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The present challenges for an inclusive, dignifying and sustainable future of work

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Introduction: The purpose of this paper

The purpose of this paper is to help understand some of the challenges associated with accelerated digitalization and automation and, in this way, attempt to contribute to the path for a fairer, more inclusive, dignifying and sustainable future of work.

The new technological paradigm associated with progress in IT (information and automation technologies), or digitalization, is both singular and disruptive because of its reach and its exponential speed. It has transformed the way we work, play, communicate, interact, and exchange, impacting in the economy (production, finance, distribution) and globalization, but also in the social, cultural, political and geopolitical spheres, at the world level. More changes are inevitable and the pace of change will probably accelerate.[2]

Technological change is also just one part of major structural changes already underway in the world today, including increasing globalization, growing inequality, rapid urbanization, a shift to service-based economies and climate change accompanied by biodiversity loss.

The ambitious landmark international agreements of 2015 and 2016, the Sustainable Development Goals 2030 Agenda and the Paris Agreement, each of them signed by over 190 countries, mark the strategic pathway ahead. But, at present, we risk being late in meeting those targets, both in terms of the sustainable development and global poverty reduction goals and in the transition to a low-carbon, resilient economy so as to secure a better and more sustainable future for people and the planet in the decades ahead.

We must realize that, in the midst of an accelerated and disruptive technological change, and given the other major structural changes already underway in the world, the emerging opportunities as well as the risks and costs of inaction are increasing faster and are greater than previously acknowledged. Therefore, we need to build a shared understanding and vision of the main challenges we face in order to align polices and actions at the pace needed. More and better data and measurement in order to inform better policies and actions is also at the heart of the challenge.

In what follows we will concentrate in the first and second sections of this paper on trying to better understand the interplay of digitalization, i.e. of automation and information technologies, with jobs, skills, and wages, emerging opportunities and risks, by reviewing recent research and economic literature on the subject. The concept of technological change (TC) in this paper refers specifically to digitalization, i.e. of automation and information technologies. The literature reviewed is, however, largely based on the experience and evidence of advanced economies. One relevant question we need to ask, therefore – and although we cannot fully answer it here – is what the effects of this wave of technological change could be on the development trajectories of developing countries. We can, however, given the research findings based on the experience of advanced countries, elaborate some proposals to help both advanced and developing countries meet these challenges. Section III of this paper attempts to formulate some global policy proposals and initiatives, which rely on international and multilateral cooperation, in order to reduce the risks and harness the opportunities of technological change and digitalization for a more inclusive, dignifying and sustainable future of work.

I. THE UNDERSTANDING: A RESEARCH REVIEW

I.1 What do we know from recent history?

– Not yet a widespread substitution of human labour

The evolution of labour aggregates in developed countries does not reflect a steep disruption in their employment-to-population ratios. Autor & Salomons (2017) demonstrate that even when increases in labour productivity in an industry are associated with a within-industry reduction in employment (direct negative effect), they also generate a cross-industry increase in employment (indirect positive effect).[3] These positive effects tend to outweigh the within-industry fall in employment.

– Sharply disrupted composition of labour with large distributive impact: employment polarization

Technological change (TC) in developed countries, from the 80s and 90s, resulted in employment *polarization* (or *hollowing-out*) with a shrinking of middle skill jobs, white and blue collar, and an increase in the employment share of low and high-skill occupations.[4] Polarization, in advanced economies, is explained by *Skilled Biased Technical Change* and *Task-Biased Technical Change*,[5] much more than by the offshoring of jobs.[6] In addition, there is some new evidence of polarization patterns as well in emerging countries (Dutz, Almeida and Packard 2018, see footnote 11).

– A growing skill mismatch and massive workers transition

There is a growing "*skill mismatch*", i.e. lack of correspondence between the demand of skills of new employment and the supply of skills of workers whose jobs were substituted by technology, and a challenge for public policy to facilitate and ease massive workers transitions. According to McKinsey (2017), an estimate of between 75 and 375 million workers will transition from obsolete occupations to new ones by 2030.

– Wage inequality affected by employment polarization and skilled biased technological change

Employment *polarization* (or *hollowing-out*), i.e. the shrinking of middle skill jobs, did not replicate the U pattern in terms of wage compensation but did translate into a tendency towards greater wage inequality. This was not produced by a fall in the compensation of middle-skill jobs but by a decline of the relative wages of low skill workers with low levels of income, increasing thereby the relative wage gap in relation to the high skill occupations. Although low skill service jobs are seen as a "refuge" against automation, the relative wage compensation of these occupations was indirectly affected by the tendencies towards employment polarization and skilled biased technological change (Autor 2015).

