

THE IMPACT OF AI ON WORK

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Abstract: Artificial intelligence (AI) technologies are developing fast, with many potential benefits for economies, societies and currently influence our lives more than ever before. AI technologies offer the promise of productivity and creating new products and services. The potential of AI to drive change in many employment sectors has revived concerns over automation and the future of work. However, there is consensus that AI will have a disruptive effect on work, with some jobs being lost, others being created, and others changing. According to several economist technological progress will widen the income gap even further and may lead to falling incomes and rising unemployment in large segments of the population. Many economists assume that this increasing automation could lead to a massive increase in unemployment within even the next 10-20 years. So this article aims to review the literature on AI and work, and make conclusion and try to clarify more significant directions in research on AI and work which could be analyzed and discussed further.

Key words: Artificial intelligence (AI), work

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Introduction

The artificial intelligence (AI) technology is developing rapidly with the many benefits to the economy, society and individuals. It is an important issue today to implement these benefits as broad as possible, as quickly as possible, to safely use and transfer technology as much as smooth. In any sector, AI technology has proven to increase productivity and create new products and services. Today, AI is already in the retail, manufacturing and entertainment sectors, and there are many opportunities for pharmaceutical industry, education, and transportation.

With these opportunities, there are challenges and questions about AI affects jobs and people's work-time, and have updated with public and policy debates on automation and future work. British social attitudes in 2017, research on robots explains that AI will have a significant impact on the labor market in the coming years. 75% of all respondents said that most of the current work of the people is replaced by machinery and computer applications within 10 years, while 10% are worried very and quite that their work will be automated (Phillips et al., 2018).

While part of the public discussion on AI is concerned about "end of work", part of it is likely to change slightly in terms of employment, but the evidence obtained from the research paper is neither of these extreme polarization. Instead, it is generally recognized that artificial intelligence has a work barrier or a destructive effect, some of which have been removed, some have been created and some have changed. In that sense, two priority areas of policy-oriented: ensuring that technology-based change leads to improved productivity; and ensuring that the benefits of such changes distributed throughout society (British Academy 2017) has emerged.

Literature review

Research evidences on impact of AI on the work

There are many recent studies in this area has been conducted by many researches, we specify three of the most widely-mentioned and well-known studies: 1) The evidence of the Royal Society and the British Academy is a study of several sectors from economists, historians, sociologists, data researchers, lawyers, management experts and other specialists. It aims to discuss the key subjects of the researches and debates on the impact of AI on work and inform policymakers about how to mitigate the changes between different groups and strategies to decline negative impacts.

For the findings of this study have been collected over 160 English papers published since 2000. These include journals and research articles, as well as

publications, reports by international organizations, journalists and consultants. This is a theoretical basis to examine 47 documents from the 160 and to examine the historical and recent impacts of technological workplaces and future effects of AI; and evidence of perception of future impact (British Academy 2017).

2) The University of Oxford study to answer how a work can be computerized? this question, was assessed the probability of computerization of 702 occupations by the latest advanced technology of Machine Learning (ML) and Mobile Robotics (MR)-based methodology as well as the expected effects of future computerization in the labor market of USA (Frey, 2013). 3) AI 100-year research report of The Stanford University has been studying AI for a long time, and the Standing Committee conducts research on AI every five years, where AI studied for community and social impact, science and engineering (Stone, P. et al., 2016). Prior to considering above-mentioned and other research findings of the impact of artificial intelligence on quantity and quality of works in business sectors, we aimed to identify technologies, which related to AI.

Artificial intelligence (AI) is an umbrella term that describes a suite of technologies that seek to perform tasks usually associated with human intelligence (British Academy 2017). John McCarthy, who coined the term in 1955, defined it as “the science and engineering of making intelligent machines.”⁶

Digital technology refers to all forms of hardware and software using binary code to perform tasks, from conventional spreadsheets or calculators on personal computers to networked systems and advanced algorithms that enable computer systems to make decisions based on data analysis. (British Academy 2017)

Automation in its broadest sense is the replacement of human beings with machines, robotics or computer systems to carry out an activity. The term can apply to the earliest mechanical devices, the changes seen in the Industrial Revolution and assembly line manufacturing, as well as computing and robotics. In policy debates about artificial intelligence, automation is often used to refer to the migration of human tasks to computers and robots, whether or not AI technologies are necessary to enable this. (British Academy 2017)

Machine learning is a branch of AI that enables computer systems to perform specific tasks intelligently⁷. These systems carry out complex processes by learning from data, rather than following pre-programmed rules⁸.

