a talent management system for the entire city. Medellín is committed to working through public-private partnerships to create such a system, but we must ensure that all of the necessary actors are participating in this effort. We have arranged lines of credit with private companies to assist with a wide range of training programs. With the assistance of the IDB, we will be providing training for businesses in creative and cultural areas (the orange economy), and we are

starting a process of technical cooperation to provide training for life sciences companies.

The most rewarding part of what we are doing is taking people who urgently need employment and transforming them into the types of skilled workers that our country needs to take advantage of the opportunities that are now appearing in the digital economy. It is heartening to learn from the experiences of our Chinese colleagues that our greatest weakness, a lack of skilled workers, can eventually become our greatest strength, a workforce for that new economy, through the types of efforts that we are making in Medellín.

Plan 11Mil: Argentina's Vision for Talent Development

Pia Giudice

Knowledge-based services are the most dynamic sector in the Argentinean economy, with sales growing 70 percent between 2007 and 2017, and exports of US\$6.5 billion in 2017. Employment in the sector grew by 65 percent between 2007 and 2017, and average salaries are 40 percent higher than those offered by companies outside the sector.

However, there is a critical shortage of appropriately skilled workers to fill positions in knowledge-based services. This has been clearly documented for workers with information technology skills, where demand for software development skills is particularly strong and the level of difficulty of finding skilled programmers is high. In addition, employee turnover rates in the ICT sector in general are quite high.

Talent formation has become an urgent priority for the government, and types of training that can provide workers with necessary skills more quickly than the formal educational system are especially desirable when trying to meet the demands of a quickly growing and highly dynamic sector.

One of the responses of the government was to create Plan 111Mil in 2016 in close cooperation with the private sector. Originally the intent of the plan was to create 100,000 new software programmers, 10,000 software professionals, and 1,000 software entrepreneurs in four years. Enrollment in the year-long program is free, and 364 hours of training is provided in four modules offered in 700 locations in 216 cities. The Ministry of Education was involved in creating the program and helps to certify skills to increase the employability of graduates. Job placement assistance is provided for graduates.

More than 80,000 people initially registered for the program, but far fewer actually began training and dropout rates are high, probably partly due to the fact that the program is free, the courses are technical, and the program lasts for a year. The database of applicants was revised to include only people who seemed to be motivated to really participate in training, and only 12,000 people remained. So far, 27,000 people have participated in the program and 1,500 people have been certified, of whom 500 are now working in ICT or other knowledge-based business.

Experience gained in the first few years of Plan 111Mil is being used to improve the performance of the program in the future. We have learned, for example, that students are more likely to perform well if they participate in group exercises during training and if their teachers are truly engaged and skilled. As a result, there are now plans to train instructors to reinforce their pedagogical and technical skills.

Participants in the program are taught to program using Java. Potential employers often request skills in other programming languages as well, and we are planning to add new modules in languages such as JavaScript and .NET. English is attractive to employers, but it is not being taught in Plan 111Mil courses. However, in some of the communities where training is being provided, agreements have been signed with the municipalities whereby they assume the responsibility for providing language training.

Some IT positions that are in high demand do not require a high level of technical skills, such as software testers, so shorter courses in such areas are being developed, leading to faster job placement. It is also hoped that job placement can be improved by promoting internship agreements with software companies, and by inviting representatives of software companies to talk to students about being employed in the sector.

I would like to mention the story of one of our students as an example of what Plan 111Mil can do for its graduates. Matías was a 30-year-old dog groomer and Tai Chi teacher with an excellent attitude who studied in a city 70 kilometers from his home; he lost both his jobs while he was studying. Within two months of graduation and certification, he interviewed with Belatrix, a software company, and was hired.

China's Public Policy Agenda on Digital Talent

Zhang Qing

Cultivating and developing talent has sustained China's economic growth in the 40 years since market reforms were implemented and markets were opened. Talent is becoming

even more important as the economy pivots toward digitalization and participation in the global internet economy. GDP growth in China in 2017 was 6.9 percent, indicating that the previous high-speed model of approximately 10 percent annual growth is transforming into a medium- to high-speed growth model with average annual growth of approximately 7 percent. The Chinese government has placed great emphasis on the growth of the digital economy, whose overall output value increased by nearly 20 percent in 2017, contributing almost 55 percent of overall growth and accounting for 33 percent of GDP. The interaction between talent and economic growth is obvious in the internet economy: demand for talent increases as the economy grows and more workers with internet skills can increase economic growth. While the growing size and quality of the talent pool serves as a pillar to support the development of the digital economy in Chinese internet businesses, rapidly increasing demand for skilled workers is not being met and actions must be taken to remedy this situation.

Taking AI as an example, the number of workers with high-end AI skills in China reached 300,000 by June 2017 but there was a shortage of at least one million such workers. According to a report jointly released by the China Development Research Foundation and Sequoia Capital, the value of the core AI industry in China grew to US\$5.6 billion in 2017 and was estimated to reach US\$22 billion by the end of 2030, indicating the rapid growth and impacts on innovation of the AI industry in China. A quarter of economic output comes from AI, internet, and other industries affected by these technologies, and it is estimated that this figure will exceed 35 percent by the end of 2020, making it vitally important to increase support for these technologies and industries.

The Chinese government has already introduced significant strategies and measures—such as Internet + Action, the Outline Plan for National Informatization, and the Action Outline for Promoting Big Data Development—to expand and improve the use of information. However, further actions are necessary to increase innovative manufacturing, further integrate the manufacturing industry with the internet, and accelerate the construction of internet infrastructure. Continuous efforts will also be made to improve internet speed, lower its cost, and overcome difficulties in core technologies to facilitate the development of the information industry and the digital economy.

Creating a new driving force for the digital economy requires the support of national laws and public policies. For governance of the digital economy, a co-governance structure with the participation of the government, the public, and platform operators is gradually being formed. Progress has been made in institutional governance by promoting public supervision, enterprise autonomy, and industry associations. The government plays an active part in creating an environment to construct and govern infrastructure, but public supervision is also necessary to stimulate entrepreneurship, which is always at the core of economic development.

Further, the Chinese government, from President Xi to all other levels of government, attaches great importance to developing digital economy talents. In the policy area, China issued the 2006–2020 National Informatization Development Strategy in May 2006, which includes strategic plans for future development of the industrial sector in that timeframe. This wide-ranging strategy includes two important measures. First, it recognizes the need to establish clear requirements to enlarge and manage the information-based talent pool, including gathering reliable information about demand for skills. Second, it highly

emphasizes the strategy of Going Out and Bringing In to attract overseas talent and encourage overseas graduates to be part of the national informatization process. We have benefited greatly from the principle of reform and opening up during the past 40 years, and this principle can be adopted in solving the issue of talent shortages by encouraging overseas study and making a fervent effort to attract a large number of overseas graduates to return to the country.

The national government also provides training to improve the information technology capabilities of its personnel, and the training system at all provincial and municipal levels also educates local officials so they can improve their abilities with information. Moreover, according to the Outline for National Informatization Development issued in July 2016, it is essential to optimize the talent pool and improve skills through training and by assessing how the results of training are related to employees' overall work performance.

China also issued its 13th Five-Year Plan for the Development of Strategic Emerging Industries. Seven industries were named as emerging strategic sectors nationally. We must step up our efforts in terms of training and incentive mechanisms to develop more workers with the skills that are in short supply, encourage more skilled workers to move to the business sector, and make full use of global human resources by importing high-end talent. Currently, we are planning to establish a permanent residence system for foreigners by simplifying the application process for permanent residence and providing other assistance for foreigners with high-level skills.

