



Technological Change and the Future of Work

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I NEARLY 30 YEARS OF LIVING (AND WORKING) WITH THE INTERNET

The internet has changed our lives. It has represented a revolution in the way we communicate. In fact, information technologies have brought fundamental change throughout society, driving it forward from the

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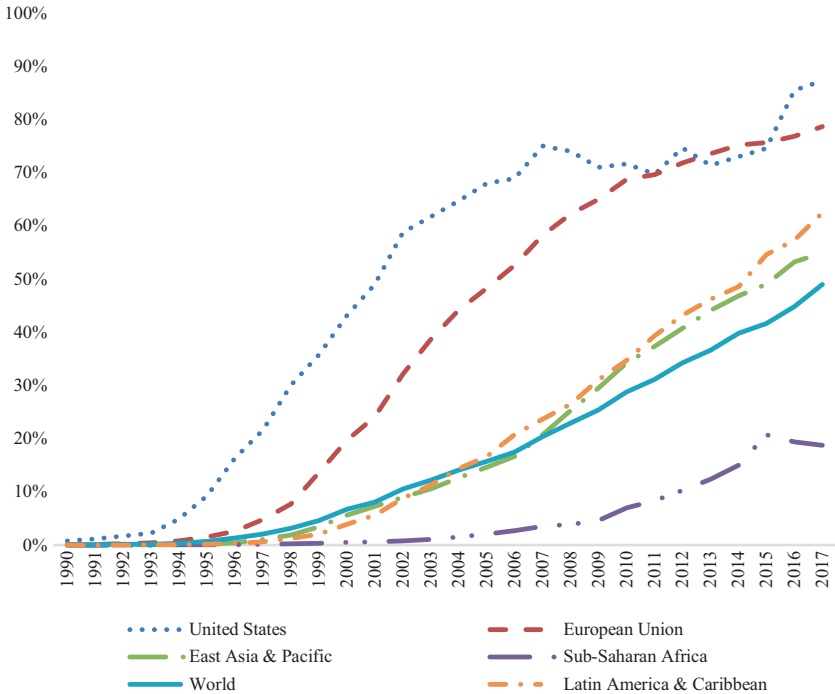


Fig. 1 Individuals using the internet as a % of population. (Source: Authors' calculations based on World Bank (2021)) data.

industrial age to the new digital era. Figure 1 shows the proportion of population using internet from 1990 up to the latest available data in different regions of the world. As it can be seen in the figure, while more than half of the population in the world uses internet, there are still significant differences according to the region considered: while in the United States or Europe more than 80% of the population are regular users, in Sub-Saharan Africa this proportion is still around 20% (although it is improving thanks to the fast penetration of smartphones). Closing the digital divide is, in fact, a policy priority in order to not leave nobody behind in the new technological world (World Bank, 2016).

But the fast developments in information and communication technologies have not only changed the way we live, and we work, it has also affected how we produce and how we consume. The improvements in

global transportation infrastructures and the associated reduction in transportation costs together with the new role played by information technologies are key factors explaining the rise of Global Value Chains (GVCs). In fact, globalisation is closely intertwined with technological change (Rodrik, 2018). Since 1991, trade openness, internationalisation of production and labour mobility have fostered productivity and innovation around the globe, increasing technological imports and technology adoption in both developed and developing countries, but also changing the nature of work.

2 TECHNOLOGY AND JOBS

Although in the past there have been movements protesting against technological improvements (such as Ludists), there is a wide consensus among economists that technological progress during the nineteenth and the twentieth century did not result in net job losses (Autor, 2015). In fact, previous industrial revolutions seem to have generated new opportunities for low-wage workers to move into better-paid medium-skilled jobs allowing them to capture the benefits of specialisation and the economies of scale derived from automation thanks to mass education. Skill-biased technological change (SBTC) and capital-skill complementary (CSD) hypothesis explain how technological changes translated into higher economic growth and a lower overall wage inequality during most of the twentieth century (Katz & Murphy, 1992; Goldin & Katz, 2008; Buyst et al., 2018).

However, starting in the 1980s, the impacts of the current technological revolution on labour markets seem to be different. Acemoglu and Autor (2011) argue that technological progress is currently replacing workers doing routine and therefore codifiable tasks. According to this hypothesis, recent technological change is “routine-biased” (RBTC) leading to job polarisation because easily codifiable routine tasks are concentrated in intermediate jobs. On the opposite, high-paid jobs that mainly involve doing non-routine cognitive tasks with a creative component and low-paid jobs involving non-routine interactive and manual tasks seem to be much more difficult to automate. In a very influential paper, Frey and Osborne (2017) analysed the probability of computerisation for 702 occupations in the US by considering these dimensions and applying this approach; they assigned a probability of 0.94 that computerisation would lead to job losses within the next decades to accountants and auditors but

only 0.37 to actors, 0.17 to firefighters or nearly 0 to dentists. From an aggregate perspective, they found that 47% of all jobs in the US were potentially automatable in a near future.