Recent years have seen significant advances in the capabilities of machine

⁶ McCarthy, J. (n.d.) What is artificial intelligence? Stanford University. Retrieved from: <http://jmc.stanford.edu/artificial-intelligence/what-is-ai/index.html>

⁷ British Academy, The Royal Society (2017). The Impact of Artificial Intelligence On Work, An evidence synthesis on implications for individuals, communities, and societies

⁸ Stanford, <https://www.coursera.org/learn/machine-learning>

learning, as a result of the increased availability of data; advanced algorithms; and increased computing power. Many people now interact with machine learning-driven systems on a daily basis: in image recognition systems, such as those used to tag photos on social media; in voice recognition systems, such as those used by virtual personal assistants; and in recommender systems, such as those used by online retailers.⁹ Today, machine learning enables computer systems to learn to carry out specific functions ‘intelligently’. However, these specific competencies do not match the broad suite of capabilities demonstrated by people. Human-level intelligence - or ‘general AI’ - receives significant media attention, but this is still some time from being delivered, and it is not clear when this will be possible. (British Academy 2017)

Impact of AI on economy and work

AI technologies are already supporting new products and services across a range of businesses and sectors¹⁰:

- Intelligent personal assistants using voice recognition, such as Siri, Alexa, and Cortana, are commonplace in many businesses.
- In the transport sector, AI processes underpin the development of autonomous vehicles and are helping manage traffic-flows and design of transport systems. (Stone, P. et al. 2016)
- In education, AI technologies are supporting personalized learning systems.
- In healthcare, AI is enabling new diagnostic and decision-support tools for medical professionals.
- In retail and logistics, AI is supporting the design of warehouse facilities to improve efficiency.
- In development and humanitarian assistance, data analytics enabled by AI are helping support the delivery of the Sustainable Development Goals and the assessment of humanitarian scenarios. (Vacarelu, F. 2018)
- In the creative industries, developers are creating computer systems that can produce simple news reports, for example on business results (Lacity, M.C. et al. 2016), compose orchestral music (Moss, R. 2015), and generate short pieces of film (Hutson, M. 2018).
- Across sectors, AI is being put to use to analyse vast quantities of data, to improve business processes or design new services.

AI development and usage vary. In Stanford’s study, noted that it is “limited place, unpredictable” (AI Index Team 2017). This definition is supported by

⁹ The Royal Society, Machine learning report.

¹⁰ British Academy, The Royal Society (2017). The Impact of Artificial Intelligence On Work, An evidence synthesis on implications for individuals, communities, and societies

numerous surveys and business leaders' attitudes. For example, according to the 2017 survey, 14% of UK businesses have invested in AI/ robots or have plans in the near future. This indicator is little more than 9-12%, which is of the top 10 most successful firms introduced AI and have a consensus internationally (Goos, M. & Manning, A. 2004). This study summarizes the policy measures from the research works that contribute to the realization of the economic benefits of AI. The Royal Society's 2017 Machine learning study explores the potential of these technologies and challenges to implement over the next five to 10 years. In this study, identified the key directions for action to realize the economic and societal benefits of machine learning in UK, in which Mongolia should consider:

- Create information environment based on open data and standards;
- Support the use of vehicles for businesses through government consultancy networks;
- Facilitate skills at all levels, including key concepts in schools, and trainees who are trained in postgraduate and postgraduate levels;
- Reform the governance system to support data use; advanced research on technical and social interest.

Changes made by AI could affect the quantity and quality of work

Throughout history, the wave of technological innovations has led to public and policy debates on work and automation. For example, in the 20th century, automation has emerged as a new assumption that people will be unemployed. In 1930, John Maynard Keynes, a renowned British economist, said coming available the opportunity to "solve" economic problems (John Maynard Keynes, 1963). In 1950, President of the United States John F. Kennedy said "hard" problems to automate automation of thousands of jobs. (John F. Kennedy, 1960) In 1995, the American economist, Jeremy Rifkin, argued that the was a signal of "End of the Work". (Rifkin, 1995)

He said information technology eliminates millions of jobs. Automation will have a strong impact on retail and wholesale workers, while small companies' intellectual work managers and staff will benefit more from high technology and the workplace will be a concern for the middle class. He predicted that with the downturn in the market economy and public sector the voluntary and community based public organizations in third-sector would be create new jobs with the help of the government.

Such debates are related to the fear of losing jobs depending on AI and experts have different perspectives on generating wider economic benefits.