– Growing Inequality between labour and capital: the rise of super-star firms

According to the literature reviewed, digitalization not only contributed to increasing inequality between workers, but also to widening the gap between workers and employers compensation. On the one hand, a relative decline in labour shares over national income is observed both in advanced and developing economies (Karaboutnis and Neiman 2014, Dao, Das, Koczan and Lian 2017). These tendencies were driven by the fall in the labour share of income of low and middle skill occupations while high skill occupations benefitted with an increase in their share of income (Dao, Das, Koczan and Lian 2017).[7] One of the factors that could have contributed to a decline in the labour share is the automation of work (Autor and Salomons 2018). Another complementary explanatory factor, although more controversial, is the increase in the profits share, after the 1980s, due to market concentration (Barkai 2014, De Loecker and Eeckhout 2017, Kurz 2017, Autor, Dorn, Katz, Patterson and Van Reenen 2017, De Loecker & Eeckhout 2018, Diez Leigh & Tambunlertchai 2018). The research of Autor Dorn, Katz, Patterson and Van Reenen (2017) shows that in a group of developed countries, during 1980-2010, those industries with increasing market concentration of sales by a few super-star firms experienced a larger fall of the labour share. The authors found that growing concentration was positively and significantly correlated with two variables related to technological change: total factor productivity and patent intensity. An OECD report (2018), as well as Levy Yeyati and Sartorio (2018), point out to three characteristics of the digital economy markets that explain why technology stimulates greater concentration and market power: network externalities, lock-in effects and economies of scale and scope.

I.2 Predictions related to Future of Work

Predictions of the risk of automation show significant variance.[8] The emblematic work of Frey & Osborne (2013) estimated that 47% of US employment was at "high risk", while Arntz, Gregory & Zierahn (2016), using the same automation indexes by task, but considering within-occupation variability in the intensity of different tasks, concluded that only 9% of employment in US was at high risk.[9] Predictions need to take in account, also, that the net impact of automation will depend on the creation of new jobs, some of which we do not know or do not exist yet, still harder to estimate.

II. THE CHALLENGES

Recent research on the Future of Work has highlighted both the great challenges and opportunities and risks confronting governments and institutions (notwithstanding data and measurement gaps). To improve our understanding of the challenges, risks and opportunities, and in order to provide the necessary rationale to the policy proposals, it is useful to summarize the main findings in the following nine points:

1) Technological advances associated with IT (information and automation technologies), including machine learning, AI and robotics will continue with exponential reach and speed. The biggest innovations will still be introduced and new technological capacities will probably emerge.[10]

2) IT-led technical change is Skill and Task Biased. It has resulted and will further result in: i) the automation of routine tasks (cognitive and manual), typically middle skill, resulting in employment polarization in developed countries with new evidence of polarization as well in emerging countries;[11] ii) the augmentation of the capacity of workers to perform certain tasks, usually non-routine, where technology is a complement of work (not a substitute); iii) the creation of new occupations, that we do not know and are difficult to predict;[12] iv) the object of automation is tasks not occupations, but the automation of routine tasks leads to the substitution of certain occupations and the regrouping of tasks in another occupations; v) the probability of automation decreases with the level education and income of the worker.

3) The final net impact of these technologies over employment is not predetermined. The ultimate effects will be the result not only of TC per se, but of how it is used, and how people, governments, firms, institutions and international organizations respond and prepare for these changes in the economy and society.[13] In spite of the fear of the likely impact of disruptive innovations over employment, some studies indicate that we cannot conclude until now, on the basis of evidence, that technology has resulted in a net reduction of the quantity of employment.[14] On the other hand, the impact of the technology on the quality of employment is more difficult to be assessed and it is still an open question that directly relates to the dignity of work. Additionally, it is important to realize that the magnitude of the challenges ahead, both in terms of quantity and quality of employment regarding the future of work, is larger for developing countries that for advanced economies, and that international cooperation and development finance will have to be a key components of the solutions.