In some traditional industries with high technical requirements, such as handicrafts and Chinese medicine, training is not provided in schools but through mentorship. We have started to

adopt this mentorship system for some enterprises in specialized fields to cultivate new talent. In addition, the 13th Five-Year National Informatization Plan recommends making full use of the private sector to train talent of national importance and considering how to create incentive mechanisms for enterprises to attract, keep, and motivate talent. In December 2016, the 2016–2020 Manufacturing Development Plan emphasized building a manufacturing talent pool. We have since introduced detailed measures to fit into the comprehensive framework for talent training.

GREEN, BLUE, AND INTELLIGENT

Setting the Stage: Costa Rica's Sustainable Development Strategy and the Role for Innovation

Monica Araya

Costa Ricans are living in interesting times. We have the youngest president on the continent and a president of the congress who is 35 years old. We are at a point where we must try to make intelligent decisions in all areas, not only with respect to the digital economy but also about issues related to competitiveness, the future of work, and air quality. We want to have cutting-edge technology, but we also want to prosper, grow, be happy, and not destroy what we already have. We want to find partners to collaborate with us and who want to be part of the history of a small country that thinks big.

Our bets on turning green issues into opportunities have certainly paid off. A few years ago, 27 percent of the country was forested; forest coverage has doubled while the population has grown and income per capita has tripled. Areas such as the Monteverde cloud forest, once seen as a natural wonder, are now also regarded as valuable natural capital. Electricity in Costa Rica is generated from water, biomass, wind, and volcanoes; while other countries are trying to develop renewable energy sources, we have already done so.

Our efforts to create a green country and a green economy have so far produced excellent results, but there are still challenges to be met and we have to find ways for our generation to do even better. The digital economy is extremely interesting to us in this context because it offers great opportunities to improve our efforts in the area of decarbonization.

We must become a more diversified, decentralized, de-carbonized, and digitized country. To do so, we need capital and talent, and we need to give environmental issues highest priority in our planning, which is not often done when considering how to improve competitiveness.

The idea of creating green economic instruments first appeared in the 1990s. When decarbonization is mentioned today, the discussion focuses on moving beyond fossil fuels, but during the 1990s, it was focused on carbon markets and part of that mechanism originated in Costa Rica. In a related development, a fuel tax was established in Costa Rica in the 1990s and part of the funds generated were paid to people who were cutting trees so that they would protect them rather than destroying them.

Costa Rica has played a significant role in climate diplomacy; when the Paris Agreement was signed, a Costa Rican woman was present, and the country has specified its Nationally Determined Contribution for reducing emissions and moderating global temperature changes. CINDE, Costa Rica's Agency for the Promotion of Foreign Direct Investment, has worked to create a brand for the country that emphasizes green uses of technology, positioning the country as a hub for attracting investments that contribute to better living conditions for its citizens. We would like to be a global leader in environmental management, but while we were ranked number one in LAC in the Yale Environmental Management Index for 2018, we were ranked 30th in the world because we aren't managing our wastewater well.

The gap between the green growth we have and the green growth that we can have was recently studied, with the goal of establishing what can be done in Costa Rica from an economic perspective to help both the economy and the environment. The results indicated that we should emphasize the develop-

ment of clean public transportation to decrease vehicle emissions, which are very high.

If Costa Rica is a model for using renewable energy resources in generating electricity, why do we continue to use gasoline-powered vehicles that cause serious environmental problems? If we are trying to develop a truly digital economy and we still continue to use gasoline in cars, we must ask ourselves if this is the best way to create prosperity for our citizens.

Decarbonization requires moving away from generating this type of emissions and eliminating them by the middle of the century. A plan is being prepared called “Costa Rica without oil is a success”; it will be launched on December 1, the date that Costa Rica abolished its army, of 2019. It has 10 axes and eight cross-cutting strategies and recognizes that transportation is our Achilles heel. Costa Rica used to be an agricultural country and urbanized very rapidly, but transportation did not modernize at the same pace. If our transportation problems are not solved, the country can no longer be regarded as modern.

We must ask those who know the most about digital economies what can be done in our country to achieve decarbonization. What is the green digital opportunity? We obviously need the latest information available on this topic and need to involve innovative startups in the development of solutions. The IDB has been very supportive of our efforts, and Costa Rica has recently had a small satellite launched that will monitor the health of our forests; however, much remains to be done.

Costa Rica is a small country that thinks big. We have not achieved all of our environmental goals, but we have been pioneers and are working on an international level to make progress on issues of decarbonization, as can be seen in our partic-

ipation in the Paris Agreement. We say to our colleagues from China that there is a great opportunity for us to work cooperatively on the use of digitization to support decarbonization, both in LAC and in China.

China: Frontier Green Technology as Part of the Development Vision

Qiao Qi

This morning, Mr. Cai and the President of Costa Rica mentioned that this year marks the 40th anniversary of market reform and opening in China, and the world has witnessed the rapid growth and great progress that this produced.

Economic progress also creates environmental problems, such as the serious smog problem in Beijing. China is also known for rich industrial resources, and the majority of enterprises in 660 industrial categories (with the exception of the nuclear industry) have the highest output in the world. For instance, China ranks first among all countries in steel production output, followed by the United States. In fact, China's Hebei Province, and even the city of Tangshan in Hebei Province, produce more steel than the United States. The enormous scale and rapid expansion of this industrial capacity has come at huge environmental costs. At the 17th Communist Party of China National Congress, the government proposed the idea of ecological civilization to make China a better place, with blue skies and clear water, providing Chinese citizens with an ecological environment like that of Costa Rica. Driven by the government, many pilot projects—such as ecological civilization construction, urban mines, eco-industry recycling parks, sponge cities, and intelligent cities—have been proposed to promote sustainable, eco-friendly development in China.

The rise of eco-friendly enterprises has been the response to this situation. The total value of environmentally friendly industry reached ¥3 trillion in 2012 and grew at an annual average rate of 16.4 percent to ¥4.55 trillion by 2017, surpassing the annual average GDP growth rate of 9.5 percent. The steady growth in the value of eco-friendly enterprises is a result of several factors, including increased profits in 39 A-share listed companies, higher than those of all other enterprises during the same period, and the fact that a substantial number of state-owned enterprises have entered this area, indicating that it is an industry with a promising future. At the same time, mergers and acquisitions of eco-friendly enterprises have become popular, with 100 enterprises going through this process in 2016, of which 14 were involved in overseas transactions. Given the increasing burdens involved in environmental protection in recent years, these trends show that the environmental services industry could grow rapidly by providing environmental consulting, technology development, monitoring, integration plans for environmental management, and other services.

However, there are clearly important issues involved in the early stages developing this industry. Driven by the establishment of laws and regulations to treat water, gas, and solid waste in 1972, China developed relatively mature technologies in those areas, but it has not developed similar treatments or technology for new pollutants. Therefore, we need innovation. The law for Soil Pollution Prevention and Control was introduced last year to solve this emerging problem but, with no comprehensive map of the coverage and severity of pollution for all regions, investigation of the gravity of the problem is still underway. In addition, great opportunities for development still exist in fields like environmental monitoring, since we need to upgrade monitoring equipment such as spectrum devices. In order to improve its quality and capability, the environmental industry needs to

integrate with the digital economy by improving its use of AI, automation, informatization, and big data.

The issues that China faces in the environmental industry can be divided into four areas. First is investment. Although demand for investment in the industry is clear, it is difficult for venture capital firms to determine appropriate directions, products, and technologies to invest in since the process of assessment takes a long time. Second, although more and more intellectual property patents are owned by domestic environmental companies, the country is still evaluating and transferring foreign technology. Only if we generate domestic demand for applications and technology development can we deal with environmental problems that exist only in China but not in other countries. Third, environmental enterprises need to consider how to make projects affordable, accessible to the government in the long term, acceptable to the public, and compatible with local conditions, since China is a vast country with highly diverse geographic features, weather, and educational levels between different populations. Last, we need to increase the availability of environmentally friendly technology. While it is well known that the purpose of the Blue Sky Plan in the Beijing-Tianjin-Hebei region is to improve air quality, many enterprises were punished for using expensive technologies that failed to meet national standards. As a result, many enterprises have collapsed or labored under large debts in recent years. When it comes to developing an ecological civilization, the government needs to provide more opportunities for the environmental industry to develop by introducing more strategies, policies, and ideas on green development.

