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Abstract

This contribution focuses on the impact of technological progress on the long-term growth, its effects on the labor factor, and its influence on the future of work. Technological progress alters the nature of work and society as a whole, but it does not necessarily benefit everyone. The paper emphasizes that technological progress, including the adoption of digital technologies and automation processes, often involves the substitution of machines for labor, which can lead to the displacement of workers. It also acknowledges the existence of counterbalancing forces. Technological progress can also lead to changes in the quality of work, transforming jobs and necessitating the emergence of new tasks, skills, and retraining efforts, along with the creation of new professional roles. Particular attention is devoted to the recent evolution of AI, including generative AI, and its disruptive effect on work.

The main argument of this paper is that the disruption caused by digital technologies puts many jobs at risk. However, the most evident effect is not so much that there will be fewer jobs with the introduction of technologies such as AI, but rather that the nature of work will change.

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JEL Classification: O30, O40, J23, J24, M53, M54

INTRODUCTION

Economic theory has long examined the relationship between capital and labor, both in terms of the analysis of production, economic growth, and income distribution.

Initially, attention was focused on the relation between quantities used of the two production factors, with great emphasis given to the accumulation of capital.

However, in the 1950s, the studies of Moses Abramowitz (1956) and Robert Solow (1957) highlighted that technological change constitutes a more important factor in long-term economic growth.

Solow (1957) pointed out that the unexplained growth component, or the statistical "residue," must be attributed to technical progress. His analysis revealed how technological innovation helped increase the productivity of both capital and labor.

Similarly, Abramowitz (1993) stated that "the major contribution of capital accumulation to nineteenth-century growth was a consequence of technological progress dependent on scale and capital utilization." He explained that "the significant contributions of education and research and development conceal the new intangible capital of technology-driven biases."

In the 1980s and later, Paul Romer (1986, 1990), inspired by the theoretical contributions of Joseph Schumpeter, developed the endogenous theory of economic growth. Romer emphasized that the accumulation of knowledge and innovative ideas endogenously explain technological advances and underlie long-term growth.

In addition to the relationship between technological progress and long-term growth, the hot topic that has drawn the attention of economists concerns the effects of technological change on work.

This paper starts with the premise that technological progress is a crucial factor for long-term growth. Furthermore, it provides an overview of global growth and employment from the 1970s onwards. It then

examines one of the two issues related to the impact of technological progress: job displacement. Afterward, it discusses the other important impact of new technologies on work: work transformation. The paper end with a discussion and conclusions.

TECHNOLOGICAL PROGRESS, LONG-TERM GROWTH, AND ITS EFFECTS ON WORK

Economic literature on growth has highlighted that technological progress is the key factor for the long-term growth of economies. One of the controversial themes regarding the relationship between technological progress and labor has been the issue of technological unemployment. In this regard, a significant contribution to this discussion has been David Ricardo's analysis presented in the chapter "On Machinery" of his work *Principles of Political Economy and Taxation* (Ricardo, 1821).

Ricardo argued that machines and labor are in constant competition with each other, and the introduction of machines in the production of goods depends on the price of labor, i.e., wages. Ricardo's main thesis was that the introduction of machinery could result in permanent (technological) unemployment and a decrease in wages. According to his view, with the introduction of machines, the demand for labor declines, leading to unemployment and a reduction in the available amount of products for workers to consume.

However, Ricardo is not against the introduction of machines and technological development. On the one hand, these may lead to a decrease in the use of labor. On the other hand, the economic development that technological progress entails, in terms of an increase in the overall net product of the economy, results in a greater accumulation of capital. This, in turn, increases the amount of capital used and favors the reabsorption of technological unemployment. These elements also foster overall employment growth.

Historical experience shows that technological progress is almost never neutral, thereby confirming Ricardo's thesis. Technological progress typically alters the capital-to-labor ratio in production processes to achieve a specific output quantity. It often tends to favor labor-saving methods, reducing labor costs by employing less work while aiming for an overall increase in productivity.