4) Education and training systems will need to constantly adapt in order to improve the quality of education and widen its access and to prepare the workforce for the changing labour market. There is a certain consensus that as IT continues to substitute or complement many work tasks, workers will need both digital skills and transferable skills that emphasize creativity, adaptability, and interpersonal skills over routine information processing and routine manual tasks.[15] At the same time, IT offers significant opportunities to be used to advance educational and lifelong training strategies and delivery. IT also can be used to reduce the skill mismatch problem by building skills, matching opportunity with talent and addressing digital gender divides.[16]

5) IT is enabling new forms of work on-demand via apps and remote crowd-work, through digital platforms which are growing exponentially and show significant potential for employment growth, labour inclusion, and transparency. However, there are potential risks and challenges of the gig economy, as pointed out in by ILO (2017), regarding social protection, employment security, earnings, hours, occupational health and safety, training and representation.[17] Similarly, Hunt (2018), from the standpoint of gender parity, points out that, given the existence of digital gender divides and discrimination (because of gender, race, or age) specific attention by policy makers is needed to ensure equality and non discrimination in digitally mediated work, and its link with the social protection system. The non-discrimination and inclusion are key factors for a dignifying future of work. The good news is that both labour inclusion and non discrimination in digital platforms and remote crowd work can be achieved, even in developing countries, as some initiatives show us already good results and give hope.[18] But it is necessary to scale up and multiply these initiatives, and this will require concrete commitments from the public and private sector, and international organizations and, mainly, access to capital and finance. The process of labour inclusion and non discrimination in digital technologies, focusing on marginalized and vulnerable populations can be deliberatively launched and implemented, but it will not happen spontaneously, due to the play of market forces alone.

6) **TC has impacted and will continue impacting global value chains (GVCs) and globalization**. Progress in robotics technology is resulting in the re-shoring of some relatively low skill labour-intensive manufacturing activities and the shortening of manufacturing GVCs. These trends could result in both future significant disruptions for emerging countries that are integrated in GVCs or limit the opportunities of lower income countries to climb the ladder by promoting manufacturing-export led development.[19] On the other hand, digitalization, and the increased services intensity of manufacturing, is enabling the participation, and maybe the leapfrogging, of developing countries through the export of knowledge intensive services.

7) TC and digitalization have a strong distributive impact among workers and also among firms, with the rise of *superstar firms.* All of this is opening a huge policy debate around the “redistribution” issue, which goes from universal income to tax policy and competition policy and beyond. Artificial Intelligence (AI), the new leading edge of TC, is raising among academics two other sources of concern. One concern is with the market power and the pioneering innovation edge deriving from ownership of big data centers and the huge computing firepower required to develop the technology behind futuristic products like self-driving cars or digital assistants. Researchers fear, therefore, a future of AI, and deep learning software models, where mainly a few big tech companies will have the staggering amount of computing resources needed for innovation, posing a threat to university research and invention in this field. The second concern is about the energy power use of AI software. Researchers at the University of Massachusetts, Amherst, estimated that training a large deep learning model

can produce the same carbon footprint as the lifetime of five cars.[20] To compensate, big tech companies are significantly increasing their investments and purchases of renewable energy. One relevant question is whether these super-star firms could make larger commitments to help meet the challenges of the Future of work and contribute thereby to achieving Agenda 2030 and the Paris Agreement goals, while supporting university research and invention in future open AI that could help preserve the planet and the dignity of work.

8) To better inform public policy, private sector decisions, quality education and lifelong learning strategies a systematic, continuous and comparable international research effort is necessary to track new technological developments and their impact on employment, the workforce and the economy, both in advanced and developing economies.[21] To this end new statistical sources are needed that should be comparable internationally, new data sources, new indicators and rigorous forms to measure the impact on the economy and society.

9) There are dramatic information failures in the job market that impair policy responses. Dramatic information failures in the job market preclude understanding of the scale and depth of the challenge. These failures impair the capacity of governments and institutions to ease worker transitions, solve the skills mismatch problem, and disrupt technological unemployment and non-dignifying work. Data and measurement are at the heart of this conundrum. Particularly, real time, more granular data regarding changes in occupations and skills demand is needed in order to make anticipated and better decisions in education, lifelong learning and training strategies as well as in the cushioning and facilitation of worker transitions, labour inclusion and non-discrimination.

Until we can measure the size of the future of work challenges adequately, it will be difficult to attract the commitment of the resources needed, as well as the breadth of the multistakeholder engagement required to address them. Because of this and because of the difficulties to predict associated with the inherent uncertainty of technological change, the Future of Work is often considered as a “soft” issue.