The goal of green development is to make sure China can achieve sustainable economic growth within the carrying capacity of its ecosystem and using available resources in a way that allows people to enjoy an acceptable quality of life and a comfortable

environment. To do so, we need to resolve problems of global climate change and resource shortages, as well as of energy efficiency and energy safety, since China is an industrial country with a huge population. This is why our country has emphasized the concept of ecology in national development and ecological civilization in recent years. We also need to balance and coordinate environmental protection and social progress. We consume more coal than Japan and use twice as much energy in producing a unit of paper products, but we consume less electricity to produce a ton of aluminum than does the United States, which indicates that the Chinese development model must be applicable in a wide variety of situations. Hence, the green industry in China faces both opportunities and pressures in the future.

Several policies and measures further illustrate the need for green products in China. Made in China 2025 includes five major tasks in 10 industries that require such products, and the Industrial Green Development Plan specifies levels of development and numbers of green enterprises and industrial parks by 2020. Green development is also a priority in the 13th Five-Year Plan, while other related plans for accelerating development of the environmental industry propose additional concrete goals for green development in China.

In summary, green development in China is in need of innovative and environmentally friendly strategies, policies, and standards. The digital economy is closely related to the environmental industry, since the goal of green industry is to provide solutions for environmental problems in areas such as carbon reduction, cleansing, and recycling, and achieving this will require intelligent environmental protection equipment, new concepts and approaches to energy saving and recycling, and overall improvement of the quality of the service industry.

Innovative technology and standards play an indispensable role in driving green development, and the Belt and Road Initiative creates opportunities for green industry to contribute to improvements in this area throughout the world.

Using the internet and intelligent technology in manufacturing will give rise to Chinese industry Version 4.0. We also need a Version 4.0 for the intelligent environmental industry. Integrated solutions and products will be provided by environmental enterprises in China to serve more than 300 enterprises and industrial parks that currently focus only on a single area, such as engineering, consulting, testing, or equipment manufacturing. We are also making efforts to develop a wide range of comprehensive pollution control technologies and solutions that are applicable in many industries. Meanwhile, we provide a system of standards for enterprises, groups, and industries that are aligned with international standards, helping to promote the development of green industry in China and contributing to global environmental protection.

Blue Economy and Innovation: An Opportunity for Sustainable and Inclusive Economic Growth

Kirk Humphrey

Barbados has a small landmass but a much larger maritime area. Since we don't have large forests, we are excluded from most conversations about the green economy. But we do have an ocean, which makes the blue economy very important to us, as demonstrated by the fact that we recently established a Ministry for Maritime Affairs and the Blue Economy.

In very broad terms, the blue economy is about using the ocean as an economic resource while at the same time sustaining the ocean in a way that allows it to sustain us. We have always felt that we take care of the ocean, but we still face problems. For instance, we have recently had issues related to land-based pollutants entering the ocean, and the rising sea level and warmer waters may have serious effects in the future.

Whatever we do in the blue, green, or orange economies must have an impact on people. In real development terms, you are either managing a need, trying to solve a problem, or creating opportunities for people to advance. We have to be thinking about the digital economy in these terms as well.

We have a number of challenges in Barbados, some of which are related to the way in which we operate. Many government departments are isolated in silos; however, in the real world, everything is interrelated. We have good public services, recognized as some of the best in the world, but they are far from digitalized. Making progress doesn't mean putting files into digital formats, but thinking about the world in a new and transformative way.

In the area of fishery and agriculture, our legislation needs to be brought up to date and our markets must be repaired. We are wasting 50 percent of the fish we catch, which is a problem that could be attacked by appropriate use of digital information. We could do much more about maritime control and surveillance and are working on mobile apps to allow fishermen to share information and know where to fish. We have one main port in Barbados, which is used by both cargo and cruise ships, and it is badly in need of repair. We want to have electronic scanning for cargo and digital energy management systems in port so that we can better monitor what we are us-

ing. We also have waste management issues; the only sanitary landfill that we have is almost full and we are thinking about banning plastic.

My ministry has a coastal zone management unit that has a national information platform that tells us what the likelihood of damage is in case of floods, hurricanes, earthquakes, and other natural disasters. However, even though it provides information about where problems are most likely to occur and who is most likely to be affected, we weren't using it to manage things such as where people should live and what areas they should abandon. The principal problem with the system is that it is based on information that was gathered at a single point in time, and we need to update it constantly for it to be truly useful. We also need a baseline bioprospecting study to better understand what is in our waters and to provide us with the information we need to model the effects of situations such as a projected 2 percent increase in the temperature of the sea, which would be catastrophic for an island like Barbados. We already know that we have to take steps to protect our coastline, but we need more detailed information.

We are also trying to create marine management protected areas because we both overfish and have to import 80 percent of our fish, which is embarrassing for an island. This means that we need to create space for fish to replenish and teach fishermen new skills so that they don't overfish.

The prime minister announced that we have to be a fossil fuel free country in the near future, but we still need to be able to generate revenue, which requires dependable energy sources. We have expanded our renewable sources of energy but must do more in the future.

In the Caribbean, sargassum seaweed has become a major problem. Large amounts of this seaweed wash ashore on our beaches, where it rots and the smell drives tourists away. We have developed innovative approaches to this problem by using sargassum to produce biomethane gas and soaps.

We are also trying to build several small islands offshore, but once again we need to know more about what is in the ocean to avoid causing major damage to our marine resources.

We know that we must develop our blue economy, and we know that doing so will require technical innovations developed in partnership with digital entrepreneurs from around the world. We believe that this can be done and that the key to doing it successfully is to begin doing it now.

LEARNING FROM PIONEERS: TAKEAWAYS FOR LAC FROM THE DIGITAL BOOM IN CHINA

Insights and Perspectives: Learning from Pioneers

Cong Cao

China joined the internet in 1989 and by 2008 had the largest number of internet users of any country in the world. During the early stage of the internet era, the Chinese were mostly imitators and followers of more developed countries such as the United States. In the mobile internet era, however, although the United States is still the global leader, Chinese firms have become highly innovative and ubiquitous applications have changed the lives of all Chinese people. The retail industry has been especially strongly transformed by this wave of innovation, and e-commerce in China now has more transactions than France, Germany, Japan, the United Kingdom, and the United States combined. This has been made possible in part by leapfrogging credit card payments and moving directly to mobile payments.

There have been several generations of internet companies in China, beginning with internet portals, followed by a second generation of companies such as Baidu, Alibaba, and Tencent, and most recently by a third generation including Didi and other sharing economy companies. By the end of 2017, the number of unicorns in China, especially in the internet and mobile internet space, was almost equal to the number of such companies in the United States. Five years ago, only a few Chinese internet companies were global leaders in terms of market value; most were from the United States. Now, almost half of the largest internet companies are from China.

China has grown very rapidly in terms of technology and innovation, as measured by indicators such as expenditure on science and technology, and on R&D; the latest statistics available indicate that China now invests an amount equivalent to 2.1 percent of GDP on R&D. It also has the largest talent pool in the world, including about 3.8 million scientists and engineers, and the quality of its workers' skills has greatly improved. Higher education has expanded dramatically, as has the number of Chinese scientists publishing in international journals. Also, foreign investments have contributed significantly to China's growing levels of innovation and technological upgrading. China is now a global manufacturing center that makes increasing use of high technology, and it has become a center for many types of scientific research, assisted by substantial improvements in the facilities where modern research is carried out.

