The impact of artificial intelligence on employment before and during pandemic: A comparative analysis

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Abstract. Current trends in scientific research and the development of information technologies cover more and more areas of business. In these conditions, the findings of scientific-technical revolution and the innovations most important factors for the country's economic development and crucial to become a competitive state. The gradual establishment and the scope of use of artificial intelligence on the world innovative technology market increases daily. The purpose of this work is to investigate its impact on business based on the experience of the world and particularly, in Georgia. Accordingly, the study discusses the stages and main trends of artificial intelligence development. Depending on the scale of implementation, Georgia's current trends in job cuts / disappearances along with automation are analysed and future prospects are assessed. The paper discusses the use and increased importance of artificial intelligence 4.0 industry in the context of pandemic restrictions in various sectors of the economy and assessed the role in the post-pandemic period. The paper uses both qualitative and quantitative research methods. Content analysis of the scientific literature, statistical indicators and practical examples of different countries and international organizations is provided. Studies of leading analytical institutions are also included to analyse the current situation and prospects for development.

1. Introduction

Artificial intelligence as a scientific field explores the issues of intellectual programming. Given the wide scope of use in practice, the issue is very relevant. According to data from leading international research organizations, using artificial intelligence than human agents, companies can deliver better customer service (27%) [8]. So, global consumers (73%) are open to the use it and provide to become life easier [9]. As a result, some experts (48%) think that both white- and blue-collar employees will be replaced by robots and digital agents [14]. 54% of jobs are at risk of computerization in the EU member states [12], scientists expects that 9% of new US jobs will be created by robots and automation [13] and artificial intelligence will grow into a $118.6 billion industry by 2025 [56]. Researchers from Pew Research Center used interviews of US citizens for gathering information and to assess the tendency of public attitudes toward AI. According to a survey, 65% of respondents believe that their work will be replaced by a robot or an intelligent algorithm within 50 years [15]. According to the survey of Boston Consulting Group most respondents (84%) expects AI will enable them to obtain a competitive advantage. They (83%) imagine AI as a strategic priority for their businesses today and state (75%) that AI will allow them to move into new conditions in businesses.

The survey is based on interviews with more than 3,000 business executives, managers, and analysts in 112 countries and 21 industries [17].

Consequently, we need to consider all the positive and negative aspects that accompany these processes – the transformation and impact of the various sectors of the economy in the workplace, both in terms of human resource roboticization and the development of new opportunities. Alongside these processes, as in most of the developed countries: the US [17], Germany [19], Sweden [20], Spain [21] and others, a number of international organizations – the European Union [22], the OECD [24], the OSCE [23] have started to set up appropriate regulatory institutions and set up guidelines. In addition, the main focus is on the need for scientific research and increased funding in these areas ([1], [2], [4], [25]). The paper discusses based on specific cases (such as Korea) the role that artificial intelligence programs have played in adapting to new economic realities for business entities.

Purpose, objectives and subject of the paper: Georgia is gradually involved in the processes of digital economy development and implementation of artificial intelligence in certain sectors of the economy. The purpose of this paper is to analyze the impact of artificial intelligence on the business industry. Also, the scheme of establishment and functioning, advantages and disadvantages, study of the main trends in the use of artificial intelligence in Georgia and its impact on the labor market and its comparison with world experience.

2. Research methods

The paper is based on "task-based" model of the economy ([7], [10]). This model distinguishes jobs as follows: "low-educated workers perform mainly routine cognitive tasks and non-routine manual tasks; middle-educated workers perform mainly routine cognitive tasks; high-educated workers perform mainly non-routine cognitive tasks".

Consequently, along with technological development, one considers the situation where:

- Middle-educated workers are displaced.
- Middle-educated workers move towards low-education occupations, because high educated workers have a strong comparative advantage over middle-educated workers in performing non-routine cognitive tasks.
- Demand for high-educated workers, who are complemented by the technology that can now perform routine cognitive tasks, increases.

In the UK, Goos and Manning [48] find evidence of job polarisation in the UK between 1975 and 1999 having the following consequences.