Better data and better measurement will allow for better judgment and better policies necessary to ease workers transitions, to invest in people and to facilitate the digital transformation of SMEs globally so as to make digitalization work for all, increase productivity, and prevent new social and economic divides.

The G20 is a key international forum for the addressing some these challenges on a global scale, but needs to be complemented by initiatives from multilateral organizations and financial institutions, by policies and programs from national and sub-national governments and by the collaboration and commitments of the private sector and NGOs.

In conclusion, at the international level, to effectively address these Future of Work challenges and embrace the opportunities of digitalization, the research agenda should be strengthened in, at least, the three main pillars indicated below (Proposals 1, 2 and 3) and, at the same time, it is necessary to implement global and local multistakeholder initiatives to bridge the digital skills gap (Proposal 4) and to build consensus for an international agreement on investment facilitation that could orient future economic incentives to the labour factor only, so as to stimulate employment creation and re-training, while phasing out and banning corporate income tax exemptions (Proposal 5). The latter risk furthering inequality and may lead to the unsustainability of investments, when fiscal benefits expire, or of public finances, particularly in developing countries.

III. PROPOSALS

i) Proposal 1: Track technological developments globally

Identification and tracking of technological developments by Governments and International Organizations (IOs) in a multidisciplinary, collaborative, integrated and comparative world research program. Duplication of efforts among IOs should be avoided. More coordination and cooperation is needed. Similarly, more emphasis should be placed on the analysis of how TC can be oriented to stimulate a more inclusive and sustainable development pathway in emerging countries and contribute to the diversification of their exports. Also, research findings should be treated as a global public good and made open so as to facilitate different actors in society, public and private sectors, to conform the future of work for the benefit and dignity of all, for more inclusive growth and sustainable development. G20 Leaders can instruct IOs to continue and align their ongoing research efforts to these objectives

ii) Proposal II: Develop new methods of measurement for the digital economy

The development of new methods of measurement should be pursued so that the digital economy and innovation are integrally measured and reflected in macroeconomic statistics, and are consistent with the measurement methodology of GDP and National Accounts SCN08 from United Nations. The National Accounts System we are using must adapt to measure the economy of the 21st century, not just 20th century economy. We have proposed an Innovation Satellite Account (Coremberg and Nofal 2017) in order to integrate the impact of digital economy from the point of view of GDP accounts, growth accounting and welfare. This methodological

approach follows the main proposals of Stiglitz, Sen and Fitoussi (2009) to expand traditional accounts in order to measure welfare, growth and environmental sustainability.[22]

Measurement challenges related to the digital economy, particularly the accurate measurement of intangible capital services and knowledge-based inputs, partly explain the Productivity puzzle. New digital technologies do not appear to have resulted in aggregate increases in productivity so far. Instead, recent decades have experienced a "productivity slowdown", reflecting both slower capital deepening and weaker growth in total factor productivity (OECD 2018).

It is also necessary to advance on an internationally agreed definition of digital trade and a form of measuring it. One of the difficulties to measure digital trade is that digitalization per se erodes the cross border frontier that traditionally defined the measurement of physically traded goods and services. The G20 Trade and Investment Working Group in 2017 started to work on this issue of digital trade but no final conclusion was reached. There is an ongoing dialogue in WTO on digital trade without yet an agreed definition on its scope and form of measurement, although there is an agreed definition of electronic commerce. Also, it is advisable that G20 Leaders entrust international organizations to update the measurement methodology of GDP and National Accounts so as to include the Digital Economy.

iii) Proposal III: Harmonize the Occupational Taxonomy and Develop New Sources of Data and Indicators at the International and National Levels

New, more timely and granular sources of data and indicators, regarding occupations and workforce, should be developed and harmonized so as to be comparable internationally. This is required to better monitor, measure and anticipate the impact of technological change on the labour market. It will allow governments and institutions to make better informed decisions regarding education, training and lifelong learning, as well as regarding active labour market and employment policies and workforce development.

On the one hand, for international comparable research work on the impact of technological change on the labour market we need to have at the international level an harmonized occupational taxonomy and database like the US O*NET or ESCO from Europe with detailed, standardized and quantifiable descriptions of tasks involved and skills required in different occupations. The international replication and harmonization of an occupational taxonomy and code system like O*NET or ESCO is necessary to analyze the impact of these phenomena globally, as well as to be able to develop more rigorous indicators, for instance, that can measure the risk of automation of certain tasks, and also to analyze, on a comparable basis, the impact of offshoring and international trade on the labour market. To the extent possible, policymakers should also encourage employers to use the harmonized taxonomy when describing jobs opening and tasks, skills and experiences required.

