Preliminary report on the emergence of new business model in the digital economy

Disruptive technology changes and the emergence of new business models and production strategies will impact employment[1]

It is possible to observe two very distinctive trends associated with the diffusion and use of new and disruptive technologies in businesses and production systems that will impact on the labor market and employment relationships:

a. The "gig economy", as a consequence of the consolidation of digital platform companies' business model, imposes new challenges not only for competition policies, but also for labor policies.
b. The acceleration of automation processes, in the framework of digital transformation, through the adoption of Industry 4.0 technologies seeking improvements in productivity (efficiency gains and cost savings).

1. Consolidation of digital platform companies' business models

A. THE GIG ECONOMY

Digital technologies and the use of advanced algorithms are allowing the consolidation of Internet based platform businesses, and what is called the "gig economy", also known us "on-demand economy" or "sharing economy".

The "Gig Economy" refers to the practice of people using internet based platforms to employ themselves and offer up their service for specific "gigs" or tasks to consumers. Most commonly understood, connecting service providers to consumers is facilitated by internet based platforms like

[1] The background presented here is based on three ECLAC's documents: Castillo, Gligo and Rovira (2017), Artecona and Chau (2017), and Sepulveda (2017).

Uber, Airbnb, Etsy, Task Rabbit, and others. These platforms are characterized by their ability to leverage large amounts of real-time data to efficiently match a large number of suppliers and consumers. Digital platform work typically entails self-contained tasks that can be performed relatively unsupervised, require short time commitments on the worker's side, and are more cost-efficiently performed by a human being than a machine.

There are two forms of digital platform work: crowdwork, which works as an online service market where providers do not have to be physically present, and on-demand work via apps, where the service provider must be physically present.

Well-known examples of a crowdworking platform**s** are Amazon's Mechanical Turk (AMT), Crowdflower, Crowdsource and Clickworker, which provide services ranging from survey filling to graphic design. Examples of platforms that require physical presence are Uber (transportation), Lyft (transportation), Postmates (delivery), Handy (home services), Taskrabbit (home services) and Care.com (home services).

Such digital platforms are transforming labor markets around the world and have brought several benefits to the overall economy: the use of IT and high speed internet allows platforms to efficiently match supply and demand for several industries in a way traditional allocation methods cannot, have improved capacity utilization, and have improved worker welfare by allowing flexibility in some respects such as schedule choice. They also allow certain sections of the population that would not be able to find regular employment due to other commitments or constraints to participate in the workforce.

Although better data is critically needed, the data that exists points to a growing number of the population engaging in the workforce through these platforms. It has been estimated that the percentage of workers in the United States that participate in these platforms is currently low, around 715,000 workers at the end of 2015, or 0.5% of the U.S. labor market (Harris & Krueger, 2015; Katz & Krueger, 2016; Farrell and Greig, 2016). However, there is a growing body of evidence that these digital work platforms have increased in size at a rapid pace in the past decade. For example, Hathaway and Muro (2016) estimated that between 2010 and 2014 there was a 69% increase in independent contractor drivers in the United States (from 200,000 to 350,000) that coincided with the start of Uber's operations in 2010. A survey conducted by the Pew Research Center between July and August of 2016 found that 8% of adults in the U.S. earned money in the last year working or performing a task on a digital platform. Farrell and Greig (2016) estimated that from late 2012 to late 2015, about 10.3 million people earned income on some form of digital platform—about 1.75 million more people than the population of New York City. In the case of transportation services in the United States, as of December 2014, Uber had around 160,000 active drivers and an estimated 450,000 registered drivers in 2016 (McCormick, 2016) while Lyft had 51,000 drivers . As a point of comparison, in 2014 there were 233,700 taxi drivers and chauffeurs in the United States (Bureau of Labor Statistics (BLS), 2015a).

B. CHALLENGES FOR LABOR MARKET REGULATORS AND THE SOCIAL SAFETY NET

But at the same time, these platforms cause significant challenges in the labor market because of the kind of jobs they create and the implications these work arrangements have for a growing segment of the population participating in them.