To achieve the goals listed above, the following tasks were required:

- Clarifying the essence and regulation of artificial intelligence;
- Institutional analysis and foreign experience research;
- Identifying the risks associated with job cuts as well as analysing qualifications relevant to the new reality;
- Analysing surveys conducted by a leading research organization and summarizing the results.

3. Results and discussion

3.1 Features and uses of artificial intelligence

Artificial intelligence, as a scientific field, was separated from cybernetics in the late 1950s [59]. According to the widespread definition of the term, "Artificial intelligence describes the work processes of machines that would require intelligence if performed by humans." It also means "investigating intelligent problem-solving behavior and creating intelligent computer systems" [54] and defined "as the process of making intelligent machines" [45] doing "specific task at or above human level capabilities, which has the potential make it more attractive than a human laborer" ([26], [47]).

However, the first who began research on the subject in 1955 and summed up the exact aspects of artificial intelligence learning was John McCarthy ([27], [45]). Also, Allen Newell and Nobel Prize

winner in economics, Herbert Simon [49], believed that "Machines will be capable, within twenty years, of doing any work a man can do". He argued that many traditional jobs will be abolished by new technologies [28]. Before them, an English computer scientist and mathematician Alan Turing developed a method (named Turing test) of inquiry in artificial intelligence for determining whether or not a computer is capable of thinking like a human being [29].

According to the classification developed by the IBA Global Employment Institute [30], the use of artificial intelligence in economics is divided into the following categories:

- Deep learning – machine learning based on a set of algorithms that attempt to model high-level abstractions in data.
- Robotisation – Robots have been replacing employees because they work more precisely than humans and cost less.
- Dematerialization – because of automatic data recording and data processing, traditional 'backoffice' activities are no longer in demand.
- Gig economy – There are more and more independent contractors for individual tasks that companies advertise on online platforms.
- Autonomous driving – Vehicles have the power for self-governance using sensors and navigating without human input. Taxi and truck drivers will become obsolete.

Technological development impact on the employment in two main ways:

- Displacement effect – by displacing workers from tasks they were previously performing.
- Productivity effect – by increasing the demand for labor in industries or jobs that arise or develop due to technological progress [31].

It means that computer system can work constantly in other external circumstances and it is not affected by various factors. As a rule, synchronous work ensures greater productivity and transparency ([6], [32]). In addition, unlike the workforce, the computer system is not affected by fatigue and other factors [34] and sometimes production robot is cheaper than a worker in China is [34]. Therefore, in the Western high-labor cost countries savings with regard to the cost of labor and products caused by automation. For example, the use of a robot costs between €5 and €8 per hour and it is cheaper than one production working more than €40 in German automotive industry [35]. But there is some advantage for employees: on one hand repetitive and monotonous work can be performed by autonomous systems and on the other hand, people have to do less manual or hard work [37]. In conclusion it can be said that rapid technological innovation can threaten and radically changes the structure of employment.

3.2 International experience

John Maynard Keynes [35] postulated that technological change causes loss of jobs and developed his "technological unemployment theory" ([36], [40]). The wave of automation, brought about by the first and second industrial revolutions of the 19th and early 20th centuries, has led to a rapid rise in demand for low or unskilled labor, raising concerns about the growing nature of technological change [38]. Today some researchers think that advances in robotics and artificial intelligence over the next decades could lead to significant job losses or job polarization, and thus expand income and wealth [41]. According to the classification research developed by Oxford University up to 35% of all workers in the United Kingdom, and 47% of those in the United States are at risk of computerization over the next 20 years [42].

The increase in the number of interested groups and lobbyists in this field, as well as the amount of money spent on lobbying, indicates the importance of artificial intelligence. According to The Washington Post, in 2019, the cost of lobbying to influence the federal government by tech companies' businesses extends into smart home tech, autonomous vehicles and artificial intelligence has reached a colossal amount compared to previous years: Amazon-$16.1 million, Apple-$7.35 million, Facebook-$16.71 million [66].

The European Artificial Intelligence Association, The European AI Alliance, Blockchains and Artificial Intelligence for Business, Economics and Law (BABEL), the European Artificial

Intelligence Association (EurAI) – is a small list of interest groups from The Transparency Register that are actively lobbying. European artificial intelligence policy is in the process of developing. It should be noted that artificial intelligence is considered a field whose implementation strategy, regulatory norms and legal framework are in the process of formation even in developed countries. Consequently, there is great motivation and interest to influence decision makers to achieve the desired result.

