



OCTOBER 20-22, 2019 LANSDOWNE RESORT AND SPA, VIRGINIA

EMERGING
MARKETS
FORUM

2019
GLOBAL
MEETING

BACKGROUND
PAPERS

IMPACT OF
TECHNOLOGICAL
CHANGES ON
EMERGING
MARKETS: THE
CASE OF JOBS

Soumitra Dutta



**Emerging
Markets
Forum**

A nonprofit initiative of the Centennial Group

Impact of Technological Changes on Emerging Markets: The Case of Jobs

Soumitra Dutta

In this paper, I try to address the issue of how technology is impacting jobs today and will impact jobs in the near future, with a specific focus on emerging markets. I explore five inter-related themes which together provide a useful lens on policies and strategies that can be undertaken at the macro (country/regional) and micro (firm/individual) levels.

Theme 1: How is technology different today? Technology has had an impact on jobs over the past several centuries. However, the concerns around the impact of technological changes on jobs has become more acute today. It is useful to begin with an understanding of why this is the case.

Theme 2: Will technology lead to net new job creation in the future? History suggests that over the last couple of centuries, technology has created more new jobs as compared to jobs that have been destroyed. An important question is whether this trend can be expected to continue in the coming decades.

Theme 3: What policies and actions can help us to navigate technological transitions and aid the creation of new jobs? Technological progress opens up new sectors and creates new jobs. How can governments aid the creation of these new sectors and jobs?

Theme 4: How is technology changing the nature of jobs and what does this mean for the nature of skills required to succeed in jobs? What kind of actions can individuals take to be prepared for the future of jobs?

Theme 5: Is technology leading to better lives for people? As concerns around privacy, security and trust have emerged to the forefront, what are the implications for jobs?

Theme 1: Is technology different today?

Technology has always had a strong impact on both job destruction and new job creation. With each new generation of technology, be it the printing press or the introduction of railroads or the deployment of computers, specific sectors of the economy (and our lives more

generally) have been impacted significantly. Advances in transportation technology, such as the introduction of railroads and the commercialization of flight, destroyed a range of jobs associated with prior modes of transportation and led to increased commerce and a new set of jobs. The deployment of computers and the rise of personal computing led to a revolution in how businesses were organized and eliminated the need for a whole class of jobs (such as data clerks). However, it also helped the creation of new sectors of the economy and the rise of a new category of workers who could perform more sophisticated tasks (such as computer-aided designers and programmers).

Three elements are relevant for discussion here with respect to the core technological changes we are witnessing today and expect to see over the next few decades.

Element 1.1: The exponential pace of progress in digital technologies will continue

The pace of progress in digital technologies has been exponential. This has been best expressed by Moore's law, which states that the processing power of computers doubles every 2 years. Moore's law has largely been true for the past several decades. Today, when people are questioning whether the limits of semiconductor physics and the extreme tolerances of our semiconductor manufacturing processes will end Moore's law, quantum computing is becoming increasingly viable as a radical new way of continuing the upward push in computing power. Quantum computing offers hope not only that Moore's law will continue to hold, but that the pace of future progress in computing power may actually be higher than the rates we have enjoyed over the last few decades. As this note goes to print, Google¹ has just announced the successful creation of a quantum computer which can run through a complex computation in a few minutes as compared to several thousand years on the fastest traditional computers available today. One can expect to see quantum computing get more commercialized in the years ahead.

1. <https://www.ft.com/content/b9bb4e54-dbc1-11e9-8f9b-77216ebe1f17>

We are looking at a future where the pace of progress in digital technologies will continue at a remarkable exponential pace. For any exponential trend, the longer it continues, the higher the impact of change with each passing year. Thus, we should be prepared to see larger and larger improvements in digital technologies each year for several years ahead.

Element 1.2: The trifecta of digital, biological and physical technologies is becoming a reality

For many decades, research in computation, biology and manufacturing proceeded along largely independent paths with limited crossovers. This all is changing rapidly as large parts of the biological and physical research domains are getting digitized. Consider the rise of gene editing and CRISPR technologies. It is now possible to view a biological creature as a software pattern that can be programmed and edited to create new biological versions or to change evolutionary patterns. With the rise of additive manufacturing (3D printing) and progress in material science, it is possible to think of a world where the composition and design of objects (including edible foods such as meat) can be reduced to software designs that can be printed on demand by additive manufacturing techniques.

Physical objects are being represented by digital twins which capture the complexity of the object in all aspects (physical models and associated behaviors). GE has digital twins for each of its heavy industrial machines, such as its wind turbines. These digital twins represent real-time software-based representations for the corresponding physical objects and allow GE to track the behaviors of the machines and to take corrective action as needed. Digital twins are also entering the biological domain, where detailed models are being created of the human body. For example, last year Dassault Systèmes launched its digital model of a human heart (called the Living Heart²) which was approved by the US FDA for use in actual operating theatres by doctors.