Firms that own, manage and deploy these work platforms have reframed employer–worker relations by defining their core business as the provision of the technology that enables certain services to be provided rather than the provision of those services, and offering their workers independent contractor arrangements rather than employee contracts. For companies, the biggest incentive for replacing employees with contract workers is more control over costs

As is becoming increasingly obvious, economic legal structure was not constructed with the Gig Economy in mind. It was built on the reality at the time those laws were made that the vast majority of people were working for an employer, not themselves. It was also built on the idea that most users of services would be using services provided by formal businesses rather than individuals using their individual assets. Beyond labor law, consumer protection and competition laws were built on the idea of regulating competing firms in a market with identifiable physical presence and responsibility for the operation of its operating facilities and the behavior of its employees.

Social contracts were built on the responsibilities of employers to workers and companies to consumers, with government addressing market failures and making up shortfalls in the social safety net. Now it is needed, however, a new social contract for the digital age, built on a different set of laws and incentives.

For these workers, there are pros and cons to gig economy work. The biggest pro is the freedom. Because gig economy workers are not employees they have greater freedom than traditional workers to set their own schedules, work in a variety of environments and with different people and clients regularly, and for many it allows for the pursuit of work in creative fields or elsewhere that would not have easily fit into the traditional environment of office or industrial work.

On the cons side, gig economy workers are vulnerable to multiple forces outside of their control. Work availability may be inconsistent or sufficiently scarce that gig workers have to take jobs they either do not want to do or create difficulties for their schedule. And since gig workers do not work for a single employer, they are on their own to find healthcare and finance their retirement. Gig workers also do not receive paid vacations or time off since they work for themselves

For workers, these changes may lead to lower pay, benefits, and job security and other working conditions. Among the policy challenges that the gig economy creates is the lack of healthcare and pension benefits associated with the market. They also have no minimum wage or maximum work hours. And with the rise of automation and robotics, we are likely to see more people seeking work in the gig economy due to traditional work becoming scarcer.

Therefore, there is an urgent need for a policy debate on how to best prepare workers for this new reality: the issue of worker misclassification in digital work platforms, the lack of social security systems

for workers in the gig economy that are not considered employees, and the problems that the isolating nature of on-demand work presents with respect to worker organization and the right to collective bargaining.

C. POTENTIAL REGULATORY RESPONSES TO THE GIG ECONOMY

What think tanks, scholars, and consultants working on the gig economy tell us is fairly consistent: the gig economy workers have unstable income, lack pension and health benefits, lack easy access to training to upgrade their skills, and are easily dismissed and denied future work by prior clients. Gig economy consumers have no declared right to a service, can suffer from discrimination due to race or other factors without recourse, and cannot legally hold platforms accountable for the behavior of their users, exposing them to safety and other risks.

On the other hand, gig economy workers make use of assets they have and earn income from that use. Homes, cars, and time that would otherwise go unused are put to a productive purpose and help people earn money they otherwise would not. The evidence to date indicates that absent any change to policy, the gig economy works well as a means for people to supplement existing and stable income. It does not work well as a career except for the most capable, highly skilled, and in demand gig economy workers, including highly paid consultants.

There are multiple ways to deal with these challenges.

The first is to write law and regulation to mandate that the platforms that facilitate gig economy work and services provide those workers with minimum benefits necessary to make gig economy work a true career option. The World Bank suggested the idea of 21st Century Employment Contracts to do just that.[2] Under the contract formulation, gig economy workers would receive similar treatment to non-gig economy workers by the platform owners that facilitate their work.

In the US, some leading labor economists believe that it is needed to create a new category of worker, neither self-employed nor a direct employee, and ensure that platforms meet some basic level of worker benefits for that new classification of worker.

Either solution listed above comes with costs. Platforms enabling gig economy work are not generally local platforms, they are global. It could break the economies of scale of global platforms to have to provide varying sets of rights and privileges around the world to workers based on the place where they access the service. Also, the more expensive to the platform to comply with regulation and new law, the more likely they will be not to operate in any given location that does not return sufficient profit to justify the cost of compliance. As a result, platforms would likely be available in only the most densely populated and wealthy areas of cities around the world.

[2] http://www.worldbank.org/en/news/feature/2015/12/22/regulating-the-gig-economy

The second way to deal with these challenges is to absorb the social costs they create for workers and consumers as a community as a whole. For example, the concept of a universal basic income would help workers deal with the insecurity associated with unstable income by helping them bridge the period between gigs with some supplementary income. And making benefits portable or publicly available could also provide some stability and added security for gig economy workers.