Robotics is part of a general overview of business strategies that has become more complex and based on a wide range of variables than simple cost comparisons [43]. The increase in productivity caused by technological change will help expand income and demand [44]. Many researchers think that artificial intelligence has the potential to become another "general purpose technology" that has a wide range of applications in various professions because of its focus on mental rather than physical tasks [46].

According to the report from World Economic Forum [63] AI would create a net total of 58 million new jobs by 2022. The report also remarks that "AI will displace or eliminate 75 million jobs by 2022 and that the net increase will encompass 133 million brand-new roles" [50]. Another report by PwC found that "by 2030 the potential contribution to the economy from AI will be 15.7 trillion dollars and the global GDP could be up to 14% higher as a result of AI" [51].

Autor, Levy and Murane [10] argue that technology can replace human labor in routine tasks, be it manual or cognitive, but it cannot replace human labor in non-routine tasks yet. Goos and Manning [27] estimates that the impact of technology leads to an increase in the relative demand for highly paid skilled jobs and to a relatively high demand for relatively high demand jobs, which typically require non-traditional guiding skills [52]. Acemoglu and Autor [7] believe similar results for the US, while Darvas and Wolff [18] report such developments of EU member states: France, Germany, Italy, Spain, Sweden and the UK. In all these countries, the number of high-education jobs (managers, engineers and health professionals) is growing, while the number of middle-education jobs (clerks, machine operators, assemblers) is declining [53]. Western developed countries will profit because robotic production becomes cheaper than human production in low-labor-cost countries. For this reason, the relocation of the companies' destroy many routine jobs in the low-labor-cost countries [55].

According to the market research firm Tractica, the global artificial intelligence software market is expected to increase revenues around 118.6 billion by 2025 (figure 1).

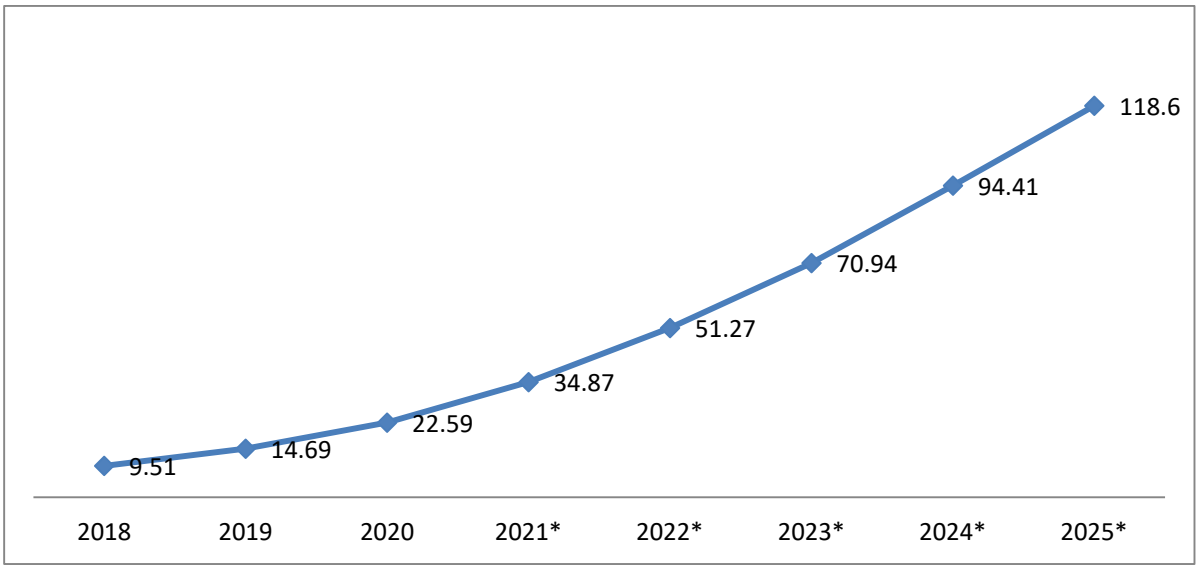

Figure 1. Revenues from the artificial intelligence (AI) software market worldwide from 2018 to 2025 (in billion U.S. dollars) **Source**: authors calculated on the basis of Statista [61]