In 1988 the world agreed and introduced a Harmonized System of Commodity Descriptions (HS), of 5300 articles and product descriptions (in a six-digit code system), to classify traded goods as a common basis for trade and customs purposes. G20 leaders can now entrust competent IOs to engage in a similar and highly needed effort to harmonize an occupational taxonomy and codes so as to fill the statistical and data gaps and formulate evidence-based policy responses for an inclusive digitalization and dignifying future of work.

On the other hand, it is important to access new real-time and more granular sources of data so as to develop new indicators related to changes in occupations and new employment creation and to the resulting changes in skill demand. For that purpose, the main sources of information is not statistical, survey or administrative but private data, mainly part of *big data* generated in digital platforms and professional social networks (like the case of LinkedIn[23] and others, e.g. Google for Jobs). Therefore, it is necessary to explore possible collaboration or partnership arrangements among governments, international organizations and digital firms to obtain access to real time and more granular research data, fully respecting privacy and data protection criteria. In this regard, it is auspicious that initiatives of this sort of strategic partnership have already been implemented to share this valuable information. It is important to coordinate at the international level these collaborative public-private research initiatives, until now implemented in the form of individual cases,[24] in order to access new sources of data and to develop new indicators for real-time monitoring of key employment, skill and economic trends. The G20 is a crucially relevant multilateral forum to launch and give impulse to this multistakeholder initiative.

Also, at the national level, Employers Skills Surveys (ESS) are recommended as a useful intelligence tool to increase understanding on the skills challenges that employers report both within their existing workforces and when recruiting; the levels and nature of investment in training and development; and the relationship between skills challenges, training activity and business strategy (IFF Research, UK Dept. of Education ESS 2017; IDB, ENHAT 2018; Ministerio de Producción y Trabajo de Argentina, Doc. 9, 2019). This is a key instrument for the effective design and implementation of active labour market policies (Levy Yeyati, Montané & Sartorio 2019).

iv) Proposal IV: Build International Collaborative Platforms for Digital Skills and the Digital Transformation of SMEs

In a complementary fashion, G20 Leaders could envisage the development of a multistakeholder agreement with the technology companies, at the international level, capable of articulating with similar initiatives at national and subnational levels. The main purpose will be to build collaborative platforms[25] in order to educate and train people on digital skills and, also, to propel the digital transformation of SMEs.[26] The strengthening of the digital capabilities and business models of SMEs would probably facilitate their contribution to meet the pressing and daunting employment challenges at present[27] and in the years to come.

v) Proposal V: Include in the potential scope of a future international framework for investment facilitation, integrated in WTO, an agreement orienting future economic incentives towards sustainable investment and only in relation to the labour factor while phasing out and banning corporate income tax exemptions. Such an agreement could stimulate employment creation, training of workers and research and development and, at the same time, contribute to the achievement of the SDGs 2030 and the Paris Agreement obligations.

Huge Investment requirements are needed to ensure and accelerate the implementation of the 2030 Agenda for Sustainable Development, particularly in developing countries. Significant investments are required also to deliver on the Paris Agreement obligations and to build globally the quality, sustainable and resilient infrastructure needed. Therefore, and in order to harness the benefits of sustainable infrastructure and productive investments and of foreign direct investment (FDI), it is key to have policies and programs in place in order to stimulate these investments and to attract and retain FDI, so as to enhance their contribution to inclusive growth and sustainable development, in the transition to a low carbon, resilient economy.

The huge investment requirements and financing gaps at the world level constitute one important factor behind the intensification of the international discussions on investment facilitation (IF). The main focus of IF is not the legal protection of foreign investors (as investment treaties do) but the implementation of policies and measures to improve the predictability and transparency of the investment environment. Cooperation on IF has been on the agenda of international, multilateral and regional forums such as the G20, WTO and APEC and of international organisations such as the OECD and UNCTAD. Investment facilitation has been present in discussions in G20 at least since China's G20 Presidency in 2016. The G20 countries account for two thirds of global outward FDI flows. In the 2016 Hangzhou Summit, the G20 Leaders adopted the "Guiding Principles for Global Investment Policy Making". Work on Investment facilitation continued afterwards during Germany's, Argentina's and Japan's G20 Presidencies in 2017, 2018 and 2019 respectively, but no agreement was signed. Complementarily, at the WTO, during the last 11th Ministerial Conference in Buenos Aires in December 2017, a group of 69 countries signed a Joint Ministerial Statement on "Investment Facilitation for Development", which calls for the start of "structured discussions with the aim of developing a multilateral framework on investment facilitation". The WTO Discussions started in March 2018 with the purpose of identifying and agreeing on elements of a possible future international Investment Facilitation Framework, before the 12th Ministerial Conference in Kazakhstan in June 2020.[28]