In 2017, Chinese universities enrolled about 7.5 million new undergraduate students and 7.1 million postgraduate students. FDI now accounts for 15 to 20 percent of China's total expenditure in R&D, and many such centers created by foreign companies operating in China have become important nodes in the global innovation network.

Chinese society has become more technologically sophisticated. The number of fixed telecommunication lines has been decreasing at the same time that the number of mobile users has exploded, showing that China has leapfrogged from low penetration of fixed lines directly to high dependence on wireless telecommunications. The number of internet users has also grown rapidly, but our penetration rate is still only 60 percent, which means that there is room for improvement in coming years. Increasingly, Chinese students have been going abroad for advanced studies, and a great number of them return to China to contribute to developing technology and creating digital economy startups.

Public policy has played an important role in China's evolution toward a digital economy in the past 20 to 30 years. At the beginning of this period, we had only a superficial understanding of innovation. It was not until the 1990s that China began to understand that innovation is more than science and technology, and R&D, but also includes issues such as talent development, the importance of property rights, and technological standards. This led to the formulation of mid- and long-term plans to develop science and technology in the period between 2006 and 2020, which called for China to build its capacities for endogenous innovation in order to become a leader by 2020 and a technology powerhouse by 2049. The government later began to focus on mass entrepreneurship and innovation, followed by formulating strategies for innovation-driven development. These top-down policy initiatives are also complemented by bottom-up activities at the grassroots level.

ICTs have had a prominent position in public policies since the mid-1980s, when China selected ICTs as one of seven strategically important technologies; the importance of software development capabilities was also recognized at the turn of the century. Strategic emerging industry initiatives such as Made in China 2025 included ICTs among areas to be developed, and there have also been spontaneous efforts made by the private sector that has greatly assisted in the emergence of the Chinese equivalent of Silicon Valley. Many of our leading companies in this sector, such as Baidu, began as small businesses and gradually became giants.

Most recently, the Internet Plus initiative was proposed, in part by executives of Tencent. This initiative helps integrate the internet as a platform into cloud computing, big data, AI, IoT, and smart manufacturing, and promotes the development of e-commerce and fintech. It has also helped Chinese companies to open up to international markets, especially in the area of AI.

Lee Kai Fu, who was an executive and AI expert at Microsoft and Google, has witnessed the growing global competition to become leaders in AI and its applications and has become a champion of the growing AI revolution in China. However, we know that we must pay attention to emerging issues regarding AI, including data privacy, legal liabilities associated with using algorithms for such things as autonomous cars, and implementation of policies without jeopardizing society.

Latin American countries can learn from China's experiences with the digital economy in the past 20 to 30 years. The first lesson is the importance of institutional change and creating a policy environment that stimulates bottom-up innovation initiatives. Another important lesson is capacity building, which not only involves improving the quality of education, but also considering how to deliver talent in a just-in-time and just-in-case way, which will be important in areas such as training the next generation of AI scientists and engineers. Finally, financial innovation is critical, with public and private partnerships, money from domestic and foreign sources, traditional banks and fintechs all playing important roles in supporting the country's digital transformation.

Comments

Deng Zhou

Statistics show that China has equaled or surpassed the United States, Japan, and developed countries in Europe through its transformation to a digital economy. During the course of this transformation, we have accumulated experience about how to catch up with developed economies despite infrastructure gaps. This information may be of interest to other developing countries.

Since China did not initially have the same availability of technology and skilled workers as more developed countries, it needed to find another way to achieve a breakthrough in the digital economy. First, it took full advantage of its huge domestic market. China surpassed America and became the country with the largest number of internet users in the world by 2008. At the end of 2017, China still ranked first, with America as runner-up and India in third place; China had approximately 770 million internet users, equaling the total number users in the United States and India combined. Meanwhile, 30 percent of global e-business transactions took place in China.

Second, as the world's largest manufacturer, China is making the most of its manufacturing capability to lay a solid foundation to support innovative business models and to provide products and services to facilitate the development of a digital economy. China is the largest producer of 220 of the 500 major industrial products investigated in a recent survey by the UN Industrial Development Organization and accounts for more than half of the world's industrial output. The fact that more than 70 percent of all cell phones, 50 percent of all motorcycles, and 60 percent of all televisions in the world are manufactured in China shows the country's enormous manufacturing capability, which can power future growth in the digital economy.

Third, China is a country with a huge population and rich labor resources. The digital economy drives requirements for high-end talent as well as for an enormous number of workers with lower skill levels. Continuous increases in automation and mechanization have made working in traditional agriculture and manufacturing less attractive to workers, while the digital sector offers opportunities with relatively higher salaries and better working conditions. Salaries and working conditions have become the major force for employment growth in

China in recent years. For instance, the number of employees in e-commerce has grown to 42.5 million people, which is equal to one-fifth of the population of Brazil, the entire population of Argentina, or almost nine times the population of Costa Rica. A large proportion of over 4 million employees in the digital sector have lower-skill jobs in areas such as customer service. Currently, there are more than 50 million people working in logistics, while over 3 million people work in the express industry. Both industries are e-business related, indicating the richness of human resources that underpin the development of the digital economy.

Last, the digital economy grows on the basis of the rapid development of telecommunications infrastructure. The past two decades have seen the development of such infrastructure in China: half of the world's 4G base stations are constructed in the country, and the national telecommunication network covers not only major cities such as Beijing and Shanghai, but also third- and fourth-tier cities and rural areas. The number of mobile phone accounts has reached 1.68 billion, of which 70 percent, or more than 1 billion accounts, are connected to the high-speed 4G network. While many countries in LAC have added 5G internet to their development agendas, China plans to start full commercial operation of 5G in the latter half of 2019.

Unavoidably, we still face shortages and challenges that may affect the development of the digital economy in China, and other developing countries as well. The first challenge has to do with the lack of core underlying technology and infrastructure. Although it has the greatest number of internet users in the world, China does not have enough secure internet server computers, ranking behind developed countries such as the United States, Germany, and Japan, developing countries such as Russia and Brazil, and even underdeveloped countries such

as Indonesia. The situation in China is also not promising in terms of the number of internet servers per capita.

China still relies heavily on foreign server computers to provide services in the digital economy. Furthermore, it is the world's largest parts importer, with products such as the iPhone assembled in China using imported chips and integrated circuits. Although this serves as a major driver for domestic digital growth, the growth of the digital economy is impeded by high reliance on imported resources. The Chinese government, as well as Chinese enterprises and R&D institutions, have recognized the importance of this issue. Enterprises such as Cambricon, ZTE Microelectronics, Horizon Robotics, and the well-known Alibaba are devoting their efforts to develop chips, especially AI chips, using independent Chinese intellectual property to overcome dependence on foreign products.

China has advantages over other countries in two other areas. First, because of its great emphasis on education and digital development, China has valuable talent resources that will support future development. Second, China possesses an enormous volume of data generated in the digital applications market. These two advantages will help China to continue narrowing the technological gap between itself and developed countries.

The second major challenge that China faces is that integration between industries is still primarily confined to the digital economy and service industries; however, progress is being made. Xugong Construction Machinery Group, a famous construction machinery brand in China, set up its own industrial IoT platform to make use of industrial big data. Currently, this platform connects more than 600,000 pieces of equipment in over 50 sectors and provides information on construction conditions in every district, as well as on economic development

and prospects. Another interesting example is the cooperative effort between the internet giant Alibaba and the well-known photovoltaic manufacturer GCL-Poly Energy to establish an intelligent factory. After the digital upgrade, this factory cut production costs by almost 50 percent, shortened the production cycle by half, and improved production efficiency by five times. The fact that GCL-Poly Energy, a leader in its industry, realized major benefits through digitization suggests a bright future for integration between the digital economy and the manufacturing sector.