The pace of innovation is speeding up as the integration of digital, biological and physical technologies becomes a reality. This will continue at a rapid pace in the years ahead and create new opportunities and jobs.

Element 1.3: Emerging markets are active participants in the technology revolution

Emerging markets have become avid adopters of new technologies. Large emerging countries such as China,

2. <https://www.3ds.com/products-services/simulia/solutions/life-sciences/the-living-heart-project/>

India and Brazil are active participants in technological progress. India, for example, now has the second-largest mobile phone user population in the world (after China) with nearly 600 million users. Some of the most innovative drone applications are seen today in Rwanda, which has opened up its airspace to innovation in drone technologies. Technology adoption in many cases has helped emerging markets to create jobs and strengthen national competitiveness. India is a global force in software development and boasts the highest share of ICT exports (of total exports) in the world. As another example, the Philippines has emerged as a global hub of excellence for call centers.

Some emerging markets have also taken a leadership position in creating new technologies. For example, China leads the world in specific technological domains such as 5G. In 2017, China exceeded the USA in key parameters of scientific innovation, such as number of researchers and number of patents. Total Chinese investment in R&D now ranks only a little behind US R&D spending and is increasing at a faster rate. In 2019, China broke into the top 15 nations in the Global Innovation Index (GII)³ ranking. Other countries such as Israel (ranked 10th in the GI) and Korea (ranked 11th in the GI) now rank among the most sophisticated technology powers in the world.

Despite important concerns related to data governance, privacy, security and trust that need resolution, emerging markets often take a more liberal stance on some of these dimensions and are thus becoming important hubs of innovative applications. A good example is the widespread use of facial recognition in China and its use for a range of applications, including the controversial social scoring of Chinese citizens.

Theme 2: Will technological progress lead to net new job creation?

Each new technological disruption has both impacted (eliminated or reshaped) existing jobs and helped create new jobs. This dual impact of future technological progress will continue. A key question in this context is whether the creation of new jobs will be more than the loss of jobs caused by technology. Let's consider three important elements linked to this question.

Element 2.1: Historically, technology has led to higher job creation than destruction⁴

Over the last century, technology has had both positive and negative impacts on job markets in both developed

3. <https://www.globalinnovationindex.org/Home>

4. The data in this section is taken from McKinsey Global Institute's 2017

and emerging markets. Although there were large shifts of workers across occupations and industries, overall employment as a share of the population generally continued to grow. New industries and occupations emerged to absorb workers displaced by technology, even though the transition has not always been smooth. The overall effect of mechanization has been to create jobs on an unprecedented scale. Machines allow workers to produce more, thereby raising productivity and (eventually) wages and lowering the price of goods for consumers. The number of hours worked has also declined while leisure time has increased.

The employment shifts accompanying this process of structural transformation have been large and interesting. In the developed markets, such as United States, the share of agricultural employment declined 25 percentage points between 1880 and 1920. Since 1960, when the second wave of structural transformation began, manufacturing fell from 27 percent of total US employment to 9 percent today, as automation and global trade transformed manufacturing and as demand for services exploded. Interestingly, female employment in the United States almost doubled as a proportion of working-age women from 32 percent in 1950 to 60 percent in the late 1990s before falling back to 57 percent today.

According to McKinsey⁵, employment and productivity both grew in 79 percent of individual years since 1960, while productivity grew as employment declined in 12 percent of years. Both employment and productivity grew in 95 percent of rolling three-year periods and 100 percent of rolling 10-year periods. This phenomenon is also seen in emerging markets. In China, employment and productivity both increased in 77 percent of individual years but in 98 percent of the 10-year periods between 1960 and 2016.

While past technological disruptions did not reduce the amount of work available to people, they nonetheless had one significant effect: a decline in the average number of hours worked per week—and, conversely, an increase in the amount of leisure enjoyed by individuals. By 2015, the average number of hours worked each week by employed workers had fallen by roughly half, to around 35 hours in Germany, Sweden, and the United Kingdom and 38.6 hours in the United States. Hours worked have continued

to decline as the workforce shifted from manufacturing to services in the past 50 years.

Element 2.2: Customer needs drive job creation

There is ultimately one important driver for job creation: customer demand. Without a customer need, there would be no need for a job to fulfill that demand. There are two important ways in which new jobs can be created: either jobs can be created to fulfill existing needs of customers that are not being satisfied (due to some reason) or jobs can be created to fulfill new needs of customers (which did not exist before). The good news is that while the nature of customer needs continues to evolve, there are no signs that the total volume of customer needs is shrinking.