The surveys showed that took a time to emerge to generate economic benefits and wage growth, and major displacements of people took place in the process of

change. Some surveys are short-term migration and work deficits, and long-term productivity, assets and employment are all expected to grow (British Academy 2017). If most of the machines faster, more reliable, and cheaper than the workers, then it will the labor market disappear. According to some economists, technological advances will further widen the revenue gap, leading to a decline in income and unemployment in large parts of the population (Mannino, 2015).

In summary, AI brings many changes to the employment sector, with concerns about automation and future work. Although AI does not come to the “end of the work”, it is not a “typical business”, and it is planned to undergo deep changes in the workplace.

The number of jobs affected by AI

The 2013 survey, which is widely cited and subject to debate, analyzed 702 US occupations by probability of computerization—otherwise described as ‘machine learning and mobile robotics’ – and found that 47% of total US employment fell into the ‘high risk’ category. (Frey, 2013) Researchers noted this study was used “occupation-based” approach. Subsequent studies have shown that their occupation consists of many separate tasks, so each task can be automated or not. Researchers using “task-based” approach have tended to identify fewer jobs at risk. For example, 2016 OECD report, which assessed tasks within occupations, found that only 9% of all jobs in the US (10% in the UK) were “automatable” through “automation and digitalisation”.¹¹ Other task-based surveys consider that the projected job at risk forecasts are more accurately calculated using a more detailed database of job-related tasks. For example,

A 2018 report used a dataset compiled by the OECD that looks in detail at the tasks involved in the jobs of over 200,000 workers across 29 countries.²⁸ It projected 30% of UK jobs as being at high risk of automation, albeit adding that the actual impact may be less due to economic, legal, and other constraints and that offsetting job gains are expected. The report took a long-term view of ‘automation’, from computational tasks to driverless cars (PwC, 2018). A further OECD study, covering 32 countries, calculated that close to 1 in 2 jobs is likely to be ‘significantly affected’ by ‘automation’, but with varying degrees of risk. (Nedelkoska, et al., 2018) For example, It found that 12% of UK jobs had a 70%—plus risk and another 25% had a 50–70%, risk. A 2017 report examining the global labour market not only used multiple databases of occupations and tasks covering 46 countries

¹¹ Artzn, M., Gregory, T. & Ziehran, U. (2016) The Risk of Automation for Jobs in OECD Countries (OECD Social, Employment and Migration Working Papers No. 189). Paris: OECD. Retrieved from: [https://www.keepeek.com// Digital-Asset-Management/oecd/social-issues-migration-health/the-risk-of-automation-for-jobs-in-oecd-countries_5j1z9h56dvq7-en#page1](https://www.keepeek.com//Digital-Asset-Management/oecd/social-issues-migration-health/the-risk-of-automation-for-jobs-in-oecd-countries_5j1z9h56dvq7-en#page1)

but also modelled AI-related factors alongside other non-AI related labour market drivers such as rising incomes, healthcare demand, and infrastructure (McKinsey Global Institute (2017)). It concluded that around about half of all work activities globally (43% in the UK according to a related study) have the technical potential to be ‘automated’ by 2030 – through “robotics (machines that perform physical activities) and artificial intelligence (software algorithms that perform calculations and cognitive activities)”

In interpreting the results of such studies, we can note the following summary. Studies vary in their definition of the process by which humans are fully or partly replaced in the workplace – whether AI technologies, some form of computing, and robotics, or a broader view of ‘automation’. This literature varies in timescale. Some studies focus on the automatability of jobs or tasks without close attention to timing. Longer timescales tend to result in high numbers of jobs being affected or created.

In summary, many projections of jobs lost, gained, or changed by AI have been published over the last 5 years. More recently, a consensus has begun to emerge that AI could result in significant job losses. Many new jobs will also be created. The rapid increase in the use of administrative data and more detailed information on tasks has helped improve the reliability of empirical analysis. There is a growing consensus of the main types of jobs that will suffer and where the growth in new jobs will appear. However, there remain large uncertainties about the likely new technologies and their precise relationship to tasks. Consequently, it is difficult to make precise predictions as to precisely which jobs will see a fall in demand and the scale of new job creation.

Jobs and tasks may be affected by AI in different ways

Automation affects different elements of work in different ways – with some tasks being more susceptible to automation than others (McKinsey Global Institute, 2017). At present, a prevailing view is that the most ‘automatable’ activities include tasks in highly structured, predictable environments. Studies suggest that such tasks might include transportation, preparing fast food, collecting and processing data, paralegal work, accounting, and back-office work.^{12, 13} There is strong consensus that lower paid and lower skilled jobs are more at risk than in previous waves of technological change. However, personal care work and manual work in unpredictable environments appear to be exceptions to this trend (Frey, 2013). Automation is expected to have a lesser effect on jobs with a high proportion of tasks that involve managing people, applying expertise, and social interactions.