However, while introducing an innovation perceived as labor-saving may result in reduced work and potential technological unemployment, the adoption of new technologies remains essential for ensuring long-term growth. These technologies also stimulate demand expansion and can contribute to overall employment growth. Indeed, technological advancements also create new job opportunities. While certain occupations may become obsolete, new roles and industries emerge as a result of technological progress. For instance, the rise of the internet and digital platforms has given birth to entirely new sectors such as e-commerce, app development, and online content creation, which have generated numerous jobs.

Another crucial consequence deriving from technological progress, automation processes, and the use of new, more sophisticated and complex technologies is that these changes necessitate a transformation in the quality of work. Therefore, concerns remain that the pace of technological innovation may outstrip the ability of the workforce to adapt and acquire the necessary skills for new roles. This "skills gap" poses a significant challenge for individuals who find themselves unemployed or at risk of displacement due to technological changes.

Therefore, new technologies, which embody technological progress, not only alter the nature of capital and save labor but also demand the development of new skills.

This is why the new technologies require the acquisition of new skills and professionalism. Efforts to address this issue involve initiatives for upskilling and retraining the workforce, ensuring that individuals can acquire the skills needed for the jobs of the future.

As highlighted by Schilirò (2021), in the case of digital technologies and the processes of digitalization, they have a strong impact not only on the quantity but, above all, on the nature and quality of jobs worldwide. The interplay of digital technologies and digitalization has accelerated many changes in the processes of production in manufacturing and services, with significant effects on work.

In conclusion, the impact of digital technologies on work and, more generally, on the labor market has created an ecosystem that is changing the structure of the labor market itself, causing a demand for new skills and the need to update existing ones. However, this also carries the risk of displacing many people due to technological advancements.

As already mentioned, a consequence of this technological disruption in the labor market is the widening gap between workers with the highest qualifications, who experience increased employability and better income conditions, and those employed in jobs with a low level of technological knowledge. Additionally, we are

witnessing the emergence of new professions and markets characterized by a lack of regulations that can ensure adequate rights, protections, and the proper recognition of work.

AN OVERVIEW OF GLOBAL GROWTH AND EMPLOYMENT OVER THE YEARS

This overview aims to provide an analysis of the trends and patterns in global growth and employment over the years, highlighting changes and challenges faced by nations worldwide, including those brought about by technological advancements.

Let's consider global economic growth and labor conditions starting from the 1970s.

The 1970s were a decade of instability, with floating exchange rates and rising oil prices. Prior to the oil price shock of 1973, the annual growth of the world gross product had been at 5.3 percent. However, during the remainder of the 1970s, annual global growth only reached 2.8 percent.

In the 1970s, unemployment rates rose slightly compared to the previous two decades. Companies were already in need of skilled and responsible workers. Although jobs were still largely divided by gender, the seventies marked a unique period, particularly in advanced countries. There was a growing demand for workers' rights, improved working conditions, and better wages. Additionally, the decade witnessed a significant transition from labor-intensive and service-based jobs to technology-driven roles.

In fact, advanced economies experienced a notable shift during the 1970s, with jobs moving away from traditional sectors like agriculture and production and emerging in the technology industry. The introduction of microprocessors, home computers, and video gaming systems opened up previously unexplored sectors, creating new employment opportunities for workers. With the rise of tech jobs, there was an accompanying increase in the minimum educational requirements for employees. Simply possessing a high school diploma was no longer sufficient to secure a well-paying position in the emerging fields. Workers needed to have higher levels of education and possess specialized skills.

On the other hand, emerging economies often exhibited a dualistic structure in their labor markets, divided into formal and informal sectors. Workers in the formal sector enjoyed higher wages, with larger units that were capital intensive and organized as either corporate entities or government enterprises. Moreover, these formal sector jobs offered more stable employment policies. However, there was a significant influx of migrants from rural areas who were attracted to the formal sector, particularly in urban areas, due to the expectation of higher wages. Unfortunately, this led to a worsening of urban unemployment and income inequality.