The third way to deal with these challenges is to work in a push-pull fashion of cooperation and collaboration between public authorities and specific platform operators to address these challenges for the people that use their platform. In various jurisdictions, Airbnb, Lyft, and Uber have worked out arrangements with authorities for their particular operations.[3]

Looking forward, as the number of workers that participate in digital work platforms increases, these issues will pose a growing challenge for all actors involved—workers, businesses, and governments. For governments particularly, the policy challenge will be to act as a balance between workers' rights and companies' interests in win-lose situations. While job quality and safety nets for workers must be maintained, regulation cannot be as overreaching as to discourage innovation. However, it is also the government's role to take advantage of the fact that policy is not a zero-sum game, and to leverage these platforms and their technologies to improve aggregate welfare.

2. Acceleration of automation processes, in the framework of digital transformation, through the adoption of Industry 4.0 technologies.

A. INDUSTRY 4.0 AND ITS POTENTIAL IMPACTS

The term "Industry 4.0"[4] refers to the ability of the Internet to control elements in the physical world by synchronizing equipment, processes and people within an industrial setting and to the changes in the traditional model of manufacturing that are being brought about in the context of the fourth industrial revolution (Schwab, 2016).[5]

This is made possible by the co-evolution and convergence of the operational technologies (OT) associated with the automation of industrial processes and new information technology platforms, such as the Internet of Things (IoT), new generation networks, cloud computing, big data analytics and

[3] http://eyq.ey.com/working-by-the-rules-can-gig-economy-companies-thrive-under-regulation-2328402509.html

[4] The term was originally coined in Germany, where *Industrie 4.0* was developed as a strategy for promoting a new technology platform. Later, the term began to be used to denote a public policy aimed at boosting the manufacturing industry's international competitiveness (Roland Berger, 2016, and European Parliament, 2016).

[5] Klaus Schwab (2016) says that there are three factors that differentiate the current industrial revolution from past ones: (i) the speed of current breakthroughs; (ii) the scope of the changes taking place based on the combination of many different technologies; and (iii) the systems impact of this transformation at the corporate, industrial and societal levels.

artificial intelligence.[6] Manufacturing models are therefore evolving from specialized automation at the factory level and isolated, standardized robots into more complex, autonomous systems encompassing the entire product value chain that make use of collaborative robotics and new protocols for machine-to-machine and human-machine interaction. Industry 4.0 brings together multiple interactive technologies. There is a great deal of uncertainty as to how this process will unfold, but it is clear that it will have a direct impact on companies that are currently employing highly standardized production processes.

The breakthroughs being made in the development of each of the Industry 4.0 technologies and their interactions are generating changes that are disrupting existing production processes and having a direct impact on productivity, costs and employment at the same time that they are paving the way for more flexible forms of production and the emergence of new products, services and business models[7]. A number of different estimates of the impact of these technologies have been proffered, some of which will be discussed below.

The Boston Consulting Group (BCG) (2015) has estimated that Germany will see productivity gains of between 5% and 8% and the creation of up to 390,000 new jobs over the next 10 years as a result of improvements in flexibility, speed, productivity and quality. Based on research dealing with 300 companies in the United States, Japan and Germany, the McKinsey Global Institute (MGI) (2015) has projected productivity gains of as much as 26%. Meanwhile, PricewaterhouseCoopers (PWC) (2014) has estimated the productivity boost for Germany at 18% over five years and the annual savings afforded by cost reductions at 2.65%. Roland Berger (2016) has simulated the impact of the implementation of Industry 4.0 in a typical automotive parts factory based on five main drivers of technological change.[8] Its

[6] The IDC consulting firm defines the third platform as being based on mobility, cloud computing, business networking and analytics (big data). This platform is supporting a new wave of innovation in such areas as robotics, the Internet of Things, natural interfaces, cognitive systems, 3D printers and new-generation security. The Boston Consulting Group (BCG) (2015) identifies nine technologies that form the underpinnings for the creation of the industry of the future: (i) autonomous robots; (ii) simulation; (iii) horizontal and vertical system integration; (iv) the Industrial Internet of Things; (v) cybersecurity; (vi) the cloud; (vii) additive manufacturing; (viii) augmented reality; and (ix) big data and analytics. The McKinsey Global Institute (MGI) (2015) groups the relevant technologies into four clusters: (i) data, computational capacity and connectivity; (ii) analytics and intelligence; (iii) human-machine interaction; and (iv) digital-to-physical conversion.