¹² PwC, Will robots really steal our jobs?

¹³ McKinsey Global Institute, A Future that Works

The manual and practical jobs in unpredictable environments, such as gardeners, plumbers, or providers of health and care services for children and older people are also expected to experience lower levels of automation by 2030, due to both the level of technical difficulty involved and the economic incentives at play (these roles often command relatively lower wages, diminishing the incentive to automate). Among the differences in occupation, some researchers show a correlation between the lower level of education and the automation. According to the survey, those who are below the general education level in the UK have 46% automation while the bachelor's degree is up to 12%¹⁴.

Recent studies have warned the risks of “professional” jobs. For example, a person's legal advice may be to a person's understanding and expressing his / her opinion, but it may be more costly to consult with consumers as well as legal advice (Frey, 2013). The 2013 analysis concludes that only 47% of all jobs in the US will be automated in 10-20 years (Frey, 2013). The most difficult task in automation is the high level of social intelligence (eg, PR counseling), creative management (for example, fashion design) and/or managing sensitive and flexible objects (for example, surgery). In these areas, AI studies are still below the level of expertise.

The way in which professional work is automated and where the computer system offers feedback is accurate, compatible and user-friendly (especially when it is important to make important changes to life) depends on the person's interaction. A number of studies have shown that it is possible to improve work efficiency by combining human and machine competence. For example, a research team from Harvard Medical School and Beth Israel Deaconess Medical Center have demonstrated that while an automated diagnostic method achieved a 92% success rate in identifying the presence or absence of metastatic cancer in a patient's lymph nodes, and a human pathologist scored 96%, the combination of human and machine yielded a 99.5% success rate. (Prescott, 2016).

Summary, researches have a wide range of prospects for “automation”, but current AI technologies are best suited to ‘routine’ tasks, while humans are more likely to remain dominant in unpredictable environments, or in spheres that require significant social intelligence.

Commercial, social, and legal factors may influence AI adoption

Many studies have shown that “risky jobs” may not be equal to actual or expected net employment deficits, which may be few for a number of reasons. First, implementation depends on business, society, law and other factors. For example,

¹⁴ PwC, Will robots really steal our jobs?

businesses may not invest in introducing AI technology, and users may not switch to products and services used by AI, but may require time for legislative developers to establish a legal framework for AI technology by lawmakers. Second, technological change creates additional jobs. For example, the cost of production decreases, demand for goods and employment increases¹⁵. Third, companies can handle new technologies by transferring migrants to new jobs. Examples of this include a decrease in typists being offset by an increase in call center staff, banks moving tellers into customer relationship roles.¹⁶ Fourth, existing factories become more competitive, and grow new types of work emerge and new jobs are created. One report noted that in 2013 almost 6% of UK jobs were not in the 1990s (PwC (2015)). Categories of possible new jobs could include ‘trainers’ (workers engaged in training AI systems), ‘explainers’ (workers interpreting AI outputs for accountability), and ‘sustainers’ (workers monitoring the work of AI systems (Accenture PLC, 2018a)). Meanwhile, advances in industrial robotics could generate employment in robotics support services to manufacturing firms, as well as in the manufacturing of robots (Eurofound, 2017).

Research has shown that any technological advances-in generally the substitution of human workers are expected to result in productivity growth, new job creation and capital accumulation. The number of jobs generated by the workforce demand, the migration of workers to other job tasks, and the new jobs associated with new technologies also affects the impact of the AI technology on the automation economy.

AI technologies may affect working conditions

While changing the total amount of work, technology also affects the nature and working conditions of both employed and new actors. Automation of permanent tasks in large-scale work places increases their independence and learning opportunities (Eurofound (2017)). However, equipment often equipped with touch-sensitive equipment leads to greater control over staff and reduces self-reliance.

There are also questions about AI technology equality. For example, AI can be used to automate hiring and promotion activities, accelerating detection of candidates, and improving people’s suitability (O’Donnell, R. 2018). Examples of unusual cases of computer algorithm sending men-managers (Gibbs, S. 2015). On the other hand, there is no possibility of such recruitment decisions. In most cases people make decisions better than observing simple statistical models (Kahneman, D., 2018).

¹⁵ McKinsey Global Institute, Jobs Lost, Jobs Gained.