It should be noted that low-labor-cost countries (China, India, Bangladesh) are still benefiting from their surplus of low-skilled workers, while Western companies are still outsourcing their production to these countries [57]. Ultimately, jobs with low or medium qualifications will be eliminated [60]. Changing human manual labor with robots makes economic sense in countries with low labor costs when the cost of human labor is 15 percent higher than the cost of robotic labor [39]. Chinese companies are already starting to build factories where robots will replace 90 per cent of human workers [11].

The key issue for developing countries is how to integrate large numbers of unskilled producers into the structurally complex labor market, depending on foreign investment. The driving force will probably be international companies that integrate their common systems across all industries in the world. If developing countries are able to provide qualified personnel in the technology sector in this way, developing countries can also benefit from technological change [62].

With big data processing, artificial intelligence, early warning systems, and intensive surveillance, South Korea has managed to get the coronavirus (COVID-19) under control for a short time. The government has created a large database of information on everyone in their territory, including South Koreans and foreign nationals, incorporating all government agencies, clinics, financial services, mobile operators and other services. As soon as a person is diagnosed with COVID-19, every person close to them receives information about their movement trajectory and activities over the past two weeks in the form of mobile alerts. Artificial intelligence ensures the rapid passage of all these stages. Artificial Intelligence provides authorities with information about possible clusters, or risk zones, that facilitate appropriate medical care in a particular area.

It can be said that artificial intelligence, in the course of implementation, gives us different results and challenges in developing and developed countries. In addition, it has various impacts on job creation due to the specific nature of the workplace. As noted at the outset, the use of artificial intelligence along with the structural change in certain sectors of the economy will create new types of jobs and the need for qualified personnel. One example of a newly created job is that of the data scientist [64]. Also crowd working is a symbol of a changing world of work for white-collar workers in the gig economy. They are freelancers who offer their skills via online platforms [65]. Creating one high-tech job will cause to create other jobs such as service jobs, gardeners, home health aides and etc. [33]. In addition, according to research by the IBA Global Employment Institute, with the development of the digital economy, the need for scientists and information technology specialists will grow. There is a greater need for the teaching profession not to be able to organize a professional team, and that includes the benefits of a professional team, the need to spend more money on companies, educate staff, and gain key qualifications for new and existing employees [13]. Also, humans with creative professions such as artists, musicians, actors, authors and etc. will not be replaced by machines in the future either [16].

It is noteworthy that qualified staffing in developing countries with new requirements may lead to an increase in the number of immigrants in developed Western countries [57]. Therefore, understanding the consequences of this distribution is important for many purposes. For example, it allows policymakers to develop appropriate education and skills policies and helps individuals make good choices about what careers they should pursue [62]. According to the World Bank (2016), in developing countries many more jobs are at risk: 69 % in India, 72% in Thailand, 77% in China and a massive 85% in Ethiopia [9]. The United Nations Conference on Trade and Development argues that the historical labor cost advantage of low-income countries might be eroded by robots if they become cheap and easily substitutable for labor [32].

The crisis caused by COVID-19 ([3], [5]) further strengthened the above arguments. In the course of the pandemic, the importance of artificial intelligence has been highlighted in a number of ways: First and foremost, security. Researchers from The Weizmann Institute, The Hebrew University of Jerusalem and Clalit Health Services – and in coordination with the Israeli Health Ministry have developed a strategy based on the questionnaire for identifying and predicting the novel coronavirus's spreading zones in the country [63].

Also, there has been a marked increase in the role of artificial intelligence in customer service services during the pandemic. In applications such as receiving information, healthcare, food and medication delivery and etc. the virtual assistants based on the artificial intelligence programme have significantly helped to regulate the increased flow of users and online referrals. For example, Hyro is a free virtual assistant to support health enterprises and their patients. The artificial intelligence uses a database compiled from the World Health Organization and other reliable sources of information to answer questions [58].