Finally, rapid growth in the digital economy may create the risk of bubbles. Focusing on the development of the digital sector in policies, regional industrial planning, financial activities, and material resources could restrict the development of other economic entities. More importantly, a growing number of university students might choose digital-related professions for their majors and future careers because of higher salaries and better working conditions, which could result in talent shortages in traditional manufacturing sectors.

Fidel Jaramillo

This has been a space to exchange the experiences and knowledge of China and LAC to understand global trends in digital transformation.

When I was a representative of the IDB in Peru, the Chinese ambassador said that we should pay close attention to China's five-year plans because, unlike LAC and some other countries, when China plans something, it achieves its goals. Professor Kae Fang has mentioned that China is working to change its economy from one based on high growth to one based on quality growth. In the case of high growth, China grew based on its capital investment, an active export market, and a change from low to high productivity activities in cities. Quality growth involves a shift toward higher productivity activities, a massive investment in technology innovation in both traditional and non-traditional sectors, and development of everything related to human capital and skills.

In the era of high growth, this translated into a high demand for commodities, soaring mineral prices, and soaring prices and demand for food produced in South America, which generated a decade of Latin American economies focused on commodity prices. In Latin America, Chinese companies were important participants in key sectors such as minerals, construction of public works, and energy. The question that we must reflect on now is what is going to happen in Latin America as a result of the new cycle of quality growth in China. What impact will it have on our foreign trade structure? What impact will it have on added value services? What will happen in areas related to electronic commerce, payment systems, and data security systems? It is vital for us to have this information, which will allow us to adapt to the new cycle of growth in China based on digital transformation and innovation.

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Innovation can be made or bought. Are we going to see Chinese companies not only participating in the construction, energy, and minerals sectors, but also increasingly buying innovative LAC startups in dynamic sectors?

We must also consider the massive investment in human capital that we are going to require as a result of the scale of China's transformation. We will obviously need to develop more and better skills in areas such as mathematics, software engineering, and English, but what does this imply for the new skills the market is demanding such as communication, teamwork, and problem solving? This poses a challenge for all the ways of working in a collaborative economy. Very importantly, we should ask how LAC was included in China's period of high growth as a fundamental partner in providing primary goods, and as a partner and an important client in constructing and financing public infrastructure. We also need to ask what opportunities there will be for us in China's new stage of development.

Some of these opportunities have been mentioned in this event. China's experiences invite us to think about potential areas of interregional cooperation, such as developing technological parks and programs of study that may be of interest to both China and the region, and in areas such as languages. Strengthening cooperative ties can lead to new business opportunities, adapted to this new way of doing business.

We have seen several digital transformation initiatives launched in the region. Costa Rica introduced its national strategy for digital transformation toward the Costa Rica of the bicentenary, and other countries such as Brazil, Argentina, Uruguay, Chile, and Colombia have announced similar initiatives. There is obvious interest in avoiding increases in the gaps that already exist between countries in our region and more developed countries.

In addition to these digital transformation agendas, we have talked about what has been done at the level of sectors such as renewable energy, health, construction, digitalization, and data sharing. All such efforts being made in the region should have certain basic components. The IDB has established five pillars that ensure the success of a digital transformation. At the base of the pyramid is human talent. We have discussed here the challenges involved in generating human capital. A second element is infrastructure and adequate connectivity. However, even with human capital and infrastructure, a regulatory framework is also required. Even then, if there is no security, nothing is going to work: it is necessary to have secure data to protect privacy and its integrity.

Applications for a digital society must be developed to permit companies, governments, and citizens to interact in a way that will generate new business opportunities with the voice and participation of our citizens. This will allow us to have more productive societies and more transparent governments, and to prevent corruption.

There is also a need for political leadership to drive this transformation. This is not a technological problem; the critical issue is political leadership, along with a strong commitment from the private sector, civil society, and the academic sector.

Hearing the presentations and reflections of our colleagues from the Chinese Academy of Social Sciences has made me feel satisfied and optimistic because they clearly see the necessity to promote an agenda of cooperation between China and the LAC region. Allies like the IDB have been working with institutions throughout the region toward this same goal, and although challenges may change, the commitment that has been maintained for six decades remains.

CLOSING REMARKS

Personally, I feel very fortunate to have participated in this event and its presentations and discussions, which will have an impact both at an academic level and at the level of policy design and implementation. Thank you very much and congratulations to each one of you who have made this event possible.

Cai Fang

Thank you very much. I would like to take this opportunity to express my gratitude to the Costa Rican government for providing this amazing environment to allow scholars, government officials, and think tanks to discuss knowledge and policies. On behalf of the Chinese Academy of Social Sciences, I also want to thank the President of Costa Rica, the Minister of Science and Technology, and the Minister of the Economy. It is an honor to have you here.

I also greatly appreciate the efforts made by the IDB, especially the support from Ana Maria and all of her hard-working colleagues. I believe this is a fruitful conference. Meanwhile, the past five years of cooperation with the IDB demonstrates that it is an efficient partner and I hope that our cooperation will continue in the future.

Finally, I want to thank all the participants and the scholars from LAC and China who have come here to talk about the digital economy. We have had excellent speeches, discussions, questions, and answers at this summit, and I personally have learned a great deal. I would like to take this opportunity to share some of my opinions.

First, I believe that the digital economy is not just about one entity, one part of a national economy, or a new type of economics,

it is a new feature of national economies and the economy as a whole. AI, the internet, telecommunications, the IoT, and other technologies change every aspect of our economy. Our missions and challenges are to modify the economic systems, mechanisms, market operations, regulations and governance, and the behavior of all parties involved to be able to take advantage of this digital trend.

In the past, it was widely acknowledged that it would take a long time, even decades, for the application of groundbreaking technology to create economic returns. Many people believed that the latest round of technological revolution would not lead to rapid economic growth. This prediction has been shown to be wrong in this meeting; the speed at which technology produces economic benefits is increasing. We are at a new stage of economic development in which developing countries can catch up with or even surpass developed countries through widespread application of technology.

Second, we have seldom touched on the Belt and Road Initiative during this meeting on the digital economy. I may be biased, but with the exception of this meeting, all the international conferences I have attended discussed this initiative, despite the diversity of their principal themes. Historically speaking, LAC was not the destination of the Silk Roads, but the proposed Belt and Road Initiative does include LAC. I am curious about the views of scholars and government officials in LAC on this initiative, and how to establish a connection between Latin America and China. After all, the initiative is based on past experience and lessons that fit Chinese logic. However, an infusion of experience and inputs from other countries can enrich and complete its content to make it better fit global logic and to prevent it from being nothing more than empty wishful thinking.

Third, the time has arrived for us to reflect on development economics. Next year will mark the 60th anniversary of the founding of the IDB, the 10th year of the partnership between China and the IDB, and the 70th anniversary of the founding of the People's Republic of China. That is to say, we have experienced ups and downs during more than a half-century of economic development. Both LAC and China have experienced successes and failures, have taken detours, but have still kept exploring, and it is widely recognized that past successes and failures are closely related to development philosophy as well as development economics. It is now time to use development economics corroborated by practical experience to improve theoretical consensuses.