In view of this international policy process, and given the research findings of the literature about risks and challenges resulting from digitalization that were summarized in Sections I and II of this paper, notably the emerging patterns of employment polarization and wage inequality, the declining labour share in both advanced and developing economies and the growing inequality between capital and labour, together with the growing skill mismatch and the massive workers transition ahead of us, this tells us that the scope of the discussion on International Investment Facilitation needs to be broadened. This is required in order to develop an International Investment Facilitation Framework of substance that could address these challenges and contribute to a more dignifying future of work, to inclusive growth and sustainable development

Clearly, the issue of investment incentives needs to be part of the "international structured discussions". Until now it has been absent or only present in an unstructured and disorderly manner, when after 2017, the Trump Administration in the US started to complain in different international fora against massive investment subsidies in China and other types of active industrial policies and government interventions.

The core of our proposal is to start building consensus for an international agreement of substance stating that in the future, investment incentives should focus on sustainable investment and only in relation to the labour factor, so as to stimulate formal employment creation (informality of work is a form of discrimination, of non-dignifying work), the training of workers and research and development, and to contribute thereby to the achievement of the SDGs 2030. This is crucial to help developing countries face some of the employment challenges and avail themselves of the opportunities of new digital production technologies which critically rely on the upgrading of skills. In developing countries both the enhancement and formalization of employment together with the upgrading of skills are key for the reduction of poverty and for a more inclusive and dignifying future of work. This is also crucial for advanced economies as well, in order to facilitate and ease massive worker transition and promote their retraining and lifelong learning.

The counterpart is that whatever investment incentives are awarded in the future, they cannot rely anymore on corporate income tax exemptions or other fiscal exemptions aimed at subsidizing profits (i.e. the compensation of capital), since they can increase inequality and negatively affect the sustainability of public finances, particularly in developing countries and, therefore, can affect the predictability of the investment environment and, sometimes, its transparency. They risk also leading to the unsustainability of private sector investments, when fiscal benefits expire.

As a way of conclusion, the preceding global policy proposals and initiatives serve to illustrate that the final net impact of these technologies over employment is not predetermined. But in order to meet the challenges, diminish the risks of new divides, and harness the opportunities we need to act on it now and prepare for these changes in the economy and society. It is important to realize that the magnitude of the challenges ahead regarding the future of work is larger for developing countries than for advanced economies, and that international cooperation, multistakeholder engagement and development finance, will all have to be key components of the solutions. The private sector has, as well, a key role to play to contribute to the solutions. Pope Francis has taught us that protecting human dignity must be a government priority. Under his guidance, may we consider advising that protecting human dignity must also be, in the 21st century, a business priority.

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END NOTES

[1] Beatriz Nofal was Argentina G20 Sherpa in 2017, during Germany’s G20 Presidency. The priorities for Argentina’s G20 Presidency in 2018 were then defined. In the preparatory ministerial meetings, the author recommended that the Future of Work should be one of the G20 priorities in 2018. The systemic importance of this topic for the global economy emerged in previous research we did for INTAL (Institute for Latin American Integration, IDB). See Beatriz Nofal, Ariel Coremberg and Luca Sartorio (2017) “Ideas preliminares para el estudio del impacto de la automatización del empleo en América Latina y el Caribe”, Nota Tecnica, INTAL, Inter-American Development Bank. This paper draws significantly from Nofal Beatriz, Coremberg A. and Sartorio L (2018) “Data, measurement and initiatives for inclusive digitalization and future of work”, *Economics Discussion Papers*, No 2018-71, Kiel Institute for the World Economy, http://www.economics-ejournal.org/economics/discussionpapers/2018-71

[2] National Academies of Science, Engineering and Medicine (2017), *Information Technology and the Status of the US Workforce*, Committee on Information Technology, Automation, and the U.S. Workforce, Computer Science and Telecommunications Board, Division on Engineering and Physical Sciences, The National Academy Press, Washington D.C., www.nap.edu, pp. 1-3.