In summary, it should be noted that a business company that has a well-developed information technology management and tries to implement innovative achievements to adapt to unexpected challenges manages more effectively. Consequently, the fourth industrial revolution (Industry 4.0) is especially important in the effective management of enterprises. This includes high-tech and digital transformation of information. Which helps the business entity to easily overcome obstacles and adapt to the changed environment. And continuing the work process without interruption makes it possible to maintain profits, qualified staff and become even more competitive.

3.3. Artificial intelligence – current trends in Georgia

As for the case of Georgia, it is noteworthy that the first Artificial Intelligence Laboratory in Georgia, based on the University of Business and Technology in Georgia provides a research space that will integrate artificial intelligence education and business into various sectors. Creating an educational space includes high-tech laboratories such a workspace, a research center, an electronic library, and resources needed to carry out research projects.

An example of implementing artificial intelligence in business is the Real Estate platform Area.ge, which integrates any real estate transaction into a single electronic space to facilitate communication between stakeholders. With the help of artificial intelligence, inaccuracies are constantly eliminated, as well as rich visual materials and an optimal price tag allow customers to make quick choices.

The Artificial Intelligence Business Association is established in Georgia with the aim of demonstrating the importance of artificial intelligence as a separate field for simplifying and securing business processes. In addition, Artificial Intelligence Digital Mind has been created in Georgia, answering questions orally and in writing: marketing, management and tourism, as it combines over 4,000 books in these three areas. The innovative project also gives blind people access to higher education.

To save time and resources, in partnership with Nova BDO, Nova has introduced the ERP system 1C ERP, which enables optimal production. High-level business process optimization simplifies the control of limits and terms of accounts receivable, customer relationships, fast and seamless inventory.

4. Conclusions and recommendations

Artificial Intelligence can promote economic growth, create new jobs and employment. Destruction mechanism is a replacement effect, new technology will replace old technology and hence changing old technology jobs will inevitably lead to unemployment. Technological advances will reduce costs, make resources more efficient. The saving effect of the innovation process will result in a reduction in labor demand, leading to a high level of unemployment [55]. New technologies create winners and losers in the labor market. They change the relative demands of the professions, even if they improve productivity and standard of living [30].

The global pandemic and the need of physical distance have put on the agenda the development of artificial intelligence that can replace the workforce and increase the efficiency of the productive force. Therefore, in our opinion, the state should pay special attention to the creation and development of educational programs about artificial intelligence. In this regard, financial support for the formation and working process of Technology Parks is also important. All this activities will contribute to the continuous growth and development of the real economic sector of the country. Consequently, given the growing role of artificial intelligence, as a recommendation it can be said that it is important for the rapid economic development of the state.

The study included the research of the formation of artificial intelligence, the stages of development, the main features of its use, the scheme of functioning and the impact on the labor market. This last issue is studied in the paper from the perspective of both individual and organizational - business companies and various economic entities. There has been an increase in the spread of artificial intelligence, which indicates the need for states to develop appropriate regulatory strategies and establish a legal framework. This makes the field particularly attractive for interest groups and lobbyists who are actively working to influence the legislature and achieve their own goals. Also, based on the results of the study, we can conclude that the pandemic caused by Covid-19 has become a factor that has made it even clearer the need to use innovative technologies. In turn, the continuous work of the business sector is the basis for the economic development of the country. Consequently, technological progress and the use of artificial intelligence are a priority for small open economies.

References

[1] Abuselidze G 2019 Peculiarities of State Funding Priority Educational Programs and Expense Efficiency *Proceedings of 5th International Conference on Lifelong Education and Leadership For All (ICLEL 2019)* pp 243–51

[2] Abuselidze G and Beridze L 2019 Financing models of vocational education and its impact on the economy: Problems and perspectives *SHS Web of Conferences* **66** 01001

[3] Abuselidze G and Mamaladze L 2020 The Impact of the COVID-19 Outbreak on the Socio-Economic Issues of the Black Sea Region Countries *Computational Science and Its Applications – ICCSA 2020, 12253 LNCS* (to be published)

[4] Abuselidze G and Mamuladze L 2020 The Peculiarities of the Budgetary Policy of Georgia and the Directions of Improvement in Association with EU *SHS Web of Conferences* **73** 01001