There is a huge unmet potential for the delivery of existing services and products, especially in emerging markets. Take the example of essential services such as education and healthcare. There are large numbers of people in developing economies who lack access to adequate education and health services. The solution of creating jobs to address this existing but as yet unsatisfied demand is both simple and complex. It is simple because the contours of the job definition are clear. The demand of the customer (for better healthcare or education) is also clear. Yet the solution is complex because the provision of the service with the right combination of affordability, access and quality is not easy to deliver due to a range of reasons, including lack of resources, conflicting priorities, or simply poor leadership.

Technological innovations can also help in creating new products or services that satisfy customer needs that did not exist before. Thus, for example, the invention of mobile technology has led to an explosion of apps and services which have in turn led to the creation of whole new sectors and jobs. It is anticipated that the commercialization of new technologies such as 5G will also lead to a new class of jobs as new services are created for customers. Assuming that the progress described in elements 1.1 and 1.2 holds true, we should see new sectors and jobs being created at an ever-increasing pace.

Element 2.3: The ongoing data explosion should create many new jobs

There are several popular analyses on the impact of new technologies such as artificial intelligence (AI) on jobs. According to a 2013 Oxford University study by Carl B. Frey and Michael A. Osborne⁶, 47 percent of US jobs are

report on the impact of automation on jobs: <https://mck.co/2NVQPPI>
5. <https://mck.co/2NVQPPI>

6. https://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf

at risk of disappearing over the next 15 years because of robots, artificial intelligence and other forms of automation. Others, such as an analysis by PwC⁷, has noted that AI and robotics could create as many jobs as they displace. AI, robotics and other forms of smart automation have the potential to bring great economic benefits, contributing up to \$15 trillion to global GDP by 2030 according to the PwC analysis.

The central role of data in the ongoing 4th industrial revolution provides a useful perspective on the creation of new jobs. It is widely acknowledged that the total amount of data in the world is growing at an exponential rate. A popular way of describing it is often along the lines of “the total amount of data created over the last two years is more than all the data created in the world since the dawn of civilization”. This trend is not only expected to continue but will increase as new technologies such as the Internet of Things (IOT) and 5G come in widespread use.

Couple this explosive growth in data with the fact that employment in most economies is today concentrated in the services sector⁸. The contribution of services to the economy has surpassed that of manufacturing in several emerging markets also, including India, China, Malaysia, Indonesia, the Philippines and Thailand. Service sector jobs can be largely reduced to two components: making sense of data and serving people. For example, a broker has to make sense of market data and provide the customer with choices about financial decisions; a hairdresser has to make sense of data about fashion trends and customer preferences while deciding how to provide the right haircut to the client. Technology is both creating more data and also providing new ways to make sense of data. These new insights have to be applied to serve humans and to address the needs (both old and new) of people.

One can postulate the following relationship:

$$\text{Number of Jobs (in services)} = f(\text{number of people, amount of data})$$

If the above function holds true, then the number of service jobs tomorrow should be larger than the number today, as the population of the world is growing and the total volume of data is growing exponentially. There are two relevant questions in this context: first, can machines and humans fulfill these service jobs equally well? And second, can economies create these jobs and fill them with appropriately trained people? There are no simple answers here.

7. <https://www.pwc.co.uk/services/economics-policy/insights/the-impact-of-automation-on-jobs.html#cta-1>

8. There is evidence to show that the total number of jobs in manufacturing is shrinking, due to increased deployment of robotics and automation.

Empathy is a key element of human service. Machines today are unable to provide empathy in a manner similar to humans. Machines can often process data better than humans but often lack the judgement necessary to interpret the data. Economies are also frequently unable to either create jobs or fill them with the right talent for a multitude of reasons. Consider the large number of unfilled jobs in programming and healthcare in most economies. Thus, while the potential to create new jobs is significant, success in doing so is not assured.

Theme 3: Which macro policies can help leverage technological progress to create new jobs?

There is no simple formula for governments to create new jobs. Yet job creation should lie at the heart of government actions and policies. Providing access to good and appropriately paid jobs is essential for allowing families to provide for themselves and for the creation of a sustainable and inclusive society. Appropriate government policies can help to navigate the dislocations associated with technology transitions as jobs are eliminated and help society prepare for the new jobs of the future. The quality of new jobs being created also matter. Witness the proliferation of jobs in the gig economy which often barely pay living wages to workers and thus undercut the notion of progress and overall welfare of society.

Let's consider some of the key elements at play here, especially from the perspective of the impact of technology on jobs.

Element 3.1: Policies to support growth and rising incomes is essential for creating jobs

The Economist headlined its May 25th 2019 issue as “The great jobs boom” and described how the rich OECD countries are in general (with a few exceptions) enjoying a jobs boom and record unemployment levels. While not pointing to any specific factor for the robustness of the labor markets in most OECD nations, the Economist did point to continued economic growth (since the last financial crisis) as the most important factor. Others have also argued that maintaining robust aggregate demand growth is important to enable employment growth. Governments should deploy appropriate fiscal and monetary policies to ensure that demand growth is vibrant.