[7] The economic benefits of Industry 4.0 for high-tech industrial companies in terms of efficiency and productivity are obvious. However, most traditional industries are confronted with a variety of technological, financial and administrative barriers that hinder their efforts to incorporate these new technologies. In order to overcome these hurdles, public policies are needed that will provide incentives for technology investment, for expanding access to technology providers and for the development of specialized human resources.

[8] These technological drivers are: (i) virtual factories that will make it possible to industrialize new products virtually before their actual production, thereby cutting development times and enhancing manufacturers' ability to launch new products quickly; (ii) automated flows (via autonomous vehicles or "cobots") that will make the entire production system more flexible and responsive and will enable it to perform tasks that are beyond traditional human capabilities; (iii) smart machines that will require many fewer operators than traditional ones and will be able to correct themselves and to operate both separately and in connection with each other; (iv) predictive maintenance systems that will permit improved planning and a more efficient use

calculations yield simultaneous increases in the return on capital employed (from 15% to 40%), plant utilization (from 65% to 90%) and profit margins (from 6% to 13.1%).

The impact of Industry 4.0 is not confined to manufacturing, but will also spread into other areas of the economy and society. MGI (2015) has estimated the potential impact of the Internet of Things (IoT) in different economic settings at between US$ 3.9 trillion and US$ 11.1 trillion annually by the year 2025; 70% of that impact will be in the form of business-to-business (B2B) applications, and, of the nine settings considered in these calculations, factories (a category that includes all standardized production environments, including even such venues as hospitals) will create the most added value (31%).

The impact of these technologies is not limited to greater efficiency or lower production costs. It also takes the form of new business models in which digitization can support, supplement or be substituted for existing business models.

The interrelationship of new technologies, which is a hallmark of Industry 4.0, facilitates their rapid diffusion and sets the stage for their evolution at an exponential pace rather than at the linear rate of change witnessed during previous industrial revolutions (Schwab, 2016).[9] Most projections indicate that the fourth industrial revolution will have become consolidated and will be bearing fruit in about a decade. The Boston Consulting Group (2015), for example, forecasts that, within the next 5 to 10 years, the world will see major technological breakthroughs, and new enterprises will take over leading market positions. The World Economic Forum (2015) estimates that between 2022 and 2025, three technological tipping points will be reached: there will be a trillion sensors connected to the Internet, the first 3D-printed automobile will be in production and at least 5% of all consumer goods will be produced using additive manufacturing (3D) processes.

The available information on the development of Industry 4.0, which is mainly provided by surveys conducted by consulting firms, indicates that companies began to take major 4.0 investment decisions in 2016. In the years from 2013 to 2015, about 75% of all surveyed companies were exploring the possibilities offered by the Internet of Things and 85% recognized the potential of these technologies, but only 15% had taken specific steps to incorporate them into their production processes. As of 2016, however, over 30% of the respondent companies had decided to invest in these technologies during the next two years.[10]

This greater deployment of Industry 4.0 is the result of advances in five areas that are of key importance for the consolidation of this new technological paradigm: first, the greater technical feasibility of technological solutions for the interactive automation of processes, activities and tasks; second,

---

of equipment, since machine downtime can be forecast; and (v) cyberproduction systems that will function as the upper command layer for the factory and its suppliers and will make mass customization feasible, as well as permitting production to be readjusted in line with variations in demand.

[9] The data and graphs showing the trends in the adoption of various high-tech mass consumer goods in the United States serve as proxy evidence to back up these statements, as they clearly illustrate how adoption cycles have been growing shorter and how the associated S-curves are becoming steeper and steeper.

[10] Information provided by KPMG on the basis of a Forbes survey.

reductions in the costs of developing and deploying hardware and software solutions and platforms; third, the increased profitability of automation options owing to labour supply constraints and higher labour costs; fourth, the growing economic benefits associated with increased efficiency, higher quality and cost reductions; and fifth, greater regulatory acceptance (MGI, 2017).

B. AUTOMATION AND UNEMPLOYMENT

The loss of approximately 6 million manufacturing jobs in the United States over the past 25 years underscores the impact of the use of industrial automation and the digitization of factory operations to take the place of middle-skill jobs and the disruptive changes that they are bringing about in the labour market. The rapid development of Industry 4.0 technologies is exacerbating these trends and lending greater credibility to the idea that they pose a threat of structural unemployment. The automation of various cognitive tasks that until recently could only be performed by skilled human beings has now become feasible because of the reduction in computer processing and storage costs and breakthroughs in artificial intelligence technologies, particularly in the areas of robotics, the Internet of Things, large-scale machine learning and deep learning (*The Economist*, 2016).