This grimmer stance has been challenged, though. Arntz et al. (2016, 2017) argue that occupation-level approaches significantly overestimate automation potentials. In particular, they argue that within an occupation, many workers specialise in tasks that cannot be easily automated, and once this is taken into account, only about 9% of jobs in the US would be at risk of automation. As highlighted by Autor (2014), this result is also related to Polanyi's paradox ("We know more than we can tell") to explain why not more jobs have been automated and well in line with the evidence obtained by Acemoglu and Restrepo (2020). Looking at US data from 1990 and 2007, their estimates suggest that an extra robot per 1000 workers would reduce the employment to population ratio by 0.18–0.34 percentage points and wages by 0.25–0.5%. Although these are sizable effects, it is a relatively small fraction of US jobs being affected by robots. However, the pace at which machines are gaining the ability to perform cognitive tasks is much faster than in the past and labour markets have polarised due to the lower demand for mid-skill workers compared to workers in the extremes of skill distribution (Gibbs, 2017).

Technological change has also contributed to the worldwide increase of non-standard forms of employment (ILO, 2016), particularly due to the emergence of digital labour platforms. According to the recent study by ILO (2021), digital labour platforms provide new work opportunities, including some groups of workers that have been marginalised in traditional labour markets, while allowing businesses to expand their activity to new customers while accessing to a more flexible workforce with varied skills. However, there are doubts about the risks that digital platforms represent to working conditions, the regularity of work and income and the lower social protection compared to traditional jobs.

In This Section: Jobs and Technological Change

The second part in this volume, "Jobs and Technological Change," studies these issues by compiling relevant publications regarding the link between technological innovation and changes in the nature of work and labour over the last three decades.

How does international migration causally relate to the technological gap? The next chapter (Chapter "The Impact of Differences in the Levels

of [Technology on International Labor Migration](#)”) in this book by Galor and Stark (2022) analyses the impact of differences in the levels of technology on international labour migration. The authors analyse which migratory patterns result from technological differences. They provide a microeconomic foundation of international labour migration, modelled in a dynamic general equilibrium framework of a world characterised by technological differences. As reported by Galor and Stark (2022), in line with the prediction of static models, if international capital movements are unrestricted, labour is likely to migrate from the technologically inferior to the technologically superior country. However, the authors show that in the absence of international capital mobility, this dynamic would not be irreversible. This is because, under certain conditions of the stationary autarkic equilibrium in the technologically superior country, migration may take place from the technologically superior country to the technologically inferior country. While also other complementary factors may impact migratory decisions, Galor and Stark innovate by isolating and exploring several technology-migration connections, and by leading to future research questions about the possible interactions of the various determinants of labour migration, such as uncertainty and availability of information, and skill differentiation.

In the developing world, labour’s marketplace bargaining power of workers may be enhanced or reduced by international market integration. Globalisation can upgrade labour’s conditions due to increasing levels of exports and production, and consequentially of employment, but also put pressure on governments in developing countries to keep wages competitive, worsening the bargaining power of labour. In Chapter “[Are Workers in the Developing World Winners or Losers in the Current Era of Globalization?](#)”, Rudra (2022) investigates whether workers in less-developed countries (LDC) are winners or losers in the current global economy. The author uses a panel data set for 59 developing countries to test the overall impact of globalisation on labour across various levels of economic development. This is done by analysing the effects on potential labour-power (PLP) trends, which is an index defined by the author for making inferences about the extent of labour’s marketplace bargaining power. Rudra (2022) finds the effects of globalisation on workers seem to depend on the level of LDC economic development. While lower income LDCs are experiencing greater employment opportunities thanks to international market integration, surplus labour problems have worsened and labour solidarity has been distressed in all countries with the exception

of high-income LDCs (e.g. in countries with the “growing population of skilled labour and the relatively small pools of surplus labour”). As Rudra points out, this suggests that workers in LDCs at higher levels of economic development are the only “winners” in the current era of globalisation. Those in middle-/low-income countries, while they have better access to employment opportunities, are “losers,” in the sense that PLP does not significantly increase with markets integration.

In Chapter “[The Role of Labour in Capability Upgrading: The Case of Emerging Market Multinationals](#)”, Amendolagine and Rabelloiti (2022) provide a complementary perspective to this analysis by considering how access to skilled labour in developed countries can help Emerging Market Multinationals (EMNEs) to improve their technical and managerial skills. In fact, EMNEs have recently started to increasingly undertake strategic asset seeking investments in developed countries (i.e. through the acquisition of technological leading companies) with the aim of acquiring knowledge and upgrading their innovative capabilities. However, the authors explain that it is not easy for these firms to take advantage of their FDI in developed countries to improve their innovative capabilities in the host region. Only those firms with strong “absorptive capacity and high reputational status” seem to be successful in exploiting the benefits of this strategy.