The Economist did point to two other factors that have contributed to the current jobs boom in OECD countries. One, technology has allowed for a better matching of employees with potential employers and this has

strengthened labor markets. The Internet has reduced the cost of search for both employers and employees, thus removing inefficiencies in the labor markets. Two, incremental policy changes along multiple dimensions over the years have provided strength to labor markets: making it easier for women to combine work and family, investing in worker education and reducing the power of trade unions.

According to McKinsey⁹, rising incomes in emerging economies will create large-scale new labor demand as spending increases on consumer goods, health care, and education. McKinsey estimates that this higher consumer expenditure could create between about 250 million and 280 million new full-time equivalent jobs, net of automation, across the 46 countries included in its study. The growth due to rising incomes can mitigate automation's expected toll on workers in retail and accommodation and food services.

In conjunction with its focus on growth orientated policies, governments need to evaluate the impact of all strategies and actions on the human capital of the country. Just as governments formulate policies to attract foreign direct investments (FDI) or to encourage businesses to invest in research and development (R&D), there needs to be a consistent focus on investing in the country's human capital as part of all policies and actions.

Element 3.2: More technology is better than less

Even though technology leads to the elimination of some jobs and to the challenges created by the dislocation of workers, shying away from technology is in general not the answer. Deploying technology is essential for improving productivity and efficiency of operations in all sectors. This helps businesses stay competitive in a global world and to grow and create jobs. Technology is also a key factor to drive innovations in business models. As new innovations thrive, businesses succeed in capturing new value and in creating new jobs.

A focus on technology development can also help in the creation of a vibrant technology sector which in turn also generates new jobs. As examples, an estimated 2.9 million people (or 1.9 percent of the workforce) is employed in the US high tech sector; in Germany, about 2.4 percent of the workforce is in a high-tech occupation. The Information and Communication Technology (ICT) sector contributes over 13 percent to India's GDP and India's digital economy generates about \$200 billion of economic

value annually. By 2025, India is expected to have an overall digital economy of about \$800 billion¹⁰.

McKinsey¹¹ estimates that by 2030 the increased spending on technology will create demand for 20 million to 46 million incremental workers globally, net of automation. While IT services jobs such as computer support specialists will remain largely local, demand for technology hardware and especially software will likely be served by the global players, for example China, Germany, India, the Netherlands, and the United States. More than half of all global tech jobs could be created in these five countries. The largest demand will likely land in emerging markets, such as China and India, with up to 13 million and six million jobs respectively.

Finally, McKinsey notes that the rise of digital sharing economy platforms can also help the marketization of unpaid work to create new jobs. About 75 percent of the world's total unpaid care is undertaken by women, including the vital tasks that keep households functioning, such as childcare, caring for the elderly, cooking, and cleaning. This unpaid work amounts to as much as \$10 trillion of output per year, roughly equivalent to 13 percent of global GDP. As these unpaid activity hours move to the marketplace, McKinsey estimates that between 51 million and 89 million incremental jobs globally could be created from this step-up scenario of shifting currently unpaid domestic work to paid employment. Research has found that digital platforms result in an increase in employment in the industry, both for traditional workers providing those services and for the newly self-employed workers on the platform.

Element 3.3: Policies to support industries of the future is essential

Supporting innovation and technological diffusion is critical, including the adoption of automation technologies themselves, as these advances enable long-run productivity, growth, and prosperity, as well as the creation of new business models, occupations, and work activities. To do so will require an effective and balanced system for encouraging the development and deployment of intellectual property, a high-skill scientific and engineering workforce, and public or private funding for basic research and its commercialization. Policies to encourage the development of industries of the future is the best way to ensure that the economy benefits from the new job creation that accompanies new job creation.

9. <https://mck.co/2NVQPPI>

10. <https://www.export.gov/article?id=India-Information-and-Communication-Technology>

11. <https://mck.co/2NVQPPI>

Of some concern here are recent observations¹² that the level of entrepreneurship and innovation in the West is declining in recent years. The reasons for this decline are several including the growing concentration of market power in some firms, the availability of cheap financing keeping unproductive firms afloat and a decrease in the number of IPOs. The long term impact of this decline is hard to gauge as the West is enjoying an extended period of wealth and job creation within a fairly unique economic and policy context. It remains to be seen how the situation evolves once the macro-economic and policy context changes.

The situation is different in emerging markets. The rise of innovation leadership is especially marked in countries such as China, Korea and India. Tsinghua University in Beijing could well become the top-ranked science university in the world, having produced more of the top 1% most highly-cited papers in mathematics and computing, as well as a greater share of the 10% most highly-cited papers in STEM than any other university in the world¹³. China's rapid progress is also visible in its companies' successes. China's global achievements would not have been possible without a disciplined effort to acquire new technology and a significant investment in home-grown innovation. Today, leading Chinese firms such as Haier and Huawei produce consumer goods that demonstrate the technological progress underway, while the battle for future technological dominance intensifies.