The 1970s teach us that the type of technological progress experienced during that decade, while leading to some labor displacement, did not necessarily result in mass unemployment. This was particularly evident in advanced economies, where the strength of the workers, thanks to their unionization, played a significant role. However, in emerging economies, the dual structure of the labor market and internal migration toward urban areas contributed to the expansion of the informal sector and an increase in inequality.

According to UN statistics, the 1980s saw a slowdown in the weighted average rate of growth of the world's economies to 2.9 percent from the 3.8 percent achieved in the 1970s. The 1980s were a decade of job growth and industry shifts. Although employment grew considerably, its strength was uneven. Three-fourths of the increase was in services and retail trade, while manufacturing and mining lost workers. The 1980s was the decade of the "Washington Consensus," when most countries embraced market- and export-oriented policies. New classical economics became the prevailing philosophy in the 1980s, where the government was expected to play an indirect role in guiding the economy and creating the preconditions for sustainable growth, but not to assume direct responsibility for ensuring full employment or high economic growth. Although the average growth rate in developing countries was reasonably good throughout the decade (around 4 percent), that growth was heavily concentrated in the newly industrializing economies of Asia. In Latin America and sub-Saharan Africa, sustained growth proved elusive.

The 1990s were the decade of globalization when international trade in goods, services, and financial capital became more widespread than ever before. The essential background to growth in the 1990s was the unprecedented extension and intensification of globalization in terms of the international integration of capital and product markets, sustained by reductions in transport and communication costs and policy choices. This also created a global labor market with a potentially infinite labor supply that pulled down wages, especially for blue-collar and unskilled workers.

If we specifically focus on the US economy and aim to provide a more detailed description of the 1990s, this decade can be divided into two distinct periods. From 1991 to 1995, the economy, employment, and wages experienced slow growth. In contrast, from the late 1990s through the late 2000s, there was a notable acceleration in employment, productivity, and wage growth, as well as faster expansion in investment and consumption (Weller, 2002).

For the industrial countries as a whole, the introduction of Information and Communication Technology (ICT) did not lead to significant Total Factor Productivity (TFP) growth during the first half of the 1990s. While productivity growth averaged 1.5% in the first half of the decade, it increased to an average of 2.5% in the second half. This improvement was primarily driven by increased investments in new technologies, particularly computers and software, and a tightening labor market that compelled firms to make better use of the existing workforce. The acceleration of productivity growth in the second half of the 1990s can also be attributed to the tight labor market, as firms maximized the utilization of their employees.

During this second part of the decade, firms began to recognize that workers constituted a valuable resource that was becoming increasingly scarce. For example, Roach (1998) argued that while IT technology had yet to fully deliver on its promise of faster productivity growth, sustained productivity growth would require improved skill development through better training and retention of workers.

In conclusion, the overall TFP growth observed in this decade did not mirror the pattern experienced by industrial countries during the "Golden Age" of economic growth, which ended in the early 1970s. The modest TFP growth in the industrial countries during the first part of the nineties, coupled with enhanced investments in human capital and research and development, may represent a gestation period before the full impact of ICT is realized.

With the exception of China, the continued and rapid catch-up growth observed in Asia can be attributed to a lesser extent to Total Factor Productivity (TFP) growth and more to capital deepening during the 1990s, in comparison to the situation in Europe during the 1970s. This trend was particularly pronounced in both East and South Asia during the 1990s, as compared to the 1980s. In the 1990s, the large capital-deepening contribution increasingly relied on remarkably high savings rates, as incremental capital-to-output ratios became less favorable.

While economic growth in the period 1995-2000 was sustained, with the world economy growing at a rate of 4.5% in 2000, according to the World Bank[1], the situation changed in the period from 2001 to 2010. In 2001, global growth was already at 2%, but it improved until 2007 when the world's growth rate reached 4.4%. However, due to the outbreak of the global financial crisis, the global growth rate experienced a sharp decline in 2008, dropping to 2.1%. Additionally, in 2009, there was a severe crisis in the economies of various countries, leading to a global GDP drop of -1.3%. In 2010
the global economy recovered with a 4.5% GDP increase and reached the same level as in 2007.