To what extent technological and structural changes are impacting employment opportunities? Employment effects of innovation are studied in Chapter “[Employment Effect of Innovation](#)”, by Kancs and Siliverstovs (2022). Their study provides novel evidence about the nexus between R & D-driven innovation and firm employment in OECD countries in a continuous framework. As the authors show, while innovation can increase labour demand, nonlinearities of the innovation/employment relationship can arise from many aspects. These may be the nature and the purpose of innovation, its dimension or, from the other side of the dynamics, on the sector of the firm, institutions, the structure of the workforce skills, and other complementary factors, which may contribute to diversifying employment effects at different innovation intensities. Using R & D scoreboard data, they frame and confirm the nonlinearities embedded in the innovation/employment relationship, by noting differences in the reaction of employment to the innovation activity of the firm, depending on the actual level of the R & D intensity. Kancs and Siliverstovs’ (2022) results suggest the labour-saving aspect of innovation is more

marked for firms with medium-high levels of R & D intensity, while it tends to increase with the levels of R & D intensity.

Concerning the relation between biased technological change and employment risks related to premature deindustrialisation, Abbot, Tarp and Wu (2022) provide new evidence about the Vietnamese development experience in Chapter “[Structural Transformation, Biased Technological Change and Employment in Vietnam](#)”. The authors analyse the differences observed between employment and GDP growth to examine the specific roles played by structural change of the economy, technical innovation and institutional bias towards capital-intensive development. The period considered by the authors is from 2000 to 2011, while the data used are from seven aggregate sectors and the overall Vietnamese economy. The study suggests only a partial portion of the difference between employment and GDP growth is driven by shifts from low-productivity to high-productivity sectors (e.g. structural transformation). Instead, a significant share of the employment-growth difference is due to technical change, when low elasticities of substitution and labour-augmenting bias in technical change are taken into account in the analysis. A remaining small portion of the difference is also explained by capital-intensive investments by state-owned enterprises. Abbot, Tarp and Wu’s (2022) results are consistent with significant labour-augmenting technical progress, and better explain recent economic performance in Vietnam. They also suggest that restructuring and investments allocation into private firms could be an important factor for driving future employment growth.

Innovation may also be considered as the specific tool of entrepreneurs (Drucker, 1985) with its own economic and social dimension, and not only a simplistic technical change. Nonetheless, innovation and entrepreneurship are too often imagined at the top-tier countries and individuals, neglecting other realities and rationalities. The second part of the book continues with Chapter “[Helping a Large Number of People Become a Little Less Poor: The Logic of Survival Entrepreneurs](#)”, by Berner, Gomez and Knorringa (2022), where the survival and growth-oriented entrepreneurs’ typologies are studied. The authors outline and systematise the different characteristics of the various categories of entrepreneurs to better understand their behaviour and different needs. In the chapter, Berner, Gomez and Knorringa systematically develop the policy implications for supporting survival entrepreneurs. The authors suggest there is a qualitative difference between survival and growth-oriented enterprises concerning several key variables, and this is reflected in

different typologies and rationales of entrepreneurship. They stress that great part of the existing policy interventions are based on the idea that all entrepreneurs are growth-oriented, which aim to push “entrepreneurs onto the ladder of graduation towards more specialization and growth orientation.” This is unlikely to address the specific needs of survivalists, who are usually more concerned with poverty, structural uncertainties and access to basic services and infrastructure.

The inclusiveness of innovation processes is still debated. Given the lack of capital for more expensive technologies, frugal innovation has become increasingly important merging different pieces of literature (Leliveld & Knorringa, 2018). While innovative systems or services can promote employment opportunities and entrepreneurship, they may also contribute to informalisation, fostering inequalities and capitalist exploitation. Chapter “The ‘Transformational’ Potential of Mobile Money in Zambia: Mobile Money Agents as Drivers of Entrepreneurship in Kitwe?” in this book, by Peša (2022), surveys this issue by analysing whether the service of mobile money can become a pro-poor frugal innovation for the agents and tellers in Kitwe, Zambia. The author proposes an empirical study focusing on entrepreneurship and labour relations, which suggests the existence of differences between agents and tellers in mobile money services. Peša (2022) studies these differences by focusing on the educational and employment background of agents and tellers, financing and business operations and the franchising structure of the sector in Zambia. The chapter suggests that frugal innovation studies should pay more attention to the longer term and ambiguous outcomes which frugal innovations have on livelihoods and development. In Zambia, while processes of inclusion might be selective, mobile money might give rise to new and partially unpredictable inequalities among the various actors involved in the process. Peša proposes frugal innovation cannot be analysed in terms of either development or exploitation, and that the role of policy in frugal innovation should receive more consideration. In Chapter “Dynamics of Mobile Money Entrepreneurship and Employment in Kitwe, Zambia”, Kabala (2022) updates this research by providing a new assessment of the capacity of mobile money agents to enhance financial inclusion and create employment opportunities. The conclusions obtained from interviews with agents and tellers of the three main players in the mobile money services market in Kitwe, Zambia, confirm the results by Peša (2022): only firms that can offer innovation in terms of a broad line of diverse and affordable services are the ones that survive the fierce competition, but even in the case of

successful firms, this does not avoid the existence of vast inequalities between agents and tellers.

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