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**Artificial Intelligence and the Future of Work in Nigeria: A shift from educational requirements to skills possession**

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**Abstract**

The invention of artificial intelligence (AI) and its adoption in the workplace is not to substitute humans but to complement tasks with precision, efficiency and fewer costs. There was suspicion and apprehension when began to replace humans in tasks that are repetitive and requires little analytical skills in the early 1990s in developed countries and early 2000s in the developing nations. However, AI opened opportunities for workers and prospective workers to enhance their skillsets to survive or to secure a job in a rapidly changing world of technology. It has been established that it has disruptive effects on employment, it has created new jobs and transformed some. It has shifted what is required from a worker or job seeker from educational qualification to skill sets possession operate in a technological-driven work environment. It has found that innovations of machines and adoption in the workplace are not a replacement of human but complementary to ensure tasks are done with minimum error, less cost and within a short time. The article adopted unobtrusive research to examine the changes ushered by technological development. It analyzes the existing statistics of how the use of AI in the workplace had displaced some workers on one hand and created more jobs on the others. The paper established that in the era where AI is witnessing unprecedented scientific through frequently, jobs opportunities created by these developments requires technical skills more than the educational qualifications or both. Therefore, the future of work in the ever-changing and dynamic world of technological advancement would be skills-based. The AI skills now needed for survival for the employed and securing job for the job seekers.

**Keyword:** artificial intelligence, job skills technology workers

### **Introduction**

Development and innovations in science and technology in 20<sup>th</sup> century and Information and Communication Technology (ICT) has impacted virtually all aspects of social structures and institutions, positively and otherwise in the world. The invention of steam engines for industrial use and electronic machines for clerical jobs has shaped and has been shaping both relations of production and accomplishment of tasks in factories and offices especially in developed economies and lately in developing nations. All these inventions are geared towards execution of task in the workplace with precision and effectiveness on the part of employers to minimize costs and maximize profits. However, they also constitute threats to the existence of some jobs that automated machines can perform or execute.

Artificial agents to refer to devices and decision-making aids that rely on automated, data driven, or algorithmic learning procedures (including artificial intelligence (AI) in its many manifestations) (Acemoglu and Restrepo, 2017). These include devices as banal as Roomba robots and online recommendation engines to more advanced cognitive systems like IBM's Watson (Osoba and Welser, 2017). Such agents are becoming an intrinsic part of our regular decision-making processes (Osoba and Welser). Emerging inventions in Artificial Intelligence (AI) generates suspicion about jobs security because of the perception that machines and gadgets are developed with the capacity to carry out tasks which humans do in the offices and factories. This apprehension has become widespread as more computerized or automated machines are developed with the capacity to discharge routine clerical works that were hitherto discharged by humans. However, it has been observed that machines substitute for tasks, not jobs. Some of those tasks are best done by humans, others by machines. Even under the most aggressive scenarios of technological advancement, it is unlikely that machines will be able to substitute for all tasks in any one

occupation. This implies constant change but also a persistent need for human labor, even in highly automated contexts (Muro, Maxim and Whiton, 2019). Innovation report has succinctly captured the impact of artificial intelligence and the future of work in the world.

In the two centuries since the Industrial Revolution, technological change has repeatedly reshaped the workplace. Yet today, the pace of that change has accelerated with the development of new automation technologies driven by Artificial Intelligence (AI). These technologies are not just disrupting the way people work, they are changing our relationship with work (Innovation Report, 2018:2)

The technological advancements make it possible to swap out machines for human in the bank, aviation and customs employees fall on the narrow side of the artificial intelligence spectrum, which means that the machines operate within a limited pre-defined coded and predictable range. It is easily foreseeable that similar jobs will be increasingly replaced by machine. While there was much uncertainty during the early days of automation, decades of these transformations have demonstrated that increasing talent development has, in many cases, allowed for workers to enhance their skillset and perform more valuable job. Nevertheless, millions of workers have been left behind without the requisite skills to retain their jobs (ICAO Training Report, 2017).

Similarly, Innovation Report (2018) found that globally, around half of the work people are paid to do work that could be automated using technology that already exists. Yet, as overall spending on technology grows, this will also create millions of new jobs, by opening up vast new areas of work, such as the marketization of previously unpaid domestic work and work in emerging industries such as climate adaptation. Artificial intelligence has the potentials to open up new ways of working. The Royal Society and British Academy (n.d) reported that the number of

jobs created as a result of growing demand, movement of workers to different roles, and emergence of new jobs linked to the new technological landscape all also influence the overall economic impact of automation by AI technologies.

Empirical evidence has shown that in some of developing countries, private businesses and public employers have started shifting demands from educational qualification to skills. Even the employed workers, they are compelled by the challenge to protect their jobs in the face rapid of changes in the world of work by the 4<sup>th</sup> revolution to update their skills if they are to retain their jobs. EY and NASSCOM (2017) examined the future of work in India, one of the rapidly growing hub for IT in the world. The study found that growth of retailing especially in tier II and III cities is helping boost employment in the sector with more stores getting opened. Also many of these new stores are planning to provide experiential shopping experience to their consumers. This shift in focus driven by technology will require significant reskilling of current employees in soft skills and IT skills. This is evident as reskilling of employees was rated as a key initiative by 71% of the industry players. Rigorous efforts are in place to equip the workers with the skills to be relevant as many jobs become automated. This shows that the country has forecasted what would happen to the jobs and workers if they are not reskilled to keep pace with the technological advancements.