All countries contributed to the increase in total global economic activity between 2000 and 2010. However, during that decade, China accounted for 22.0% of the increase in global economic activity, making it the largest contributor. The United States was the second-largest contributor, with its increase representing 14.2% of global economic growth from 2000 to 2010. These two countries also stand out as the most dynamic in terms of innovation and the adoption of digital technologies.

Apart from China, notable increases in size were observed in the countries of Nigeria, India, Vietnam, Singapore, the Islamic Republic of Iran, Indonesia, Egypt, and Russia between 2000 and 2010. On the other hand, the slowest growing countries during this ten-year period were Italy, Japan, Germany (37%), France, and the Netherlands.

The effects of growth on unemployment during this decade were mixed. In particular, at the peak of the worldwide recession that began in 2008, global unemployment reached the highest level on record, with about 7 percent of the global workforce looking for jobs in 2009. However, during that decade, the labor market underwent significant changes due to the push of globalization, while technological development has undoubtedly altered work tasks and the work environment (Acemoglu, Autor, 2011; Autor, 2013). The changes in the allocation of workplace 'tasks' between capital and labor have altered the structure of labor demand in industrialized countries and fostered employment polarization. This means there has been a rise in employment in the highest and lowest paid occupations during that period.

Finally, after the recovery of 2010, following the global financial crisis, the world rate of growth from 2011 to 2018 oscillated around 3%. In 2016, it was 2.8%; in 2017, it was 3.4%; while in 2018, it reached 3.3%. However, in 2019, it decreased to 2.6%, and in 2020, due to the COVID-19 pandemic, it collapsed to -3.1%. Nevertheless, the recovery in 2021 was strong, with an increase of 5.9%.

[1] https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG

In this decade, artificial intelligence (AI) has become a game changer. According to the OECD (2021), over the period 2012-2019, higher exposure to AI was associated with increased employment growth in occupations where computer use is high. AI has made most progress in areas such as information ordering, memorization, perceptual speed, and deductive reasoning – all of which are essential for performing non-routine cognitive tasks. Naturally, higher exposure to AI is not necessarily detrimental to workers' jobs as long as workers possess the skills required to use AI effectively.

THE ISSUE OF JOB DISPLACEMENT

A first effect of technological progress and the adoption of new digital technologies is job displacement. Digital technologies substitute work, resulting in the loss of certain jobs.

Automation is one of the primary drivers of technological unemployment. The recent advancements in robotics, artificial intelligence (AI), and machine learning have enabled machines to perform tasks previously carried out by humans. Industries such as manufacturing, agriculture, and customer service have experienced significant automation-driven job losses. For example, robotic assembly lines have replaced human workers in factories, leading to a decline in manufacturing jobs. Similarly, chatbots and virtual assistants have taken over customer support roles in many companies, reducing the need for human operators. Indeed, technology is more likely to replace workers when benefits are clearly much larger than costs, including the hidden costs of mistakes the technology itself can make.

Muro, Maxim, and Whiton (2019) suggest that all occupations will be affected by digital technologies, although routine jobs are at the highest risk[2]. According to their perspective, the most realistic scenario for the future is that some jobs will disappear, while others will be preserved. Many jobs will undergo reconfiguration, and simultaneously, new jobs will be created.

Following a different approach, Acemoglu and Restrepo (2019) design a theoretical framework based on tasks, where a single job serves as the central unit of production. They conceptualize automation as "an expansion in the set of tasks that can be produced with capital" (p. 202). Their framework builds upon the notion that technologies such as AI and robotics replace workers in tasks that were previously performed by employees, resulting in a significant *displacement effect*. This effect could reduce the demand for labor, wages, and employment. However, these authors acknowledge the presence of countervailing forces that work against the displacement effect. One such force is the productivity effect, which arises from the substitution of less expensive machines for human labor. This tends to increase the demand for labor in non-automated tasks. The second force is the capital accumulation effect, which is triggered by increased automation. This effect raises the demand for both capital and labor. The third force is the deepening of the automation effect, which tends to generate a *productivity effect* without displacing jobs, thereby increasing the demand for labor. This effect occurs because automation operates at the intensive margin, enhancing the productivity of machines in tasks that have already been automated (Acemoglu, Restrepo, 2019, p. 198).