Countries in other regions are also actively trying to step up their investments in creating industries of the future. Colombian President Ivan Duque's stated intention to turn his country into Latin America's "Silicon Valley."¹⁴ As noted by journalist Andres Oppenheimer, Duque wants to turn Colombia into a "Silicon Valley of creativity" and diversify the country's exports beyond traditional commodities such as oil and coffee to include exports from "creative industries," such as movie-making, advertising, gastronomy and web design. Duque wants to significantly increase the size of Colombia's "inspiration economy" over the next two years. He already has passed key measures, such as a seven-year tax amnesty for new "inspiration economy" startups that make a reasonable investment or employ a minimum number of people. In addition, Colombia earlier this year launched a \$150 million bond

for creative industries' startups. And Colombia is about to set in motion its first-ever Ministry of Science, Technology and Innovation this year, to speed up the knowledge economy project.

Theme 4: How to prepare for jobs of the future?

In my career as a business school academic for nearly 30 years, I have been a participant in many discussions about the future of jobs and whether we are preparing our students to succeed in their careers. I was also invited by President Obama to serve on a White House taskforce comprising peer Deans from many other top American schools to discuss strategies for supporting greater diversity, especially the inclusion of women in the workforce for the future. There are no easy solutions here. Social and workplace trends have often created a context in which many talented and educated minorities, especially women have chosen to either not participate in the workforce or do not feel fulfilled with their set of available opportunities. Technology trends have both supported (such as through the use of tele-working) and hampered (such as through the increased use of algorithmic monitoring) the development of an empowering and open workplace. In this section, we focus on specific aspects of how corporations and individuals can become more prepared for jobs of the future, as seen from the specific angle of technological changes. As for prior themes, we consider three important elements of the discussion.

Element 4.1: Education reform and policies for lifelong learning are essential

Education reform should be high on the agendas for governments and societies in both developed and developing economies. Schools and universities are stubbornly resistant to change, often due to resistance from multiple stakeholders including teachers. With a rapidly decreasing half-life of knowledge, education has to be retooled to become affordable, effective and flexible. This will help workers to smoothly transition from one job to another and make education a nimble, lifelong endeavor.

According to the US Bureau of Labor Statistics, the average worker stays at her job for 4.4 years with the expected tenure for the youngest workers to be half of this figure¹⁵. As technology creates more opportunities for job creation, this tendency to job-hop will increase. This in turn means that firms will have to become more adept at

12. <http://theconversation.com/the-surprising-decline-of-entrepreneurship-and-innovation-in-the-west-124552>

13. Sources: Simon Marginson, Oxford University, Centre for Science and Technology Studies, Leiden University.

14. <https://www.miamiherald.com/news/local/news-columns-blogs/andres-oppenheimer/article235580792.html#storylink=cpy>

15. <https://www.forbes.com/sites/jeannemeister/2012/08/14/the-future-of-work-job-hopping-is-the-new-normal-for-millennials/#5988010113b8>

providing new interesting opportunities for their employees to retain them. Greater use of technology and data analytics in jobs will also require employees to continuously invest in their reskilling. Younger employees, especially millennials are prioritizing new experiences and the learning of new skills as they change jobs.

As people live longer, they will also hold multiple jobs over their lifespan including some in parallel thanks to the flexibility provided by technology in many cases. It is not uncommon today to find workers in the gig economy who free-lance and take on multiple jobs simultaneously both for the extra income and also to leverage their skills/free time. Employees will have to take responsibility for their own learning and skills evolution across multiple, possibly very different jobs. Universities and colleges will have to gear up for flexible and on-demand education utilizing e-learning and other innovations.

Element 4.2: A people first strategy is critical

Shoshana Zuboff from Harvard Business School introduced the distinctions between the concepts of “automate” and “informate” in her book titled “In the Age of the Smart Machine” (1988). These concepts form even today a critical basis for understanding how technology impacts the nature of jobs and how roles have to be redesigned in a technology-intensive context. Zuboff identified how technology almost always automates some task or process and thus “takes away” (jobs, skills etc) from people while improving overall efficiency and productivity. Further Zuboff articulated how technology at the same time also captures information about the task or process it automates and “gives back” this information to people in a potentially easy and insightful manner. The term data analytics was not popular back in 1988 but essentially the term informate referred to the ability of people to have more data analytics about the process or task that was automated.