[5] Abuselidze G and Slobodianyk A 2021 Pandeconomic Crisis and Its Impact on Small Open Economies: a Case Study of COVID-19 *Advances in Intelligent Systems and Computing* **1258 AISC**, 718–28

[6] Abuselidze G, Slobodianyk A and Reznik N 2019 Ensuring Trading Strategies Profitability with Technical Analysis Tools and Computer Technology *SHS Web of Conferences* **71** 04005

[7] Acemoglu D and Autor D 2011 Skills, Tasks and Technologies: Implications for Employment and Earnings *Handbook of Labor Economics* vol 4 pp 1043–1171. URL https://doi.org/10.1016/s0169-7218(11)02410-5

[8] Amclaboratories 2019 50+ Vital Artificial Intelligence Statistics: 2019 Data Analysis & Market Share URL https://www.amclaboratories.com/50-vital-artificial-intelligence-statistics-2019-data-analysis-market-share/

[9] Arntz M, Gregory T and Zierahn U 2016 The risk of automation for jobs in OECD countries: A comparative analysis (*OECD Social, Employment and Migration Working Paper* no 189) (Paris: Organisation for Economic Co-operation and Development)

[10] Autor D H, Levy F and Murnane R J 2003 The Skill Content of Recent Technological Change: An Empirical Exploration *The Quarterly Journal of Economics* **118**(4) 1279–1333

[11] BDO 2020 The role of ERP system in modern business - Partnership between NOVA and BDO URL https://www.bdo.ge/ka-ge/erp-sistemis-roli-tanamedrove-bizneshi-nova-bdo

[12] Berger R 2016 Fair play in the digital arena How Europe can set the right framework for platforms URL https://www.rolandberger.com/publications/publication_pdf/roland_berger_ief_plattformstudie_en_final.pdf

[13] Bessen J 2015 How computer automation affects occupations: Technology, jobs, and skills (*Law and Economics Research Paper* no 15-49) (Boston: Boston University School of Law)

[14] Blundell B G 2020 *Ethics in Computing, Science, and Engineering: A Student's Guide to Doing Things Right* (Cham: Springer)

[15] Braverman H 1974 *Labor and monopoly capital: The degradation of work in the twentieth*

century (New York: Monthly Review Press)
[16] Brynjolfsson E and McAfee A 2014 *The Second Machine Age* 5th ed (New York: W. W. Norton & Company) chapter 12 URL https://edisciplinas.usp.br/pluginfile.php/622156/mod_resource/content/1/Erik-Brynjolfsson-Andrew-McAfee-Jeff-Cummings-The-Second-Machine-Age.pdf
[17] Columbus L 2017 How Artificial Intelligence Is Revolutionizing Business in 2017 *Forbes* URL https://www.forbes.com/sites/louiscolumbus/2017/09/10/how-artificial-intelligence-is-revolutionizing-business-in-2017
[18] Darvas Z and Wolff G 2016 An anatomy of inclusive growth in Europe (*Bruegel blueprint series*) URL https://www.bruegel.org/wp-content/uploads/2016/10/BP-26-26_10_16-final-web.pdf
[19] De Backer K, DeStefano T, Menon C and Suh J R 2018 Industrial robotics and the global organisation of production (*OECD Science, Technology and Industry Working Paper* no 2018/03) (Paris: Organisation for Economic Co-operation and Development)
[20] European Parliamentary Research Service 2019 EU guidelines on ethics in artificial intelligence: Context and implementation URL https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/640163/EPRS_BRI(2019)640163_EN.pdf
[21] Frankfurter Allgemeine 2016 Mein Chef, der Roboter URL https://www.faz.net/aktuell/wirtschaft/fuehrung-und-digitalisierung-mein-chef-der-roboter-14165244.html
[22] Frey C B and Osborne M A 2017 The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change* **114** 254–80
[23] Frontier Economics 2018 The impact of Artificial Intelligence on Work URL https://www.frontier-economics.com/media/3118/ai-and-work-evidence-review-full-report.pdf
[24] Furman J and Seamans R 2018 AI and the economy (*NBER Working Paper* no 24689) (Cambridge: National Bureau of Economic Research)
[25] Future of life Institute 2019 AI Policy – Spain URL https://futureoflife.org/ai-policy-spain
[26] Global Legal Insights 2019 AI, Machine Learning and Big Data 2019 / Germany URL https://www.globallegalinsights.com/practice-areas/ai-machine-learning-and-big-data-laws-and-regulations/germany
[27] Goos M and Manning A 2007 Lousy and Lovely Jobs: The Rising Polarization of Work in Britain *Review of Economics and Statistics* **89**(1) 118–33
[28] Government offices of Sweden 2018 National approach to artificial intelligence URL https://www.government.se/491fa7/contentassets/fe2ba005fb49433587574c513a837fac/national-approach-to-artificial-intelligence.pdf
[29] Haag M 2015 Kollaboratives Arbeiten mit Robotern – Vision und realistische Perspektive *Zukunft der Arbeit in Industrie 4.0* ed A Botthof, E Hartmann (Berlin, Heidelberg: Springer) pp 59–64
[30] He Z 2017 Labour Market Restructuring Where Artificial Intelligence Will Be Served *China Business Daily*
[31] IBA Global Employment Institute 2017 Artificial intelligence and robotics and their impact on the workplace URL https://www.ibanet.org/Document/Default.aspx?DocumentUid=c06aa1a3-d355-4866-beda-9a3a8779ba6e
[32] International Labour Organization 2018 The economics of artificial intelligence: Implications for the future of work URL https://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms_647306.pdf
[33] Jaimovich N and Siu H E 2020 Job Polarization and Jobless Recoveries *The Review of Economics and Statistics* **102**(1) 129–47