Additionally, Acemoglu and Restrepo (2019, p. 199) argue that excessive automation also contributes to a drag on productivity growth. This observation could help explain the disappointing productivity growth witnessed in recent decades. In their perspective, while these first-order countervailing effects are important, they are typically inadequate to significantly increase employment and generate new jobs. Therefore, Acemoglu and Restrepo (2018, 2019) assert that a more potent countervailing force, which boosts the demand for labor and potentially employment, arises from the creation of novel tasks, functions, and activities wherein labor possesses a comparative advantage over machines. The emergence of new tasks produces a *reinstatement effect* that directly offsets the *displacement effect*. The competing forces of task automation and task displacement determine the net effect of technological change on labor demand: if automation outpaces reinstatement, labor demand falls, if conversely reinstatement outpaces automation, labor demand rises (Acemoglu, Restrepo, 2018)[3].

The speed and nature of task creation rely on the choices made by firms, workers, and other societal actors, and may be fueled by advancements in automation technologies.

Acemoglu and Restrepo (2019) also conduct an empirical analysis of task displacement and task reinstatement for two long time intervals: 1950–1987 and 1987–2017 in the US economy. Their analysis suggests that these

[2] This view is nowadays challenged by the advent of generative AI, which puts intellectual jobs at risk as well.
[3] See also Autor (2022).

two forces—automation and task reinstatement—were roughly in balance during the first-time interval of 1950–1987. However, automation subsequently outpaced task reinstatement during the second time interval of 1987–2017, which is consistent with the simultaneous decline in labor's share of national income.

Furthermore, Acemoglu and Restrepo (2019) argue that automation has the potential to create new tasks endogenously, such as with AI. However, they caution that the adjustment process in an economy rapidly adopting automation technologies can be slow and arduous. The authors emphasize that a crucial factor is the potential mismatch between the new skills required by the new tasks and the new technologies. This issue becomes especially significant when the education sector fails to keep pace with the demand for these new skills. They also demonstrate that such a mismatch hampers labor demand adjustment, contributes to inequality, and diminishes the productivity gains from both automation and the introduction of new tasks. These authors propose empowering AI in uses where it can complement labor and generate opportunities for new tasks as a possible solution. Therefore, supporting academic and applied research and considering social factors in the development of AI is critical. Additionally, it is necessary to design new and improved institutions that can ensure the more equitable distribution of gains derived from these new technologies.

Susskind (2020) takes a more radical and provocative yet pragmatic stance regarding the effects of new technologies and machines, particularly AI, on the labor market. In his book "A World without Work," Susskind (2020) argues that recent advancements in AI have increasingly put all types of jobs at risk. It is no longer necessary for machines to think like humans in order to outperform us, as was once widely believed. Instead, the latest machines are learning to perform various non-routine tasks on their own. Consequently, tasks that were previously considered beyond the capabilities of computers - such as diagnosing illnesses, drafting legal contracts, writing news reports, and composing music - are now within their reach. The threat of technological unemployment is now real. In the coming decades, a world with less work will become a reality, leading to even greater social and economic inequality. However, Susskind is not necessarily pessimistic. Technological progress could bring about unprecedented prosperity, ensuring that everyone has enough to live on. The challenges will be to distribute this prosperity fairly, constrain the burgeoning power of Big Tech, and provide meaning in a world where work is no longer the center of our lives.

Instead, Autor (2015) recognizes that automation does indeed substitute for labor. However, in his view, automation also complements labor and raises output in ways that lead to higher demand for labor, interacting with adjustments in labor supply. This can help explain why automation has not wiped out a majority of jobs over the decades and centuries.