While the automate dimension represents the classical fears around job losses or the reduction in scope of jobs, the informate aspects allows firms to re-evaluate the nature of jobs and to allow people to interpret this information in new and novel ways, provided they have the appropriate skills and responsibilities. Thus if more information or data analysis is presented from an automated process or machine to a shop floor worker, she now needs to have new skills to interpret the data and to have the freedom to perform additional what-if analyses (as needed) to test hypotheses. Further she will need to have the authority to change parameters if she finds based on her judgement that some modifications are necessary. A similar dynamic

is also visible in more skilled jobs such as computer aided design. Earlier, a designer would use a software platform to design a specific product. Today, cognitive design systems are capable of generating several dozens of different design options (based on analysis of prior designs and other model parameters) and the designer may have to act more as an orchestrator who chooses amongst different machine generated designs or decides to create a new design by selectively combining parts of different machine generated designs.

There is concern today about the increasing use of algorithms in jobs which not only automate key parts of the jobs previously performed by humans but also at the same time making it easy to monitor the performance of people at minute levels of granularity. For example, the software platforms used by many ride sharing companies monitor the driving behavior of drivers to a minute level of detail such as their rates of acceleration, their braking patterns and of course speeds at each instant of the rides. It is important for all organizations to be cognizant of the positive and negative ways in which technology can be used to disempower or empower people. These issues become even more crucial as the technology becomes more intelligent with the introduction of AI systems. A people first strategy towards the design of jobs is essential as technology become more pervasive in all environments.

Element 4.3: Attention needs to be paid to job dislocations in emerging markets

Government and corporations need to cooperate on job retraining and enable individual workers, especially in emerging markets to learn new skills throughout their lifetimes. According to McKinsey¹⁶, hundreds of millions of people will likely need to find new jobs as automation advances, and even more will need to learn new skills, including how to work seamlessly with technology. In general, we have not succeeded in creating the conditions in which workers displaced by globalization and technology quickly find new high-quality employment. The result for many individuals has been a series of lower wage jobs with limited opportunities for advancement.

Significant declines can be expected in emerging markets as automation progresses. China¹⁷ saw an annual decrease of 8m jobs each year in manufacturing between 2015 and 2017, a trend that is expected to continue as Chinese manufacturing units invest more in advanced

16. <https://mck.co/2NVQPPI>

17. <https://www.piie.com/blogs/china-economic-watch/chinas-manufacturing-job-losses-are-not-what-they-seem>

robotics and automation. Similar declines can be seen in the large farming sector in India where according to some surveys¹⁸, more than 75% of all farmers want to quit farming and move to other jobs. Governments, the private sector and society at large have important roles to play in helping ease these job dislocations in emerging markets. Governments have to provide special financial support and social safety nets (such as housing and child support) to ease the burden on families as bread earners make their transitions across jobs. Corporations need to introduce special schemes to provide extended support to affected workers through financial, training and reskilling programs. Civil society can also play an important role in easing these job dislocations through the concerned action of NGOs and other civic bodies. Millions of workers in emerging markets are likely to be impacted by automation-induced job dislocations in the coming decades, and an effective partnership across government, private sector and civil society will be essential to help ease the transitions for these workers and their families.

Theme 5: How to move back to hope from concern?

From a technology perspective, the last twenty years have been an amazing journey. Two decades ago, the commercial Internet was in its infancy. Digital leaders such as Amazon were just being born, inspired by the potential of the Internet to revolutionize commerce. Government and public sector leaders considered the Internet as an important tool to aid development and reduce socio-economic disparities. Civic leaders looked at the emerging technology to usher in a more transparent and equal world. There was hope all around in terms of the many positive changes the Internet would bring to life and the world around us.

It would be not correct to say that we have been disappointed. We have seen far more technology progress than what we could have expected, especially in terms of raw computing power and connectivity. Access to technology has increased with mobile phones becoming cheaper and ever more powerful. Cloud services have brought sophisticated but affordable computing resources to the doorsteps of many small and medium sized businesses. Private sector digital leaders have ushered in an age of consumerization in which people have become accustomed to accessing information and making transactions, all with a simple click of a button. An explosion in apps have helped digitize increasing chunks of our daily lives, from reading

the news to buying groceries to managing travel. Many governments such as Korea and China have used technology as part of their national strategies to make themselves more competitive and aid national development. The list is long and there are many other ways in which the hopes of the early years of this century have been realized. We should be happy with this progress.

Yet, we could not have predicted all the different ways in which technology would change our world and impact our lives. In recent years, there is a growing sense of anxiety, and perhaps even pessimism that leaves people wondering if technology is helping create a better world or not. Let us briefly consider three important questions that being raised:

Element 5.1: How is technology impacting inequality?

In 2019, about two thirds of the global population own a mobile phone and a little more than 55% of the global population is connected to the Internet. While these penetration rates are significant, especially when compared to 5 or 10 years ago, the rate of growth in penetration has slowed and with prevalent technologies and at current rates of increases in penetration it may take us another 50 years or more to get the whole world to be connected to the Internet. As we usher in a digital economy, is this technology divide in effect accentuating inequality? The technology divide is not just across high income and low income countries, but across richer (typically cities) and poorer (usually rural) parts within the same country. Divides also exist across the quality of technology being accessed – such in the bandwidth of broadband connectivity. There are fears that the rich with more skills and greater access to resources may be able to leverage better technology for greater success in high value jobs than the poor who have access to some technology (but not the best), have limited skills and access to lower value jobs. This will in turn increase the wealth gap and make the world a more unequal place. While the recent trends in inequality are mixed – increasing in some (typically advanced industrial nations) and decreasing in others – the question of whether technology will increase inequality over time remains an important question in the minds of many.

Element 5.2: Is technology leading to better lives?

We have seen an undeniable increase in the ease with which we can search for a restaurant, make a hotel reservation, buy a book online and run a video call across multiple parties. All of these conveniences have helped to make our lives so much better (or at least those of us who

18. <https://www.downtoearth.org.in/news/indias-deepening-farm-crisis-76-farmers-want-to-give-up-farming-shows-study-43728>

have access to the Internet). At the same time, there is growing concern about whether technology is ultimately leading to better lives for us. There are questions being raised about the nature of jobs being created in the so called “gig economy”. Most employees in the gig economy work part-time, without contract, without health benefits and often at or close to minimum wage. It is estimated that around 40% of the US working population is in the gig economy. Many of these workers have a hard time saving for buying a home or paying for their children’s education. Thus it is not surprising to see gig-workers protesting with strikes. Workers in the gig-economy often have to work long hours or take multiple jobs to make ends meet. As mentioned earlier, the nature of jobs itself is also changing in the gig economy. With ubiquitous technology, employers are able to monitor minute details of their employee behaviors and reward or penalize them accordingly. Working for small rewards and bearing constant monitoring in jobs does not necessarily lead to better lives.

Element 5.3: Are we controlling or being controlled by technology?

Recent controversies have brought into focus how much data is being harvested by digital companies and how all this data can be so easily mined and used for the wrong purposes. Authors such as Shoshana Zuboff have critiqued the rise of a new kind of “surveillance capitalism” in which our personal data is being harvested, mined and in some cases sold by digital companies all without our explicit knowledge or permission. We are far from the utopian scenario of individuals controlling the privacy and use of their own data. We are in most cases helpless participants who are resigned to the loss of personal privacy in our digital lives. Further, the progress of Artificial Intelligence (AI) over the last decade has instilled a deeper existential fear in the minds of many. AI has reached or surpassed the levels of performance of human experts in some fields and it is approaching human level performance in many others. Will my job be secure in the future? This is a fear in the minds of many.

Conclusion

This paper has described the key themes with respect to the impact of technology on jobs today and in the years ahead. The issues are complex and there are no easy solutions. However, there is good reason for optimism on the front of jobs because as the pace of technology progress speeds up, the rate at which new opportunities are created will also become faster. It will be our challenge, both at

the macro and micro levels to be agile, be open to new possibilities and to leverage these new opportunities to create new jobs.

Leadership will be essential for these transitions. A good case in point is the setting up of the Cornell Tech campus in the heart of New York City (NYC). About a decade ago, when NYC was reeling from the financial crisis and the decline of its once flourishing media sector, Mayor Bloomberg realized that NYC needed to have a strong digital ecosystem of innovation to assure its future success. Mayor Bloomberg organized a global competition to invite a major technology university into the city. Stanford and Cornell were the two finalists and Cornell won the competition. For the last 7 years, Cornell has set up Cornell Tech on Roosevelt Island, a unique experiment to incubate a digital ecosystem in the heart of NYC. An important metric of success of Cornell Tech is its ability to create more technology jobs in the city and to attract and retain appropriate talent for these jobs. Mayor Bloomberg’s leadership was critical for bringing a new focus on technology and jobs in one of the most global and dynamic cities in the world.

The value of having a strong technologically trained workforce is obvious to many today. However, not all governments have made this aspect of human capital development a national priority. For nearly two decades I have co-authored two major global indices on technology (the Global Information Technology Report¹⁹ published by the World Economic Forum) and innovation (the Global Innovation Index²⁰ published by the World Intellectual Property Organization). I have observed through empirical data how the competitiveness of nations have evolved in different ways based upon their focus on developing and absorbing new digital technologies. The difference between innovative nations and others has often been a strong focus on investing in technology and stimulating new technology-intensive sectors.

Emerging markets are in a special position to benefit from technology. If leveraged properly, technology can provide a great path for leapfrogging and a source of creating jobs and improving competitiveness. Witness the rapid adoption of new mobile-based payment systems in many emerging markets in Asia and Africa, without having gone through the step of large scale credit card adoption. Another relevant example is the rapid spread of mobile technology in emerging markets without having gone through the usual cycle of fixed line phone penetration.