Last, I am reminded that the annual LAC-China Policy and Knowledge Summit will be held in China next year. The proper topic should be selected after extensive consultation, after which a suitable Chinese city will be chosen to host the summit. I propose Zhengzhou in Henan Province as the host city for the following reasons. First, Zhengzhou is the capital of Henan Province, which has a population of more than 100 million people and can serve as the most representative province in China. Second, there are rich organizational resources in Zhengzhou. The dean of the Chinese Academy of Social Sciences was once the governor as well as the secretary of the provincial Party Committee of Henan Province. Furthermore, I am in charge of the research division in Zhengzhou and we can properly organize the event. Third and possibly most relevant for all participants, Zhengzhou is in Henan Province, a late-comer region located in the middle-west of the country, which is increasingly catching up with coastal regions. Further, Zhengzhou and Henan Province have distinctive features of rapid development that you many find interesting. Fourth, Henan Province has a long and rich history. As the central region of China in the past, Henan has the greatest number of

archaeological sites and cultural relics in the country, permitting participants to dive into the sea of traditional Chinese culture. Last but not least, Zhengzhou is conveniently located; it is only two and a half hours from Beijing by high-speed train. Hopefully, I will see everyone here at the next meeting in Zhengzhou.

Victoria Hernández Mora

In this forum, experts and decision makers have shared their experiences and recommendations, contributing greatly to our ideas about how to meet the challenges that we are now confronting. We have discussed how technologies such as the internet, robotics, AI, and cloud computing, together with technological convergence and increasing connectivity, are enabling us to take advantage of disruptive innovations. From my perspective as the Minister of the Economy, it seems clear that the Fourth Industrial Revolution will transform the market dynamics of all economic relationships and global production processes.

The United Nations Industrial Development Organization has pointed out that Industry 4.0 is linked to developments related to new materials, mechanical engineering, biotechnology, digital technology, and neurotechnology and is radically transforming productive systems and the boundaries of traditional industries. Industry 4.0 will improve productivity and competitiveness and should increase efficiency in the use of resources, help us to protect our environment, and facilitate the transition to a circular economy.

China has much to teach us in this area. The recent Global Competitiveness Report of the World Economic Forum ranks the Asian giant as 28th overall among the 140 countries analyzed. At the more detailed level of the 12 pillars that are addressed in the

report, China also stands out. In the second pillar, adoption of ICTs, China is ranked 26th with a score of 61 on a scale of 1 to 100. For the 12th pillar, innovation capacities, it is ranked 24th with a score of 64. For LAC, the report shows an average score of 46.4 for adoption of ICTs and 33.8 in terms of capacity for innovation.

China's route to the digital economy involved four decades of achievements and lessons learned that have been discussed during this summit. One of the lessons learned was the importance of thinking and planning for the long term, which is what Costa Rica's Ministry of Science and Technology proposed when our digital national strategy was presented. China's long-term thinking is clearly demonstrated in its plan Made in China 2025, which was launched on August 8, 2015. This plan calls for China to substantially improve its manufacturing sector by 2025, to be able to compete successfully with developed countries in manufacturing by 2035, and to position itself among world leaders in advanced manufacturing by 2045. To achieve these goals, China is restructuring its industrial sector and adopting measures related to innovation, intellectual property, sustainable development, and market reorganization.

The impressive changes promoted by the second-largest economy in the world cannot be ignored in our region. We must enhance our potential to take advantage of the opportunities offered by the Fourth Industrial Revolution, rather than fearing it, and try to diagnose our situation and plan for where we would like to be in 20 or 25 years.

We remember the famous phrase of Benjamin Franklin in the 18th century: "Tell me and I will forget. Teach me and I will remember. Involve me and I will learn." In this sense we are grateful to China because yesterday and today China is involving us in the process of transformation.

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With the United Nation's 2030 Sustainable Development Agenda, the international community recognized the importance of sustainable and inclusive industrial development. Costa Rica is fully committed to the goals of this agenda and to promoting resilient infrastructure, sustainable industrialization, and innovation, not only in our own country, but on the global level.

As the Minister of Economy, Industry, and Commerce, I view all of these challenges with great enthusiasm. However, we are a small economy with 5 million inhabitants, open to international trade, with an enormous capacity for renewable energy, but with great need for foreign investment. We must increase employment and its quality and work to continuously provide better skills for our inhabitants.

The Global Competitiveness Index for 2018 indicates that Costa Rica was in position 55 among 140 countries. In 2017, we were ranked 54th among 135 countries, but we were ranked third among LAC countries in 2018 in terms of adoption of information technologies. Being in 55th is a wake-up call. We are not a poor country and Costa Ricans know how to live well, but we are in an unequal region. We must become involved and work hard to take advantage of what we have heard in this forum and learn from those who have already found a way forward so that we can forge new economies for future generations.

Site Visit to the Coyol Free Trade Zone and Establishment Labs

Since the middle of the 1980s, a key element in Costa Rica's model for economic growth has been attracting FDI in export-oriented sectors, and in the last few decades the country has strongly emphasized drawing FDI in high-technology and knowledge-intensive industries. Aided by its reputation for political stability and an excellent educational system, as well as special incentives provided by the government, Costa Rica has been highly successful in obtaining such investment in areas such as advanced manufacturing (e.g., advanced electrical components, automotive components, and aerospace) and providing international corporate services (e.g., business process outsourcing, information technology outsourcing, knowledge process outsourcing), and, more recently, in life sciences (e.g., medical instruments, pharmaceuticals, biotechnology, and new materials).

The number of life sciences businesses the country has attracted has grown quickly in the past decade, and there are now more than 70 such companies with more than 22,000 employees operating in special free trade zones. In 2017, life sciences surpassed the agricultural sector as the largest exporter of goods in the national economy, with the exportation of precision and medical devices growing especially rapidly; Costa Rica is now the second-largest exporter of medical devices in LAC, behind only Mexico, and is among the top seven suppliers of such devices to the U.S. market.

The Coyol Free Trade Zone (CFZ) is a technology and manufacturing park specifically focused on the life sciences sector, located on the outskirts of the Greater Metropolitan Area in the

center of the country, San Jose, Costa Rica. It is approximately 10 kilometers from Costa Rica's largest international airport and has easy access to the main highway to the Atlantic seaport of Caldera, making it possible to carry out manufacturing, packaging, and export directly from the zone. It occupies more than 107 hectares and currently has more than 400,000 square meters of construction occupied by facilities of 27 life sciences companies, including seven of the 20 largest medical devices companies in the world. In total, the companies operating in the CZF exported almost US\$2 billion worth of goods in 2018, representing 63 percent of all of Costa Rica's exports of medical devices for that year.

These companies currently have more than 14,000 employees and will require more than 1,500 new operators, technicians, and professionals within the next six months. As is often the case in LAC countries, providing workers with appropriate skills for modern businesses represents a challenge for the Costa Rican public, private, and academic sectors, and the CFZ is notable for having addressed this challenge proactively through a series of initiatives.

The Intégrate A Coyol (Integrate Yourself with Coyol) program, for instance, provides training for people from nearby communities in courses that are designed to meet the requirements of specific companies. The BachiCoyol program, offered in CFZ facilities in partnership with the Costa Rican Ministry of Education and other educational institutions, provides employees and their families with the opportunity to complete their high school educations. To assist in providing individuals with higher level technical and professional skills, the CFZ is also working with the Technological University of Costa Rica to provide on-site courses in areas such as quality and production management, as well as internationally

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recognized master's degrees in supply chain management and medical device engineering.

Establishment Labs, a Costa Rican company with headquarters in the CFZ, illustrates the potential of LAC companies to successfully participate in high value-added industries such as medical devices. It is dedicated to designing, developing, manufacturing, and marketing advanced silicone-filled breast and body shaping implants and associated medical technologies. It has more than 500 employees in Costa Rica and offices in Belgium, Brazil, and California, with plans to hire more employees in the near future. Its earnings increased by more than 120 percent between 2017 and 2018, and it exports its products to more than 60 countries. Establishment Labs' growth has been assisted by FDI from other Central American countries and the United States, and it recently became the first Costa Rican company to be listed on the NASDAQ stock market.