Industry 4.0 is paving the way for the incorporation of a new generation of intelligent automation technologies that will make the current workings of the labour market obsolete and will make many workers redundant as their tasks are replicated with a high degree of reliability via low-cost automation. The impact of automation on the labour market has been estimated by various sources. According to Frey and Osborne (2013), 47% of the workforce in the United States is at risk of being replaced by machines in the coming decades, while the World Bank (2016) puts the figure at 57% for the countries of the Organization for Economic Cooperation and Development (OECD). As for emerging economies, the percentages of the workforce whose jobs are threatened by automation have been estimated at 77% for China and 69% for India.[11]

These innovations are also, however, said to have the potential to boost productivity and the creation of new types of jobs that differ in various ways from traditional occupations, with many of the new jobs taking the form of freelance and highly flexible positions. Nevertheless, how fast the countries' economies will be able to create new jobs to replace the ones that are lost and what wage levels will look like are both open questions (OECD, 2016). Optimistic arguments have been advanced according to which, as has occurred during earlier technological revolutions, these changes will create more jobs than they eliminate, although the new jobs will be very different from the ones we are familiar with today. If this proves to be the case, there will be two main challenges for society to meet: first, how to educate and train workers so that they can take advantage of these new opportunities; and, second, how to ensure that the benefits derived from productivity gains are widely shared (WEF, 2017).

[11] There are also other, more conservative, estimates. For example, OECD studies indicate that around 10% of jobs in developed countries are at risk because of automation (OECD, 2016).

There are others who take a more skeptical view and forecast a less bright future in which the savings and productivity gains made possible by new technologies will depress employment levels. What is not contested by proponents of either of these two views, however, is that the new technologies will displace routine, low-skill jobs and will call for human resources with new and different skills to handle and administer them and that the net effect on many traditional types of jobs will be negative.

For example, a recent study by the World Economic Forum (2016)[12] found that in 2015-2020, as a result of a variety of economic, social, demographic and technological trends, 7.1 million jobs will have been lost while 2 million new positions will have been created, for a net job loss of 5.1 million. The biggest loser will be administrative jobs, with a reduction of 4.7 million positions, followed by manufacturing and production, with 1.6 million job losses. Unlike what was found to be the case in other parts of the economy covered in that study, the substitutive effect of new technologies, compounded by other socioeconomic factors, is likely to be more apparent. The same technology-related factors will also be responsible for the expansion of job creation in the fields of computing and mathematics and in architecture and engineering, where job growth is projected at 405,000 and 339,000, respectively.[13]

C. SITUATION IN LATIN AMERICA

There is still some uncertainty as to the impact that Industry 4.0 will have on unemployment in the region, but there are some preliminary estimates. The World Economic Forum has calculated that technological changes in the region could lead to the net destruction of 3.38 million jobs by 2030, with sharp decreases being seen in the intermediate-skill range in manufacturing and construction and an increase in low- and high-skill jobs in the services sector (WEF, 2016). IDC has forecast that in 2019, as the number of objects connected via the Internet of Things surges, the region will be struggling with a shortfall of around 450,000 ICT professionals. The biggest human resource shortage (nearly 64%) is expected to be in persons with expertise in emerging technologies such as video, cloud computing, mobility, data centres and virtualization, big data analytics, cybersecurity, the Internet of Things and software development (IDC, 2016).

The extent of inequality may be heightened by the polarization of employment among an emerging middle class that is estimated to represent some 35% of the population. This is because the largest portion of the jobs that may be eliminated are in the intermediate-skill range, which is precisely the category in which the region has the relatively largest supply of human resources owing to its expansion of the coverage of its secondary education systems (OECD/ECLAC/CAF, 2016).

Human resource development systems must therefore adapt to new technological demands. Curricula dealing with basic and generic skills need to be strengthened, continuous learning mechanisms need to be reinforced, incentives should be provided to encourage students to enrol in programmes dealing with

[12] A total of 371 global enterprises representing over 13 million jobs in 9 industries and 15 countries were surveyed.