[3] The cross-industry increase in employment is stimulated by a combination of income effects resulting from an increase in the disposable income of consumers due to lower prices, and forward and backward linkages, which raise production and employment in industries not directly affected by the particular innovation (“indirect positive effect”). These positive effects tend to outweigh the within-industry fall in employment, concluding in a modestly positive net effect of productivity growth over employment, in line with the relative stability of labour aggregates in developed countries (Autor & Salomons, 2017).

[4] This finding is very robustly documented by a vast set of academic works: Spitz-Oener (2006), Goos & Manning (2007), Goos, Manning & Salomons (2009), Mieske (2009), Autor (2010, 2015), Oesch & Menes (2011), Holmes & Mayhew (2012), Autor & Dorn (2013), Adermon & Gustavsson (2015). Using their initial mean wages as a proxy of the skill content of occupations, they observe the variation of the share in total employment during a specific period, documenting a polarization pattern with the corresponding fall in the share of middle-skill occupations and a relative growth of low and high-skill employment.

[5] Following this hypothesis developed in Autor, Levy & Murnane (2003) and Acemoglu & Autor (2011), TC tends to automate “routine tasks” that follow easily definable procedures, and which are frequently characteristic of middle-skilled jobs. Nevertheless, TC has difficulties to replace both highly qualified abstract tasks like complex problem solving, creativity, leadership or negotiation and non-routine less qualified manual tasks highly dependent on personal interaction or visual and language recognition and which are very important in low-skill services and difficult to automate.

[6] Task-Biased Technical Change is the fundamental explanation of polarization, above others like the offshoring of middle-skilled jobs. See for example Autor & Dorn (2013), Autor, Dorn & Hanson (2014), Michaels, Natraj & Van Reenen (2014) and Goos, Manning & Salomons (2014). These studies corroborate the greater intensity in routine tasks of middle-skill occupations and showed that technological adoption was correlated with more routinary occupations and with the consequent decline in their share in total employment. In contrast, offshorability measures have little or no explanatory capacity when the effect of technology and routine intensity are controlled for. OECD (2017) analyses the relationship between polarization and de-industrialization (employing econometric techniques), and concludes that technology displays the strongest association with both polarization and de-industrialization. Although the role of globalization is less clear-cut, there also emerges some indication that international trade has contributed to de-industrialization in advanced countries.

[7] Other research work that has documented this phenomenon is that of Piketty (2014); Autor, Dorn, Katz, Patterson y Van Reenen (2017), and Autor and Salomons (2018).

[8] See for example Frey & Osborne (2013), Arntz, Gregory & Zierahn (2016), World Bank (2016), McKinsey Global Institute (2016). However, even future of work predictions show a high degree of variance, the relative comparison of the studies is useful. It helps to identify areas of consensus in relative estimates regarding differential susceptibilities for types of occupations, gender, social and demographic subgroups, productive sectors, and geographies. When analyzing how policy should respond it is critical to understand the implications for different groups and regions, notably the most vulnerable and those with the highest exposure.

[9] Indeed, there are diverse obstacles in the forecast which generate biases and explain variability in the estimates (that depend on indexes conditioned by both the subjectivity and knowledge of the experts consulted and the weighting methodology). In addition, defining with precision the degree of intensity in routine tasks needed to entirely replace an occupation can lead to radically different conclusions: while the McKinsey Global Institute (2017) estimates that no more than 5% of occupations are fully composed by susceptible automatable activities, more than 60% of occupations have at least 30% of automatable activities. The economic discipline has, therefore, limitations to predict with precision the timing and the specific magnitude of these phenomena with a satisfactory level of confidence. Note that the "potential scope of automation" is a different concept from the "effective estimated impact of automation", since its cost effectiveness or social and legal factors can delay its effective adoption.

[10] National Academies of Science, Engineering and Medicine (2017), ibid, pp. 2, 8, 14, & 158.

[11] Dutz, M., Almeida R., & Packard T. (2018). *The Jobs of Tomorrow: Technology, Productivity and Prosperity in Latin America and the Caribbean*. World Bank Group, Washington D.C.

[12] National Academies of Science, Engineering and Medicine (2017), Ibid; Nofal, Coremberg and Sartorio, Luca (2017); Jim Jong Kim (2018) "Building Human Capital", President of the World Bank, speech made in the IMF/WB Spring Meetings, April 21, 2018, www.live.worldbank.org

[13] National Academies of Science, Engineering and Medicine (2017), Ibid; Nofal, Coremberg and Sartorio (2017).