Establishment Labs places great emphasis on carrying out its own research, development, and innovation, which, together with its marketing and sales activities, allows it to participate in the areas of highest value creation in global value chains. Its R&D unit has been responsible for important innovations, such as developing a new surface for implants that minimizes problems with biocompatibility and designing a smart radiofrequency microchip insert for implants that provides improved traceability. In cooperation with other Costa Rican companies, including Intel Costa Rica, Establishment Labs has recently developed a 3D simulation system that allows patients to visualize post-surgical results of implanting Establishment Labs products in real time.

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Roland Despinoy, President, Chamber of Information and Communication Technologies, El Salvador

Sydney Armstrong, Head of the Department of Economics, Faculty of Social Sciences, University of Guyana



Ana Maria Rodriguez-Ortiz, Vice President of Sectors and Knowledge and Manager of Institutions for Development, IDB

Ana Maria has been vice president of Sectors and Knowledge since September 2018 and Manager of Institutions for Development since February 2011. She previously served as manager of the Andean Country Group. She holds a master's degree in development economics from Williams College in Massachusetts and a degree in economics from Universidad de Los Andes in Bogota.



Sun Yi, Political Counselor of the Chinese Embassy in Costa Rica

Sun is a career diplomat who joined the Chinese Foreign Service in 1995. He has worked in the Department of Latin American and the Caribbean, as well as in the Chinese embassies in Equatorial Guinea and Mexico, and as political counselor in Chinese Embassy in Colombia.



Luis Adrian Salazar Solis, Minister of Science, Technology, and Telecommunications, Costa Rica

Luis was sworn in as Minister of Science, Technology, and Telecommunications on May 8, 2018. Before joining the ministry, he was a professor of customs administration and foreign trade at the University of Costa Rica. He previously carried out consulting and advisory work in Central and South America. He holds a master's degree in educational administration from Costa Rica University.

BIOGRAPHIES



Cai Fang, Vice President, Chinese Academy of Social Sciences

Cai is vice president of Chinese Academy of Social Sciences. He is a member of the Standing Committee and Deputy Director of the Agricultural & Rural Affairs Committee of the 13th National People's Congress of China. He is also editor-in-chief of the academic journal *Studies in Labor Economics*. His research interests include labor economics, China's economic growth, and income distribution.



Carlos Alvarado Quesada, President of Costa Rica

Mr. Alvarado is the 48th president of the Republic of Costa Rica; he was inaugurated into on May 9, 2018. He was born in San José, Costa Rica, and is a professor, politician, and author. He studied journalism at the University of Costa Rica, holds a master's degree in political science from the same university, and has a master's degree in development studies from the University of Sussex in England.



Du Yang, Research Fellow and Deputy Director General, Institute of Population and Labor Economics, Chinese Academy of Social Sciences

Du's main research fields are labor markets in China, economic growth, poverty, and development. He has published a host of papers in domestic and international journals and several books on the Chinese labor market. He has served as a consultant for international organizations, including the World Bank, the ADB, ILO, UNDP, and OECD. He holds a PhD in economics from Zhejiang University.

BIOGRAPHIES



Gonzalo Rivas, Division Chief, Competitiveness, Technology, and Innovation Division, IDB

Among other positions, Gonzalo has been executive vice president of CORFO (the Production Development Agency of Chile) and president of the National Council of Innovation and Competitiveness in Chile. He is also author of numerous publications in the field of productive development and innovation policies. He holds a degree in economics from Universidad de Chile and a master's degree in economics from the Catholic University of Leuven, Belgium.



Vanessa Gibson, Investment Climate Head, CINDE, Costa Rica

Vanessa has worked at CINDE for 20 years, beginning as an economic researcher. Three years later, she assumed the position of service sector manager and in 2009 she was promoted to aftercare director. In her current position, she oversees the coordination of public-private partnership projects and programs. She is an economist with a master's degree in program development and project evaluation from the University of Costa Rica.



Wang Huimin, Deputy Director, Institute of Credit Research, Chinese Academy of International Trade and Economic Cooperation, MOFCOM

Wang's fields of research include cross-border e-commerce and the sharing economy. He has published more than 10 academic reports related to the cross-border e-commerce of local governments for the Ministry of Commerce, as well as more than 20 academic papers and more than 10 internal reports.

BIOGRAPHIES



Claudio Barahona Jacobs, Country Manager,
Telefonica Open Innovation and Wayra, Chile

Claudio served as Wayra's Head of Portfolio and was part of MovistarInnova's founding team, the initiative prior to Wayra in Chile. Before joining Telefonica, Claudio worked for the Department of the Economy of the Chilean government as coordinator of Entrepreneurship and Human Capital in the Division of Innovation. He holds an industrial engineer degree from the University of Chile and has dedicated most of his career to boosting Chilean innovation and entrepreneurship.



Carlos Araya, Founder and President, Singularities,
Costa Rica

Carlos is an experienced entrepreneur in the software industry and has been innovating in the fields of artificial intelligence and programming. He obtained his bachelor of science degree in computer engineering from the Instituto Tecnológico de Costa Rica, then pursued a master's degree in engineering and a master's degree in science at the Instituto Tecnológico de Monterrey, and in 1986 took a Fulbright scholarship from the ITCR to pursue doctoral studies at the University of Kansas.



Sebastian Barona, Leader of Latin
American Expansion, Udacity

Sebastian is Colombian and currently works at Udacity's office in Sao Paulo. He has extensive international experience. Prior to Udacity, he worked in various operations and strategy positions for various industries in several multinational companies, including Johnson & Johnson, Sony, Strategy& (formerly Booz & Co), and Uber. He holds a degree in electronic engineering from the Universidad Javeriana, and an MBA from the Yale School of Management.

BIOGRAPHIES



Elkin Echeverri Garcia, Planning and Prospective Director, Ruta N, Colombia

Elikin is a serial entrepreneur with more than 30 years of experience. Previously, he was director of the Science, Technology, and Innovation Plan of Medellín. He has been a speaker on innovation and technology subjects, and a professor at several distinguished universities. He has a degree in electronic engineering and a master's degree in telecommunications from the Universidad Pontificia Bolivariana.



Pía Giudice, National Director of Knowledge-Based Services of the Ministry of Production, Argentina

In 2013, Pia served as the chief operating officer for idea.me, the main crowdfunding platform in LAC for creative entrepreneurs, and in June 2014, she became chief executive officer. In 2011, she was an organizer of TEDxBuenosAires. She has been a professor at the Universidad Argentina de Empresa and the Miami Ad School, and a Coolhunter for leading companies such as Coca-Cola, Pepsi, Adidas, and Trendcentral.com. She graduated in public relations from the Universidad Argentina de Empresa.



Zhang Qing, Deputy Director and Professor, Department of Economics, Chinese Academy of Governance

Zhang was an instructor at Renmin University of China. She was a communication specialist at the China Council for the Promotion of International Trade. She was vice president and director of human resources, Beijing Huicong International Information Co., Ltd. Her research fields include government economic administration, the internet economy, issues of agriculture, and farmers and rural areas. She holds a PhD in economics from Renmin University of China.

BIOGRAPHIES



Monica Araya, Co-founder of Costa Rica Limpia, Costa Rica

Monica is an advocate, adviser, and communicator who has incubated several initiatives in LAC. She founded Costa Rica Limpia (costarica-limpia.org) to bring people closer to clean, smarter technologies that improve their everyday life. Her work focuses on consumer and citizen engagement in the shift toward renewable energy and zero emissions electric mobility.



Qiao Qi, Deputy Chief Engineer, Chinese Research Academy of Environmental Sciences (CRAES), Ministry of Ecology and Environment, China

Qiao is also the director of the Research Center for Cleaner Production and Circular Economy of CRAES and deputy director of the national laboratory for environmental protection and ecological industry. She has served as director of the committee of ecological industry branch of Chinese Society for Environmental Sciences and is a standing member of the professional committee of eco-industry economy and technology of Chinese Society for Ecological Economics.