[34] Kaiser T 2018 Roboter werden in Deutschland besonders viele Jobs vernichten URL https://www.welt.de/wirtschaft/article175180209/OECD-Studie-Roboter-bedrohen-die-Karrieren-Tausender-Teenager.html
[35] Keynes J M 1937 The General Theory of Employment *The Quarterly Journal of Economics* **51**(2) 209
[36] Keynes J M 2010 Economic Possibilities for Our Grandchildren *Essays in Persuasion* (London: Palgrave Macmillan) pp 321–32
[37] Khurana R 2017 Estimating the Impacts of Artificial Intelligence on Employment and Wages. A Frictions Analysis of the Economic Potential of Current Artificial Intelligence Technologies to Disrupt the Labour Market URL https://www.academia.edu/34782622/Estimating_the_Impacts_of_Artificial_Intelligence_on_Employment_and_Wages
[38] Korinek A and Ng D X 2017 The macroeconomics of superstars, mimeo URL http://www.korinek.com/download/Superstars.pdf
[39] Korinek A and Stiglitz J 2017 Artificial Intelligence and Its Implications for Income Distribution and Unemployment URL https://doi:.org/10.3386/w24174
[40] Krischke B and Schmidt H 2015 Kollege Roboter URL https://www.focus.de/finanzen/news/wirtschaft-und-geld-kollege-roboter_id_4940370.html
[41] Lischka K 2011 John McCarthy Der Vater der Rechner-Cloud ist tot URL https://www.spiegel.de/netzwelt/web/john-mccarthy-der-vater-der-rechner-cloud-ist-tot-a-793795.html
[42] Liu Sh 2019 Global Artificial Intelligence Software Market Worldwide URL https://www.statista.com/statistics/607716/worldwide-artificial-intelligence-market-revenues/
[43] Marglin S A 1974 What Do Bosses Do? *Review of Radical Political Economics* **6**(2) 60–112
[44] Maschke M and Werner N 2015 Arbeiten 4.0 – Diskurs und Praxis in Betriebsvereinbarungen URL https://www.bmas.de/SharedDocs/Downloads/DE/Thema-Arbeitsmarkt/Arbeiten-4-0/stellungnahme-hbs.pdf
[45] McCarthy J 2007 What is artificial intelligence? URL http://www-formal.stanford.edu/jmc/whatisai.pdf
[46] Méda D 2016 The future of work: The meaning and value of work in Europe (*ILO Research Paper* no 18) (Geneva: International Labour Office)
[47] Muehlhauser L and Salamon A 2012 Intelligence Explosion: Evidence and Import *Singularity Hypotheses. The Frontiers Collection* ed A Eden, J Moor, J Søraker and E Steinhart (Berlin, Heidelberg: Springer)
[48] Nantais J 2020 Federal Government Regulation of AI URL https://towardsdatascience.com/federal-government-regulation-of-ai-4fa08b7bd99a
[49] Newell A and Simon H 1956 The logic theory machine – A complex information processing system *IRE Transactions on Information Theory* **2**(3) 61–79
[50] OECD 2019 Going Digital – Making the Transformation work for growth and well-being URL https://www.oecd.org/going-digital/ai/oecd-moves-forward-on-developing-guidelines-for-artificial-intelligence.htm
[51] OSCE 2018 Human Capital Development in the Digital Era URL https://www.osce.org/chairmanship/405899
[52] Petropoulos G 2018 The impact of artificial intelligence on employment *Work in the Digital Age* URL https://www.bruegel.org/2018/07/the-impact-of-artificial-intelligence-on-employment
[53] Pew Research Center 2016 Public Predictions for the Future of Workforce Automation URL https://www.pewresearch.org/internet/2016/03/10/public-predictions-for-the-future-of-workforce-automation
[54] Ping H and Yao ying G 2018 Comprehensive view on the effect of artificial intelligence on