[14] Autor, David (2015) "Why Are There Still So Many Jobs? The History and Future of Workplace Automation". *Journal of Economic Perspectives* – Volume 29, Number 3, Summer 2015, Pages 3-30. Also, the results of the WEF Business Survey in 2016, titled "The Future of Jobs", result in an estimate of a net positive impact of technological change of 2.02% in future employment.

[15] LinkedIn, IDB with the collaboration of Beatriz Nofal (2018) "Presentation G20 Workshop: Building Opportunities for an Inclusive Future of Work", Presentation G20 Workshop of three Working Groups: Digitalization, Employment and Education. Buenos Aires, Argentina, April 12, 2018. PDF version. A Summary is posted in LinkedIn's Economic Graph "Sharing Labor Market Insights in Latin America".

[16] The G20 #eskills4girls Initiative is an excellent example of this in practice. Also, SheWorks.com is other example of a platform that addresses the gender digital divide and helps women's labour inclusion as well as the building of women's digital skills.

[17] ILO (2017). "Inception Report for the Global Commission on the Future of Work", December 2017.

[18] Hunt, Abigail (2018). An example of digital labour training and inclusion, in the province of Buenos Aires, Argentina, is the case, implemented in Cooperative "La Juanita" by social leader Toty Flores and by Oscar-winning movie Director Juan Campanella ("El Potrero Digital"). Similarly, Arbusta, in Argentina, is a case of entrepreneurial impact investment that builds digital skills of workers from marginalized low-income areas. Another example of how technology can at the same time help transparency in the execution of public purchases of computer based services, labour inclusion and productivity (translating in fiscal savings), is the platform TransparentBusiness.com

[19] Hallward-Driemeier and Nayyar Gaurav (2017) *Trouble in the Making? The Future of Manufacturing-Led Development*, World Bank Group, Washington D.C.

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[21] National Academies of Science, Engineering and Medicine (2017).

[22] Stiglitz J., Sen A. and Fitoussi J.P. (2009) "Report by the Commission on the Economic Performance and Social Progress", http://ec.europa.eu/eurostat/documents/118025/118123/Fitoussi+Commission+report, and www.stiglitz-sen-fitoussi.fr. This report highlights that several economic phenomena that impact on wellbeing are not included in GDP. The measurement of new digital activities is under debate and also their impact on wellbeing and productivity, mainly because traditional methods on how to measure it have been questioned.

[23] See LinkedIn and IDB G20 Workshop Presentation together with Beatriz Nofal (2018) as a sample of the potential. LinkedIn, the professional network, has more than 550 million members, 20 million companies,

and 14 million jobs on its platform. The activity of this network, analyzed in LinkedIn's "Economic Graph," cumulatively generates billions of data points every day which are relevant to understanding and reacting to employment, skills and workforce trends.

[24] For instance, the World Bank and the Inter-American Development Bank have agreed individually with LinkedIn to work together to widen the understanding of present and future of work challenges.

[25] As example of collaborative digital transformational platforms implemented by advanced countries Germany developed "Plattform Industrie 4.0", France "Industrie de Futur" and Spain "Industria Conectada 4.0".

[26] SME's represent, on average, 95% of the companies in almost every country of the world (WTO 2016), concentrate about 60% of jobs in developed countries and 80% in developing countries (World Bank 2013) and are estimated to account for 60 to 70% of global GDP (UN SDGs 2015-2030).

[27] Hunt (2018) highlights that "Gelb and Khan (2016) have shown that the number of people seeking jobs may be ten times the number recorded as officially unemployed by most statistical systems – 2 billion people globally are classified as 'outside the labour force', meaning they are neither working nor looking for work. Critically, very little is known about this group – what is clear, however, is that about two thirds (68%) of them are women (ibid.), and the 2013 World Development Report (WDR) on jobs confirms that 'an unknown number' are 'eager to have a job' (World Bank, 2013, cited in Gelb and Khan, 2016)".

[28] See Sauvant Karl & Berger, Axel (2018). "Putting FDI on the G20 Agenda". *Project Syndicate*, 3 August 2018, and Berger, Axel (2019). "Investment Facilitation for Sustainable Development: Index maps adoption at domestic level". *German Development Institute (DIE),* www.blogs.die-gdi.de