Yet, Autor (2022)[4] acknowledges that traditional optimism among economists about the beneficial effects of technology on productivity and welfare has eroded as our understanding of these technologies has advanced. Autor (2022) revised its previous model on tasks in line with the views of Acemoglu and Restrepo (2018) and acknowledges that tasks are not static but continually changing. Work is continually evolving with the demands of new skills and expertise previously unimagined. In addition, in another paper, Autor et al. (2021) distinguish between innovations that automate the tasks performed by workers and those that enhance the outputs or services generated by their work. In contrast to the impact of automation technologies, Autor et al. (2021) demonstrate that augmentation innovations stimulate employment growth. However, Autor (2022) maintains that there is still much to be understood about the potential of new work creation to mitigate the adverse effects of automation on tasks. Nevertheless, he emphasizes that new work plays a crucial role in mitigating the long-term consequences of technological change. Moreover, in Autor's (2022) work, he focuses on AI and its profound impact on the relationship between technological change and labor demand. He argues that AI has the ability to transform the nature of work by enabling machines to perform non-routine tasks. While AI may replace traditional human work tasks, it also creates a new demand for human skills and capabilities. The critical question is identifying what these new demands will be. It is clear that numerous human capabilities, currently valuable, will eventually become obsolete, leading to significant costs for individuals and disruptions for society. However, Autor (2022) acknowledges that while his task framework provides a valuable starting point for analyzing the impact of AI on labor demand, it is insufficient to fully capture all the relevant labor impacts of AI. An interesting paper referenced by Autor (2022) that sheds light on the impact of AI on jobs is Acemoglu et al. (2022). The authors make a distinction between "AI Jobs," which require specific expertise in

[4] Autor is among the economists who developed a task model (Acemoglu & Autor, 2011; Autor, 2013; Acemoglu & Restrepo, 2019) to explain the impact of technological change on work.

contemporary AI tools, and "non-AI jobs," which encompass the majority of jobs that do not require AI-specific skills. Acemoglu et al. (2022) delve into whether AI affects labor demand in "non-AI jobs" and, based on empirical evidence, they affirm that it does, particularly after 2014. The emergence of AI jobs has resulted in a change in the skill requirements for non-AI positions. The overall impact on occupations, however, does not appear to be particularly significant. Autor (2022) supports the thesis that the future of work is not devoid of opportunities. He maintains that there is no compelling historical or contemporary evidence that indicates technological advancements are leading us towards a jobless future.

Finally, Nunes (2021) emphasizes that technology does not eliminate the need for human labor and criticizes the tendency of economists to solely focus on whether automation creates or destroys jobs. Instead, Nunes argues that technological change fundamentally transforms the nature of labor. She highlights that the term "Autonomous" does not imply "humanless", i.e., a complete absence of human involvement.

NEW TECHNOLOGIES AND THE TRANSFORMATION OF WORK

It is important to pay attention to the effects that new technologies have in terms of transforming work. In fact, in addition to job displacement, a second implication of technological progress, particularly concerning new digital technologies, pertains to the occupational composition and skill profiles of workers.

As maintained by Schilirò (2020), the technologies related to the Fourth Industrial Revolution affect the quality of employment, consequently influencing the tasks, skills required, and distribution of employment across sectors.

Furthermore, Warhurst and Hunt (2019) point out that occupational composition and skill profiles tend to change as humans interact with new technologies. They also argue that the presence of a large supply of unskilled labor serves as a channel for the impact of technology on inequality. Therefore, the issue of digital skills represents a major concern and ranks among the high-priority challenges for enhancing the competitiveness of economies and firms, as well as addressing inequalities.

While predicting the emergence of new jobs in the future is challenging, it is certain that new skill profiles will be in demand. Empirical studies demonstrate that a significant proportion of key skills necessary for current jobs will undergo changes within the next 20 years, with 90% of jobs requiring digital skills. Regarding how different jobs are affected, the most accredited hypothesis in the literature (e.g., Warhurst & Hunt, 2019) is that jobs of a routine nature are the ones most likely to be replaced with new digital technologies. Instead, non-routine jobs that require complex tasks serve as complements to these technologies. Consequently, a greater emphasis on training and education is necessary to meet the increased demand for skilled labor resulting from technological advancements.