[13] It is also true, however, that this study reaches the conclusion that the future outlook is too complex and subject to too many variables to permit labour market effects to be attributed entirely to digitization and automation.

the fields where the demand for workers will be the greatest and changes in skill demand need to be anticipated. At the same time, there must be a parallel increase in the demand for labour skills, since it would be pointless to expand the supply of more highly educated workers if their skills are not needed. Education and training, on the one hand, and technology-based structural change, on the other, must proceed in tandem if they are to have a significant impact on the economy (OECD/ECLAC/CAF, 2015).

BACKGROUND DOCUMENTS

Artecona, R & Chau, T. (2017). Labour issues in the digital economy. ECLAC – Studies and Perspectives, Washington, D.C. – N 17.

Castillo, M., Gligo, N., & Rovira, S. (2017). La política Industrial 4.0 en América Latina. en Cimoli, M., Castillo, M., Porcile, G., & Stumpo, G. (Eds.), *Políticas Industriales y Tecnológicas en América Latina*, Santiago de Chile, Comisión Económica para América Latina y el Caribe, Naciones Unidas.

Sepulveda, Daniel (2017). The Internet, Power in Markets, and New Challenges for Policymakers. Consulting report for ECLAC (not published).

BIBLIOGRAPHY (REFERENCED IN BACKGROUND DOCUMENTS)

Consolidation of digital platform companies' business models

Bureau of Labor Statistics, U.S. Department of Labor. (2015a). Taxi Drivers and Chauffeurs. In Bureau of Labor Statistics, Occupational Outlook Handbook, 2016-2017 Edition. Retrieved from http://www.bls.gov/ooh/ transportation-and-material-moving/taxi-drivers-and-chauffeurs.htm.

Farrell, D., & Greig, F. (2016). Paychecks, Paydays, and the Online Platform Economy. JPMorgan Chase & Co. Institute. Retrieved from https://www.jpmorganchase.com/corporate/institute/document/jpmc-institutevolatility-2-report.pdf

Harris, S.D., & Krueger, A.B. (2015). A Proposal for Modernizing Labor Laws for Twenty-First-Century Work: The "Independent Worker" (The Hamilton Project Discussion Paper 2015-10). Retrieved from http://www.hamiltonproject.org/assets/files/modernizing_labor_laws_for_twenty_first_century_work_krueg er_harris.pdf

Hathaway, I., & Muro, M. (2016). Tracking the gig economy: New numbers. The Brookings Institution. Retrieved from https://www.brookings.edu/research/tracking-the-gig-economy-new-numbers/

Katz, L.F., & Krueger, A.B. (2016). The Rise and Nature of Alternative Work Arrangements in the United States, 1995-2015 (NBER Working Paper No. 22667). Retrieved from http://www.nber.org/papers/w22667

McCormick, R. (2016, April 21). Uber settles lawsuits to keep drivers as independent contractors in California and Massachusetts. The Verge. Retrieved from http://www.theverge.com/2016/4/21/11485424/uber-suitcalifornia-Massachusetts-drivers-employee-contractor

Acceleration of automation processes, in the framework of digital transformation, through the adoption of Industry 4.0 technologies.

BCG – The Boston Consulting Group (2015). Industry 4.0: The Future of Productivity and Growth In Manufacturing

Frey, C.B. and Osborne, M.A. (2013), The future of Employment: How Susceptible are Jobs to Computerisation? Oxford Martin School Working Paper N 7

MGI-McKinsey Global Institute (2017). A Future that Works: Automation, Employment, and Productivity, enero.

MGI- McKinsey Global Institute (2015), The Internet of Things: Mapping the value beyond the hype.

OECD - Organization for Economic Cooperation and Development (2016), Improving networks and services through convergence, 2016 Ministerial Meeting, The Digital Economy, june.

OECD/CEPAL/CAF (2016), Perspectivas económicas de América Latina 2017: Juventud, competencias y emprendimiento, Publicación OECD, Paris.

PWC - PricewaterhouseCoopers (2014), Industry 4.0. Opportunities and Challenges of the Industrial Internet

Roland Berger (2016). The Industrie 4.0 transition quantifed. How the fourth industrial revolution is reshuffing the economic, social and industrial model.

Schwab, Klaus (2016). The Fourth Industrial Revolution. Word Economic Forum. Geneva, Switzerland.

The Economist (2016). The return of the machinery question, Special Report Artifcial Intelligence, 25 junio al 1º de Julio.

WEF - World Economic Forum (2015). Deep Shift - Technology Tipping Points and Societal Impact.

WEF - World Economic Forum (2016). The Future of Jobs. Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution.