

THE POTENTIAL ECONOMIC EFFECTS OF ARTIFICIAL INTELLIGENCE

Scientific discoveries and technology have always changed and accelerated the world's economy. Just as steam machines and electricity have changed production dramatically in the past, AI will significantly affect production in this century. Studies on the potential economic effects of AI predict that countries will adopt AI technologies, consequently increasing the global GDP substantially over the next 15 years. However, AI is also expected to create its own negative externalities, such as unemployment and human rights and personal privacy violations. Therefore, we must develop new public policy tools to eliminate the negative externalities of AI and reap its benefits to the fullest extent.

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New technologies, such as 3D printing, robotics, artificial intelligence, the Internet of Things, nanotechnology, and quantum computing, have started to change our economies and societies dramatically. Along with these technologies, a new era has begun. Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, calls this new era “The Fourth Industrial Revolution”.¹

Most scholars and engineers think that the importance of these technologies will not be any different than it is now in production, economies, and our lives in the future. But some think differently, and attribute greater importance to artificial intelligence (AI) than others. For example, Andrew Ng, a computer scientist and an adjunct professor at Stanford University, sets AI apart and says it “is the new electricity.”²

During the second industrial revolution, the electric motor was invented, and electric-powered machines started to be used in production. They were more powerful than steam-powered machines that led to mass production, and as a result, the first industrial revolution. Similar to electricity that powered machines in the second industrial revolution, AI will power other technologies and play a crucial role in production in the future. Ng explains that AI will transform every industry in the next several years just as electricity transformed almost everything 100 years ago.³ But what exactly is AI?

AI has several definitions; however, I believe the most comprehensible and clear definition is as follows: “AI is the ability of machines to use algorithms to learn from data, and use what has been learned to make decisions like a human would. Unlike humans, though, AI-powered machines don’t need to take breaks or rest and they can analyze massive volumes of information all at once.”⁴ AI technologies offer the ability to see (computer vision), hear (speech recognition), and understand (natural language processing).

The abilities of AI are used in various ways in production today. For example, in the space industry, AI improves the satellite manufacturing process, particularly when meticulous engineering is required to assemble multiple pieces. It is also used for

¹ Klaus Schwab, “The Fourth Industrial Revolution,” *World Economic Forum*, 14 January 2016, <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>

² E Kumar Sharma, “AI is the new electricity, says Coursera’s Andrew Ng,” *Business Today*, 5 March 2018, <https://www.businesstoday.in/opinion/interviews/ai-is-the-new-electricity-says-courseras-andrew-ng/story/271963.html>

³ Shana Lynch, “Andrew Ng: Why AI Is the New Electricity,” *Stanford GSG*, 2017, <https://www.gsb.stanford.edu/insights/andrew-ng-why-ai-new-electricity>

⁴ Lasse Rouhiainen, *Artificial Intelligence 101 Things You Must Know Today About Our Future* (South Carolina: CreateSpace, 2018), p.15.

⁵ Richard Elite and Logan Finucan, “Trends and Applications of AI in Space,” *Via Satellite*, October 2019, <http://interactive.satellitetoday.com/via/october-2019/trends-and-applications-of-ai-in-space/>

preventing collisions in orbit; Elon Musk’s SpaceX, for instance, has implemented AI operations to avoid satellite collisions. But the use of AI is not limited to the space industry; in fact, it is more common in other industries. AI is applied in healthcare, finance, travel, transportation, education, agriculture, retail, journalism, and in the entertainment industry.

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To illustrate, Watson, IBM’s AI, is used in several industries from manufacturing to agriculture, but most notably in healthcare. Many hospitals around the world use IBM’s Watson in cancer treatments today. Watson scans research papers and clinical trials in a very short time, which is difficult for doctors to do, and offers cancer treatment plans for patients. Another widespread use of AI can also be seen in the automotive industry. As is known, autonomous cars are equipped with cameras, sensors, and communication systems. Waymo, Google’s self-driving car project, benefits from AI to process data collected by these systems to be able to detect the behavior of pedestrians and cyclists for its autonomous cars, just as Tesla, GM, Mercedes, and Toyota do.

Although governments also have not remained indifferent to AI technologies, the use of AI in government lags behind the private sector. However, according to Hila Mehr, “While applications of AI in government work has not kept pace with the rapid expansion of AI in the private sector, the potential use cases in the public sector mirror common applications in the private sector.”⁶ According to my study, governments of developed countries mostly use AI technologies in public services in data analysis, translation, disaster response, and drafting documents. The use of this technology relieves backlogs, paperwork burden, and resource constraints, which reduce costs.

The Potential Macroeconomic Effects of AI

Given AI’s potential as a new energy source, we can assume that it will have a significant impact on the economy and production processes. To be able to see if that will occur, herein, I would like to mention some studies that try to predict these effects.

⁶Hila Mehr, “Artificial Intelligence for Citizen Services and Government,” *Harvard Kennedy School Ash Center for Democratic Governance and Innovation*, August 2017, https://ash.harvard.edu/files/ash/files/artificial_intelligence_for_citizen_services.pdf

According to research carried out by Accenture, AI has the potential to double economic growth rates in 12 developed countries by 2035,⁷ which together generate more than 50 percent of the global economic output. AI is also expected to boost labor productivity by up to 40 percent in these countries. Out of these countries, the US will see the highest economic benefits from AI and yield a 4.6 percent growth rate by 2035. Whereas Italy will see the lowest, as AI is expected to raise Italy's growth rate to 1.8 percent by 2035, which is the lowest increase among the countries analyzed.

Furthermore, in a research by PwC, AI is expected to increase the global GDP up to 14 percent in 2030,⁸ which is equal to 15.7 trillion dollars. The research estimates that all sectors will benefit from AI. The services industry, including health, education, and public services, will grow the most (21 percent), while retail and wholesale trade will see the largest boost (15 percent). Financial services will see smaller GDP gains (10 percent) by 2030—but these gains will appear in a shorter amount of time.

McKinsey & Company, on the other side, predicts that approximately 70 percent of companies may adopt at least one of the AI technologies, and less than 50 percent of the largest companies may use the full range of AI technologies by 2030.⁹ AI could potentially deliver an additional economic output of around 13 trillion dollars by 2030, boosting global GDP by about 1.2 percent a year. Moreover, according to the same predictions, the economic impact of AI may emerge gradually; its contribution to growth may be three or five times higher by 2030 than it is over the next five years.

All the studies mentioned above estimate that most companies will adopt AI technologies, and that AI will boost the global GDP significantly in the next 15 years. There are at least four ways for AI to drive growth:

- Increase productivity gains from business automating process, that is, it can create a virtual workforce, which is called intelligent automation¹⁰
- Enhance the skills and ability of existing workforces and physical capital¹¹

⁷ Mark Purdy and Paul Daugherty, "Why Artificial Intelligence is the Future of Growth," *Accenture*, May 2017, https://www.accenture.com/t20170524t055435_w_/ca-en/_acnmedia/pdf-52/accenture-why-ai-is-the-future-of-growth.pdf

⁸ PwC, "The Macroeconomic Impact of Artificial Intelligence," February 2018a, <https://www.pwc.co.uk/economic-services/assets/macro-economic-impact-of-ai-technical-report-feb-18.pdf>

⁹ McKinsey Global Institute, "Notes from the AI Frontier: Modelling the Impact of AI on the World Economy," September 2018, <https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Artificial%20Intelligence/Notes%20from%20the%20frontier%20Modeling%20the%20impact%20of%20AI%20on%20the%20world%20economy/MGI-Notes-from-the-AI-frontier-Modeling-the-impact-of-AI-on-the-world-economy-September-2018.ashx>

¹⁰ PwC (2018a); Accenture (2017).

¹¹ Accenture (2017).

- Drive innovations¹²
- May increase consumer demand resulting from the availability of personalized and/or higher quality AI-enhanced products and services¹³

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Negative Externalities of AI and Public Policies to Fix Them

Studies tell us that humanity will benefit from AI technologies in the future, and that AI is expected to boost production and increase GDP, leading to more prosperous societies. However, what about AI’s negative externalities?

The development in AI technologies sometimes scare people; news in media outlets and Hollywood movies trigger this fear. We see AI-powered robots surpassing humanity and taking over the world in science-fiction movies. But according to some philosophers, scientists, and AI engineers, this fear is not futile at all, as the movies might come true one day. Remember the renowned Oxford philosopher Nick Bostrom’s “Paper Clip Factory” scenario. Bostrom’s scenario describes an advanced artificial intelligence tasked with manufacturing paperclips.¹⁴ If AI-powered robots are not programmed with human ethics and values, AI, whose top goal is to manufacture paperclips, may decide that the best way to produce paperclips is to wipe out humans and terraform the Earth into a big paperclip factory. In his latest book, *The Precipice*, Australian philosopher Toby Ord puts forward an even more frightening scenario. Ord opines that AI does not need a robotic body to take over the world; AI could manipulate, influence, or coerce the masses by merely producing words, pictures, and sounds on the Internet.¹⁵

The Impact of AI on Employment

Among these anxieties, some scientists, engineers, and businessmen, including Stephen Hawking and Elon Musk, warned humanity about the dangers of AI, and signed an open letter¹⁶ to prioritize a robust and beneficial AI. But we should accept that we are decades, or even centuries, away from the scenarios about which

¹² Accenture (2017).

¹³ PwC (2018a).

¹⁴ Nick Bostrom, “Ethical Issues in Advanced Artificial Intelligence,” 2003, <https://nickbostrom.com/ethics/ai.html>

¹⁵ Toby Ord, *The Precipice: Existential Risk and the Future of Humanity* (New York: Hachette Books, 2020), p.147.

¹⁶ Future of Life Institute, “An Open Letter: Research Priorities for Robust and Beneficial Artificial Intelligence,” <https://futureoflife.org/ai-open-letter/>

philosophers warn. Instead, in the short run, we most probably will encounter a different negative externality of AI: unemployment.

It is considered that technology threatens human jobs; incorporating more technology into production processes will inevitably lead to less human labor. According to a study by PwC, 30 percent of total UK jobs could be at a high risk of automation by the 2030s.¹⁷ This rate is lower than the US (38 percent) and Germany (35 percent), but higher than Japan (21 percent). Transportation and storage (56 percent), manufacturing (46 percent), and wholesale and retail (44 percent) are likely to be the high-risk sectors for laborers. In the long run, the risk seems rather high. A research carried out by Oxford University predicts that there is a 50 percent chance that machines will be capable of taking over all human jobs in 120 years.¹⁸

Unemployment caused by AI will not only cause individuals to change their jobs and sectors, but also geographies. Unemployment will increase inequalities. AI will maybe even erode the incomes of low-skilled workers. There are some public policies, such as universal basic income, to eliminate this negative externality. Governments could apply this policy to support the unemployed. Another policy could be training programs. Low-skilled workers and those who will lose their jobs to AI could be trained to gain new skills and to improve their already-existing ones. Such programs could allow workers to remain at work in the AI-dominated industries. In order to save jobs against robots, tax measures are proposed as another policy tool. Bill Gates, for example, supports this method, and says, “the human worker who does, say, 50,000 dollars’ worth of work in a factory, that income is taxed and you get income tax, social security tax, all those things. If a robot comes in to do the same thing, you’d think that we’d tax the robot at a similar level.”¹⁹ Such a tax, known as “robot tax”, could help workers keep their jobs by discouraging companies from hiring more robots. For now, taxing robots seems technically complex and is not a widely supported idea. However, with its potential to ease unemployment problems caused by AI technologies, it will certainly be an idea that will be discussed in the future.

How Will AI Affect the Turkish Economy?

McKinsey estimates that 60 percent of the total productivity increase by 2030 will result from the global adaptation of digital technologies; this estimation holds true for Turkey as well. Automation, AI, and digital technologies are expected to have

¹⁷ PwC, “Will robots steal our jobs? The potential impact of automation on the UK and other major economies,” 2017, <https://www.pwc.co.uk/economic-services/ukeo/pwcukeo-section-4-automation-march-2017-v2.pdf>

¹⁸ Richard Gray, “How Long Will it Take for Your Job to be Automated?” *BBC*, <https://www.bbc.com/worklife/article/20170619-how-long-will-it-take-for-your-job-to-be-automated>

¹⁹ Kevin J. Delaney, “The Robot that Takes Your Job Should Pay Taxes, says Bill Gates,” *Quartz*, 17 February 2017, <https://qz.com/911968/bill-gates-the-robot-that-takes-your-job-should-pay-taxes/>

the potential to boost the Turkish economy. Societal changes driven by technology will accelerate, and as a result, changing needs will lead to an increase in consumption.²⁰ But note that research carried out by McKinsey is not just based on the effects of AI, but also on the effects of automation and digital technologies as a whole.

“Automation, AI, and digital technologies are expected to have the potential to boost the Turkish economy.”

McKinsey also predicts that 7.6 million jobs could be lost with AI, automation, and digitization by 2030. But, at the same time, 8.9 million new jobs could be created. In Turkey’s case, a net gain of 1.3 million jobs is expected. In addition, 1.8 million jobs—that currently do not exist—could be created, especially in technology-related sectors, such as digital service designers, sustainable energy experts, and cybersecurity specialists. With the impact of AI, automation, and digital technologies, the Turkish economy is eventually expected to have a net job increase of 3.1 million by 2030.²¹

According to PwC, 45 percent of jobs in manufacturing have potential high rates of automation in Turkey.²² Manufacturing is followed by construction (40 percent), human health and social work (36 percent), wholesale and retail trade (26 percent), and education (8 percent). These figures show us that workers who work in the manufacturing and construction sectors will be exposed to the effects of automation and AI technologies more than others.

In the context of demographic characteristics of workers, 19 percent of jobs held by women have potential high rates of automation in Turkey; this ratio is 36 percent for jobs held by men. Furthermore, jobs held by youth are even more likely to become automated. As 41 percent of jobs occupied by young workers have potential high rates of automation, it stands at 35 percent for jobs held by older workers. Those who have a low level of education could be impacted even more. While 38 percent of jobs occupied by workers with minimal education have potential high rates of automation, this ratio is only 7 percent for jobs occupied by highly educated workers.²³

²⁰ McKinsey & Company, “Future of Work-Turkey’s Talent Transformation in the Digital Era,” January 2020, <https://www.mckinsey.com/~media/mckinsey/featured%20insights/future%20of%20organizations/the%20future%20of%20work%20in%20turkey/future-of-work-turkey-report.ashx>

²¹ McKinsey & Company (2020).

²² PwC, “Will Robots Really Steal our Jobs? An International Analysis of the Potential Long Term Impact of Automation,” 2018b, https://www.pwc.com/hu/hu/kiadvanyok/assets/pdf/impact_of_automation_on_jobs.pdf

²³ PwC (2018b).

The above-mentioned studies show the impact of automation, AI, and digital technologies on the Turkish economy. It is very difficult to distinguish only the effect of AI. Even so, it should be accepted that AI technologies will be adopted by Turkish companies, and that we will likely see the effects of AI on productivity and employment. But according to PwC, Turkey may have relatively high exposure to later waves of automation.²⁴ This may allow Turkey to displace manual workers such as drivers and construction workers much later compared to other countries.

Conclusions

Kai-Fu Lee, a computer scientist and businessman, in his best-selling book, *AI Superpowers: China, Silicon Valley, and the New World Order*, says, “Human civilization has in the past absorbed similar technology-driven shocks to the economy, turning hundreds of millions of farmers into factory workers over the nineteenth and twentieth centuries. But none of these changes ever arrived as quickly as AI.”²⁵ Studies that try to predict the impacts of AI on economies partially prove his statement. We will most likely be exposed to AI technologies much more in the upcoming decades as AI changes production methods, consumer behaviors, and the employment-to-population ratio.

The race in autonomous weapons will also change, and, in fact, threaten the norms of war. Furthermore, AI could produce mass unemployment in some countries. There are several concerns about the use of AI, such as its ethics and use in repressive surveillance, which violates human rights, values, and personal privacy. However, humans must know how to differentiate risks and benefits, eliminate risks, and adopt the beneficial sides of AI. We, humans, have the capacity to create new public policy tools to add onto the existing ones.

Science and technology are constantly progressing, and naturally, countries are struggling to adapt to these new technologies. Needless to say, while developed countries are ahead in this race, developing ones are lagging behind. Although this race is a massive challenge for developing countries like Turkey, on the other hand, it is also an opportunity. These countries could follow the examples of developed countries, and create new public policy tools to eliminate the negative impacts of AI in advance.

²⁴ PwC (2018b).

²⁵ Kai-Fu Lee, *AI Superpowers: China, Silicon Valley, and the New World Order* (Boston: Houghton Mifflin Harcourt, 2018) p.29.