Kirk Humphrey, Minister, Ministry of Maritime Affairs and the Blue Economy, Barbados

Kirk's professional experience has spanned both the public and the private sector and has included senior positions with international development agencies, the Child Care Board, and the Bureau of Social Policy, Research, and Planning in the social sector. As a first-timer to elective politics, he successfully contested the St. Michael South seat for the Barbados Labour Party in the 2018 general election. He holds master's degrees from the London School of Economics and Harvard.

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Cong Cao, Professor of Innovation Studies, University of Nottingham Ningbo, China

Cong holds a PhD in sociology from Columbia University. As a scholar of social studies of science, technology, and innovation in China, he has published widely on China's scientific elite, human resources in science and technology, research and entrepreneurship in nanotechnology and biotechnology, reform of the science and technology system, and intellectual property rights. He is the author of *China's Scientific Elite* (RoutledgeCurzon, 2004 and 2012).



Deng Zhou, Deputy Director and Associate Research Fellow, Industrial Development Department, Institute of Industrial Economics, Chinese Academy of Social Sciences

Deng has a PhD in economics. His main fields of research are industrial development, technological innovation, and industrial structure. He presided over and participated in the National Social Science Fund, key projects of the Chinese Academy of Social Sciences and of the Institute of Industrial Economics, and more than 40 projects commissioned by ministries, local governments, and enterprises. He participated in drafting and revising *Made in China 2025*.



Fidel Jaramillo, Country Representative in Costa Rica, IDB

Fidel joined the IDB in 2005 as regional economic advisor of the Andean Countries Department and afterwards as country representative in Peru and Panama. Previously, he was chief economist and vice president of development strategies at the Andean Development Corporation. He also served as the Governor of the Central Bank of Ecuador and Minister of Finance of Ecuador. He headed the consulting firm Multiplica and worked as an independent consultant for different multilateral institutions.

BIOGRAPHIES



Victoria Hernández Mora, Minister of the Economy, Industry, and Commerce, Costa Rica

Victoria holds bachelor's and master's degrees from the University of Costa Rica in business administration with emphasis in banking and finance. She is a Coacher at Lead University and a postgraduate student in project management at the National University of Costa Rica. She is a researcher at the Development Observatory of the University of Costa Rica and a former member of the board of directors of the Central Bank of Costa Rica.



Angélica Matsuda, Founder Peru D, Peru

Angélica is also CEO of Fueradelacaja Soluciones, a consulting firm in public innovation. She was the executive director of the National Competitiveness Council of Peru until 2016 and adviser to the Minister of Economy and Finance of Peru. She also served as on the board of directors of the National Institute of Quality Standards of Peru, of the Agroideas Peruvian Program, and the Development Financial Bank of Peru.



Charles Cyrus, Acting Director, National Council on Science and Technology, Barbados

Prior to his current tenure with the Ministry of Innovation, Science and Smart Technology, Charles worked in several industry positions within the private and public sectors. He joined the National Council for Science and Technology as a senior technical officer, with responsibility for ICT promotion and innovation. His core functions are to design and implement plans and programs to achieve the performance objectives of the council.

BIOGRAPHIES



Daniel Cavalcanti, General Coordinator of Brazilian Digital Strategy, Ministry of Science, Technology, Innovation, and Communications, Brazil

In this capacity, Daniel led the development of the base document for the Brazilian Digital Transformation Strategy. He previously served as senior policy advisor to the board of the National Telecommunications Agency, Anatel, and as a project manager at the Ministry of Communications. Prior to joining the public service, he worked for several years in the private sector, both in Brazil and abroad.



Dr. Plácido F. Gómez Ramírez, Vice Minister for Science and Technology, Ministry of Higher Education, Science, and Technology, Dominican Republic

Previously, Plácido served as undersecretary of state for Science and Technology, where he was responsible for creating the basis for the first fund financing scientific and technological research in the country. He was director of the Department of Physical Sciences at the University of Puerto Rico and was elected chair of the Twenty First Session of the Science and Technology for Development Commission.



Dr. Erlinda Handal, Vice Minister, Vice Ministry of Science and Technology, El Salvador

Erlinda previously served as executive director of the Commission for Scientific Research at the University of El Salvador. She has been the executive director of the National Research Council of the University of El Salvador and executive director of the Salvadorean Commission in Cooperation with UNESCO. She has also worked as researcher at the National Center for Scientific Research, Cuba.

BIOGRAPHIES



Edwin Estrada, Vice Minister of Telecommunications, Ministry of Science, Technology, and Telecommunications, Costa Rica

Edwin was appointed for a second four-year period as deputy minister of telecommunications in the Ministry of Science, Technology and Telecommunications. He previously served as manager of rules and procedures and director of concessionary rules in the Vice Ministry of Telecommunications. He has been in his current position since 2016.



Luis Bertola, Director, National Research and Innovation Agency, Uruguay

Luis is a member of the board of the National Research and Innovation Agency of Uruguay (ANII), a member of the Uruguayan Academy of Sciences, and full professor in economic history and development economics. He has taught postgraduate courses at more than 30 universities in Europe and the Americas, was a consultant at IDB, ILO, ECLAC, and UNDP. He has widely published on Latin American long-run development, as well as on development and industrial policy.



Milverton Reynolds, Managing Director, Development Bank of Jamaica, Jamaica

Milverton has a wealth of experience in banking, construction, finance, and insurance as a management executive in both the private and public sectors. Prior to joining the Development Bank of Jamaica, he worked at the Jamaica Mortgage Bank, National Housing Development Corporation Limited, Life of Jamaica Limited, and the National Housing Trust. He was conferred an Honorary Doctor by the Northern Caribbean University, Jamaica.

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Paola Vega, Vice Minister of Science and Technology, Ministry of Science, Technology, and Telecommunications, Costa Rica

Paola previously served as vice president for research and outreach for the Costa Rican Institute of Technology (ITCR), where she also served as a professor at the School of Electronic Engineering, in the DOCINADE Doctoral Program, the Doctoral Program in Engineering, the Master in Electronics, the Bachelor of Electronic Engineering, and the Bachelor of Engineering in Computers. She created the electronic master degree program at the ITCR.



Pelayo Covarrubias, President, Fundación País Digital, Chile

Pelayo is a business engineer and MBA with extensive experience as a consultant to numerous companies and public organizations in matters related to education, telecommunications, concessions, transport, and other sectors of the economy. He has led various projects at the University of Desarrollo, the Municipality of Santiago, the SIPSA holding, and the Bank of Chile, among others.

BIOGRAPHIES



Poetisi Magubane, Policy Officer, Division of Entrepreneurship, Ministry of Trade, Industry and Tourism, Suriname

Poetisi previously served as alarm operator at Professional Private Security company. He joined the Suriname Business Development Center in 2015. He was representative of the Suriname Business Forum in the Project Board of the REDD+ program and in the Japan-Caribbean Climate Change Partnership, and chairman of the Corporate Social Responsibility working group.



Roland Despinoy, President, Chamber of Information and Communication Technologies, El Salvador

Roland is a French specialist with more than 15 years of experience developing computer systems. In his 10 years in El Salvador, he has participated in several projects stimulating the IT sector. He created an export consortium, adapted the capability maturity model integration methodologies for the geo-social realities of the region, and created software development centers, among other activities.



Sydney Armstrong, Head of the Department of Economics, Faculty of Social Sciences, University of Guyana

Sydney joined the university on a fulltime basis in 2012. Presently, he teaches the Development Economics, Industrial Organization, Industrial Policy, and Applied Econometrics courses in the Department of Economics. Prior to joining the university, he was employed as a teller at the Bank of Nova Scotia in Georgetown.