Employment *Multidisciplinary Inclusive Education, Management and Legal Services (MIEMLS)* **1**(1) 35–5 URL https://doi.org/10.26480/ismiemls.01.2018.32.35
[55] Polachowska K 2018 AI in business: What are the benefits of artificial intelligence? URL https://neoteric.eu/blog/ai-in-business-what-are-the-benefits-of-artificial-intelligence/
[56] PwC 2013 Big Data – Bedeutung Nutzen Mehrwert URL https://www.pwc.de/de/prozessoptimierung/assets/pwc-big-data-bedeutung-nutzen-mehrwert.pdf
[57] Schultz S 2016 Die Jobfresser kommen *Spiegel Wirtschaft* URL https://www.spiegel.de/wirtschaft/soziales/arbeitsmarkt-der-zukunft-die-jobfresser-kommen-a-1105032.html
[58] Schwartz E H 2020 Healthcare AI Startup Hyro Releases Free Coronavirus-Focused Virtual Assistant for Medical Providers URL https://voicebot.ai/2020/03/20/healthcare-ai-startup-hyro-releases-free-coronavirus-focused-virtual-assistant-for-medical-providers/
[59] Semerikov S O, Teplytskyi I O, Yechkalo Yu V and Kiv A E 2018 Computer Simulation of Neural Networks Using Spreadsheets: The Dawn of the Age of Camelot *CEUR Workshop Proceedings* **2257** 122–47
[60] Srivastava S 2019 Top to 10 countries leading the artificial intelligence race URL https://www.analyticsinsight.net/top-10-countries-leading-the-artificial-intelligence-race/
[61] Statista 2020 Technology & Telecommunications. Software URL https://www.statista.com/statistics/607716/worldwide-artificial-intelligence-market-revenues
[62] Webb M 2020 The Impact of Artificial Intelligence on the Labor Market URL https://web.stanford.edu/~mww/webb_jmp.pdf
[63] Weizmann Institute of Science 2020 Two Steps Ahead of the Coronavirus URL https://www.newswise.com/coronavirus/staying-two-steps-ahead-of-the-coronavirus/?article_id=728611
[64] World Economic Forum 2016 Extreme automation and connectivity: The global, regional, and investment implications of the Fourth Industrial Revolution URL https://www.ip-watch.org/weblog/wp-content/uploads/2017/09/ubs-vierte-industrielle-revolution-2016-01-21.pdf
[65] Yongqian T 2018 Artificial intelligence, employment and the reform of China's labour policy legal system *Journal of Henan University of Economics and Law*
[66] Zakrzewski C 2020 The Technology 202: Amazon, Facebook and Apple spend record-high amounts on Washington lobbying in 2019 URL https://www.washingtonpost.com/news/powerpost/paloma/the-technology-202/2020/01/22/the-technology-202-amazon-facebook-and-apple-spend-record-high-amounts-on-washington-lobbying-in-2019/5e27296e602ff14e66056866/