19. <https://www.weforum.org/reports/the-global-information-technology-report-2016>
20. <https://www.globalinnovationindex.org/Home>

Technology intensive jobs can also provide good sources of income to citizens in emerging markets. Many emerging markets such as India have large numbers of unemployed youth and many of them are finding useful employment in the gig economy.

Emerging markets should not fear technology. Yes, technology will bring some gut-wrenching changes in their economic structures and will re-distribute jobs. However, with the right leadership and an appropriate focus on investing in technology, whole new sectors of the economy can be stimulated and new jobs can be created as some jobs fade away. Witness the benefits to the Chinese economy brought about by the rapid adoption of the Internet and mobile telephony over the last decade. Something similar is underway now in India and many other emerging markets. Policies to support growth while being agile and flexible are essential for success in the years ahead.

As mentioned earlier, the technology pendulum has swung from hope to fear. At a time when we are witnessing exponential increases in the power of technology with all its positive opportunities, the fears of the negative impact of technology on jobs and our lives is top of mind for many. This has to change. We have to help swing the technology pendulum back to hope. The technology revolution is far from over. Many would argue that it is in its infancy today. The convergence of rapid technological progress in three important dimensions – digital, biological and physical – has started but is yet to unfold. We are looking at several decades where the impact of the technological revolution will play out. This is the reason why Stanford University²¹ has committed to studying the impact of new technologies such as Artificial Intelligence (AI) on our lives and the world around us for the next 100 years. All of this technological progress will bring risks and but also offer enormous positive benefits to all of us. We have to live the next decades with a strong sense of hope and optimism.

21. <https://ai100.stanford.edu/>

Selected References

- Acemoglu, D. and P. Restrepo, The race between machine and man: Implications of technology for growth, factor shares, and employment, NBER Working paper #22252, June 2017.
- Bakshi, H. et. al., The Future of Skills: Employment in 2030, Pearson and Nesta, September 2017.
- Baller, S. et. al., The Global Information Technology Report 2016: Innovating in the Digital Economy, World Economic Forum, 2016.
- Berger, T. et. al., Drivers of Disruption? Estimating the Uber effect, Working Paper, Oxford Martin School, University of Oxford, January 2017.
- Brynjolfsson, E. and A. McAfee, The second machine age: Work, progress and prosperity in a time of brilliant technologies, WW. Norton & Company, 2014.
- Davenport, T.H. and J. Kirby, Only humans need apply: Winners and losers in the age of smart machines, Harper Business Press, 2016.
- Dutta, S. et. al., The Global Innovation Index 2019: Creating healthy lives – the future of medical innovation, World Intellectual Property Organization, July 2019.
- Eberstadt, N., Men without work: America's invisible crisis, Templeton Press, 2016.
- Economist, The great jobs boom, May 25th 2019.
- Frey, C.B. and M.A. Osborne, The future of employment: How susceptible are jobs to computerization?, Research paper, Oxford Martin School, September 2013.
- Graetz, G. and G. Michaels, Is modern technology responsible for jobless recoveries?, Center for Economic Performance discussion paper, January 2017.
- Hoffman, R. et. al., The alliance: Managing talent in the networked age, Harvard Business Review Press, 2014.
- International Labor Organization, The future of work we want: A global dialogue, August 2017.
- Manyika, J. et. al., Jobs lost, jobs gained: Workforce transitions in a time of automation, McKinsey and Company, December 2017.
- Moretti, E., The new geography of jobs, Mariner Books, March 2013.
- Organization for Economic Co-operation and Development (OECD), Getting skills right: skills for jobs indicators, July 2017.
- Sundarajan, A., The sharing economy: The end of employment and the rise of crowd-based capitalism, MIT Press, 2016.
- Susskind, R. and D. Susskind, The future of the professions: How technology will transform the work of human experts, Oxford University Press, 2015.
- World Economic Forum, Accelerating workforce reskilling for the fourth industrial revolution: An agenda for leaders to shape the future of education, gender and work, July 2017.

The Emerging Markets Forum was created by the Centennial Group as a not-for-profit initiative to bring together high-level government and corporate leaders from around the world to engage in dialogue on the key economic, financial and social issues facing emerging market countries.

The Forum is focused on some 120 market economies in Asia, Eurasia, Latin America and Africa that share prospects of superior economic performance, already have or seek to create a conducive business environment and are of near-term interest to private investors, both domestic and international.

Further details on the Forum and its meetings may be seen on our website at

<http://www.emergingmarketsforum.org>

The Watergate Office Building, 2600 Virginia Avenue, NW, Suite 201

Washington, DC 20037, USA. Tel:(1) 202 393 6663 Fax: (1) 202 393 6556

 @EmrgMktsForum

Email: info@emergingmarketsforum.org