¹⁶ Same as previous

Recent studies have suggested that people are shifting to “Gig economy.” “Gig economy” is a transitional market system that is commonplace, and organizations are temporary contracts with independent workers. The term “gig” means “work in a certain time” and is often used in connection with musicians. Examples of such employees include free workers, independent contractors, project-based employees, temporary or part-time employees.¹⁷ According to the Intuit survey on the trend of Gig economy, by 2020, 40 percent of US workers will be independent contractors.¹⁸ There are several factors that increase the number of job vacancies in the short term. In this digital era, the workforce becomes more and more movable, with the ability to work anywhere, thus eliminating jobs and locations. This means that free workers will be able to choose between the world’s largest jobs and projects, whereas employers can choose the best individual in a larger field of specific projects. The benefits of migrants include the flexibility and control of migrants, while adverse impacts include workplace safety and legal uncertainty, such as employment status of employees (Davies, R., 2017). But such jobs require extra skills - “own-bench” skills (Ticona, J., et al 2018) for a better salary and well-being.

Summary, historical research has investigated the way in which the technology has impacted on the nature of work over time. The related survey indicated that changes in home-based and factory-based work were influencing gender roles. For example, manually spinning before moving on to yarn production may cause women to contribute to family income or to survive independently. The loss of employment was largely dependent on wages and salaries for men and the family contributed to the management of men and women, as well as the idea that wives and mothers should devote themselves to housework and childcare. In conclusion, AI and automation are influenced by working conditions and changed work styles to ‘Gig’ contributing to economic growth.

International Comparison.

Which countries could be most affected by AI and automation? Global estimates¹⁹ that More than two-thirds of the workers involved in the operation of over 700 million technical activities can be affected, in four countries: China, India, Japan and the United States. Then there will be 60 million workers in five of the largest powers in the European Union, France, Germany, Italy, Spain and the UK.²⁰ The

¹⁷ <https://whatis.techtarget.com/definition/gig-economy>

¹⁸ http://http-download.intuit.com/http.intuit/CMO/intuit/futureofsmallbusiness/intuit_2020_report.pdf

¹⁹ Resources: McKinsey Global Institute, A Future that Works; PwC, Will robots really steal our jobs?; PwC, UK Economic Outlook March 2017; Nedelkoska, L. & Quintini, G. (2018), Automation, skills use and training (OECD Social, Employment and Migration Working Papers, No. 202). Paris, France: OECD. <http://dx.doi.org/10.1787/2e2f4eea-en>

²⁰ McKinsey Global Institute, A Future that Works.

OECD study shows that automatability, in one paper ranging from 33% of all jobs in Slovakia to 6% of those in Norway which are significantly different. Another study has estimated that the automation level of Slovakia, Slovenia, and Lithuania is 40%, Finland, Greece, Russia and 20%, and Britain's 30%. The high risk of automation is not only a large proportion of production in these countries, but also from differences in the job content within nominally similar industries and occupations.²¹

Four groups of economics come from international comparisons. 1) Long-term automation is relatively high in countries such as Germany, Slovakia and Italy where the economy is strong. 2) The dominating economy, such as the United States, Britain, France, and the Netherlands, is less automated, and the service sector is less likely to be automated than the industry sectors. 3) There are relatively few automated workforce in Asia, such as Japan, South Korea, Singapore and Russia. 4) relatively low automation jobs are concentrated in sectors with low automation in the Nordic countries of Finland, Sweden and Norway.²²

Conclusion

One of the biggest challenges emerging from AI could be to widen inequality, and in the short run, benefits will not spread even if low-impact employees are unequal. Despite the many thoughts and doubts about the future of AI, it is clear that major changes have begun.

Studies of the history of technological change demonstrate that, in the longer term, technologies contribute to increases in population-level productivity, employment, and economic wealth. Such studies also show that these population-level benefits take time to emerge, and there can be significant periods in the interim where parts of the population experience significant disbenefits. Evidence from historical and contemporary studies indicates that technology-enabled changes to work tend to impact on lower-paid and lower-qualified workers more than others. This suggests there are likely to be significant transitional effects which cause disruption for some people or places. One of the greatest challenges raised by AI is therefore a potential widening of inequality, at least in the short term, if lower-income workers are disproportionately affected and benefits are not widely distributed

According to the investigated researches works in this study, we identified several directions for future research on AI and work. These are how future employees/"e-citizens" be prepared or required to have the necessary education and skills; issues of change of working life, "Gig"'s economic benefits, and how to eliminate the

²¹ Nedelkoska & Quintini, Automation, skills use and training.

²² PwC, Will robots really steal our jobs?; PwC, UK Economic Outlook March 2017.

biases of algorithmic systems at work; new training and development approaches to involve resettable staff with re-training and training.

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