In this regard, PwC (2020) emphasizes the importance of skills and talent for organizations. Upskilling—ranging from digital literacy to critical thinking—will be essential. It requires both individual and organizational commitment to creating a culture of learning in the workforce. Therefore, learning is also crucial as digital and human skills will be in even higher demand in the future. Additionally, the report suggests that organizations adopt a flexible business strategy, as flexibility and agile work contribute to increased productivity and work-life balance. There is an urgent need for organizations to reconfigure the traditional office and enhance remote working skills.

Kolade and Owoseni (2022) underline that digital transformation has created a new frontier characterized by evolving employment profiles, skills instability, and the urgent need to re-skill and up-skill the workforce. These authors also emphasize that digital technologies are exerting disruptive impacts on existing industries while also enabling the creation of new industries, companies, and jobs. This phenomenon is particularly evident in areas such as cloud technology, data science, security services, and online streaming services.

McKinsey (2023) reported these main findings on the future of work: One in 16 workers may have to switch occupations by 2030, with the pandemic accelerating expected workforce transitions.

Job growth will be more concentrated in high-skill jobs, including healthcare, science, technology, engineering, and STEM fields, while middle- and low-skill jobs will decline. Certain job categories could experience more growth than others. For example, the emergence of e-commerce has created a demand for warehouse workers, and aging populations in many advanced economies will increase the demand for nurses, home health aides, and hearing-aid technicians. The pandemic propelled the faster adoption of digital technologies, including automation and AI. Companies have used them to control costs and mitigate uncertainty to some extent.

World Economic Forum (2023), in its *Future of Jobs Survey*,[5] points out that the increased adoption of new and frontier technologies, along with the expansion of digital access, will continue to be a crucial driver of business transformation over the next five years. This transformation will impact the level and composition of employment, as well as the required skill sets for work. In addition, the most significant effects on job creation and destruction arise from technology, as well as environmental and economic trends. Regarding technology, the adoption of big data, cloud computing and artificial intelligence is highly probable. Job growth is expected in the field of digital commerce and trade, particularly in digitally enabled roles such as e-commerce specialists, digital transformation specialists, and digital marketing and strategy specialists. Additionally, job opportunities are expected to increase in the domains of education and agriculture. The roles experiencing the fastest decline in relation to their current size are primarily driven by technology and digitalization. According to McKinsey (2023), the majority of these fastest declining roles are clerical or secretarial positions. However, McKinsey (2023) may be overly optimistic about the overall impact of most technologies on jobs, as it is expected to have a net positive effect over the next five years. This forecast may be more plausible in high-income countries with tight labor markets, while it is unrealistic for low and lower-middle-income countries that continue to face higher unemployment rates compared to pre-COVID-19 pandemic levels.

Furthermore, the recent evolution of AI is an issue that is garnering significant attention in the business world and raising concerns among companies and employees. Generative AI, which refers to a subset of Artificial Intelligence that involves training machines to generate new and original data such as images, music, text, or even videos, is experiencing significant growth and advancement.[6] Similar to robotic process automation, the concern for generative AI is also about potential significant job losses. However, the actual outcome with robots was that it compelled many organizations to rescale their workforces and shift their focus to higher-value work. Consequently, the net reduction in jobs either did not occur or was not significant.

At the same time, the effects on work appear to be structural. As emphasized by Acemoglu et al. (2022), the emergence of AI jobs has resulted in a change in the skill requirements not only within their specific tasks but also for non-AI positions.

Regarding the future of generative AI, it appears to be more focused on niche and specialized applications. Therefore, the concern that generative AI will lead to a situation where everyone is unemployed is misplaced. By effectively bridging the gap between generative AI and specific, specialized datasets, people are likely to develop a more favorable relationship with the technology. AI needs to be integrated into specific contexts for it to truly flourish.

No doubt, the development of generative AI is reshaping the business landscape and the world of work. However, the level of threat it poses is still uncertain. On one hand, AI is expected to result in a significant boost in productivity. On the other hand, this surge in productivity could potentially lead to widespread unemployment, increased economic concentration, and even the possibility of machines dominating our economies. As a result, it becomes challenging to accurately gauge the capabilities and limitations of generative AI. Nonetheless, a mix of excitement and fear persists regarding the existence of technology bubbles.

DISCUSSION AND CONCLUSIONS

Beyond the crucial relationship between technological progress and long-term growth, this paper has highlighted the main consequences of technological progress, and in particular, digital technologies, on the present and future of work. Technological progress can displace jobs, substituting capital for labor. It also results in the transformation of jobs and the emergence of new tasks and skills, along with the creation of new professional roles.

The paper emphasizes that across various sectors such as manufacturing, retail, financial services, healthcare and transportation, every industry is leveraging the power of digital technologies, leading to inevitable consequences for work and its future.

[5] The Survey brings together the perspective of 803 companies – collectively employing more than 11.3 million workers – across 27 industry clusters and 45 economies from all world regions.

[6] Unlike traditional AI, which operates on pre-existing datasets to recognize patterns and make predictions, generative AI can produce entirely new content by learning from existing datasets and generating something new based on that information. This technology has various applications, including art and design, content creation, and even the development of chatbots and virtual assistants.

The analysis conducted has demonstrated that although digital technologies have the potential to create new employment opportunities, their distribution among individuals is highly uneven, especially in the medium to long term. This problem is further compounded by notable disparities not only across geographic areas but also in the demographic structure of the population.

Furthermore, the labor market appears to be witnessing a rising duality and a trend towards polarization. On one hand, there is a surge in highly educated, specialized, and well-paid occupations, including data scientists, app developers, IT security specialists, engineers, marketing managers, and doctors. On the other hand, there is a persistence and growth of numerous low-skilled and low-educated occupations, including cleaning, home health care, and food service. Simultaneously, job opportunities are dwindling in many middle-educated, middle-wage positions, such as blue-collar manufacturing and white-collar office work involving routine tasks. It is evident that unless these ongoing changes are proactively managed by governments and addressed through international cooperation, they will result in significant economic and social problems.

More recently, there has been significant concern about the evolution of AI. AI, as well as advanced robotics, is likely to widen the range of tasks and jobs that machines can perform and has the potential to cause more worker displacement and inequality than older automation processes. Those who predict that there will be fewer jobs with AI explain this by pointing out that the nature of work will change, similar to what happened after the industrial revolution. However, AI systems are tools, and like other powerful tools, they can be helpful if used appropriately or harmful if misused. This includes their impact on the workforce. Much depends on the choices made by companies, governments, and education systems. Companies can reduce their workforce or hire fewer people due to AI adoption, but they have other options, such as upskilling their existing personnel to utilize AI in their current roles or providing retraining for new roles. Similarly, governments and education systems have the opportunity to prioritize upskilling and preparing individuals for utilizing AI in their work.

The impacts generated by digital technologies on the world of work, amid ongoing transformations, are indeed revolutionary. They impose new organizational models and present unprecedented challenges to businesses and their employees. Today, three significant challenges emerge from the aforementioned points that we must confront. Firstly, skills: investing in training, upskilling, and reskilling pathways to enhance talent and meet market needs. Secondly, the emergence of new business models that must incorporate new digital strategies and approaches, including the adoption of Industry 4.0. This transition requires new qualifications, professionalism, and a shift in corporate and work culture. Thirdly, the rise of entirely new forms such as decentralized autonomous organizations, which hold immense potential in areas ranging from Web3, cryptocurrencies, NFTs, to the Metaverse.

These challenges are truly complex, and there are no simple answers. However, a cooperative attitude among various stakeholders is certainly necessary.

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