The current pace of unprecedented developments in technological progressions signify that virtually all jobs and occupations will be affected by task automation aided by ICT and AI. Statistics reveals that roughly 25 percent of U.S. employment (36 million jobs in 2016) will face high exposure to automation in the coming decades (with greater than 70 percent of current task content at risk of substitution). At the same time, some 36 percent of U.S. employment (52 million jobs in 2016) will experience medium exposure to automation by 2030, while another 39 percent (57

million jobs) will experience low exposure (Muro, Maxim and Whiton, 2019). Similarly, the potential of AI to drive change in many employment sectors has revived concerns over automation and the future of work. Evidence suggests that AI will not result in the 'end of work' but neither will it mean 'business as usual'. It is set to bring profound change to the world of work. Studies have demonstrated how displacement and job losses occur in the short term while over the longer term, productivity, wealth, and employment all tend to rise (The Royal Society and British Academy, n.d).

It is based on the above discourse that this paper intends to examine the future of work in the era of AI. To identify what is needed by workers and potential workers to cope with the ever-changing innovations in the world of work. The paper approached this problem adopting quantitative methodology. The paper utilized secondary data from different countries that are relevant to the phenomenon investigated. In explaining the attitude of workers, choice of job, and skills requirement, it is important to examine and present findings within a context of workplace and rates of automation of tasks, existing statistics are relevant. Therefore, existing statistics can often provide a historical or conceptual context within which to locate original research (Babbie 2013:307).

## **Literature Review**

Ensuring that present and future workers are equipped with education and skills they need to be 'digital citizens'; has been the focus of most developing and developed countries to safeguard the jobs and employees. Addressing these concerns over the changing nature of working life, for example with respect to income security and the gig economy, and in tackling potential biases from algorithmic systems at work is paramount. Meeting the likely demand for re-training for displaced workers through new approaches to training and

development has been major focus of most employers of labour in the world (The Royal Society and British Academy, n.d). Despite the positive impacts brought by artificial intelligence, skills need for the new jobs has been the major concern in the 4<sup>th</sup> industrial revolution. Mckay, Pollack and Fitzpayne (2019) opined that while automation boosts economic growth, creates jobs, and improves living standards, it can also present serious challenges for workers and communities, including job displacement, disruptions to local economies, changing skill needs, and rising inequality. This points the existence of skills gaps among the workers who are expected to operate the technologies and which shortage renders some workers jobless.

Rapid technological progress and innovation have threatened some jobs which automated machines can handle. Such a concern is not new but dates back at least to the 1930s, when John Maynard Keynes postulated his 'technological unemployment theory' technological change causes loss of jobs. Technological innovations can affect employment in two main ways: by directly displacing workers from tasks they were previously performing (displacement effect) and by increasing the demand for labour in industries or jobs that arise or develop due to technological progress (productivity effect) (Petropoulos, 2017).

A study conducted by Price Waterhouse Coopers (PwC) (2018) revealed that routine tasks such as filling in forms or exchanging information, which includes the physical transfer of information. It is also likely to see a decreased need for many programming languages as repeatable programmable tasks are increasingly automated, and through machines themselves building and redesigning learning algorithms. The findings further show that financial services jobs could be relatively vulnerable to automation in the shorter term, while transport jobs are more vulnerable to automation in the longer term. In the long run, less well educated

workers could be particularly exposed to automation, emphasising the importance of increased investment in lifelong learning and retraining (PwC). This study covered many countries in the world and attest that it is not the workers with low educational qualification that faces retrenchment but those who does not possess the needed skills for the new tasks.

Similarly, Levey (2018) explains how computers and machine learning automate workplace tasks. Automated tasks help to both create and eliminate jobs. The findings further show why job elimination centres in blue-collar and clerical work impacts is similar to those of manufactured imports and offshore services. The near-term evolution of three technologies aimed at blue-collar and clerical occupations: autonomous long-distance trucks, automated customer service responses, and industrial robotics. The findings estimate that in the next 5–7 years, the jobs lost to each of these technologies will be modest but visible. The study focused on the jobs that risk displacement as a result of automation and those that would endure despite the rising rate of automation in 21<sup>st</sup> century. This serves as a wakeup call for workers in that cadre to learn new skills or face retrenchment. This displacement does not take into account their level of education but their skills that is on the verge of becoming obsolete as new automated machines are manufactured.

Additionally, it has been observed that robotics revolution is rapidly accelerating, as fast paced technological advances in automation, engineering, energy storage, artificial intelligence, and machine learning converge. The result will transform the capabilities of robots and their ability to take over tasks once carried out by humans. The number of robots in use worldwide multiplied three-fold over the past two decades, to 2.25 million. Trends suggest the global stock of robots will multiply even faster in the next 20 years, reaching as many as 20 million by 2030, with 14 million in China alone. The implications are immense, and the emerging challenges for



governments and policymakers are equally daunting in their scale. The rise of the robots will boost productivity and economic growth. It will lead, too, to the creation of new jobs in yet-to-exist industries, in a process of 'creative destruction.' But existing business models across many sectors will be seriously disrupted. And tens of millions of existing jobs will be lost, with human workers displaced by robots at an increasing rate as robots become steadily more sophisticated. There are 20m number of manufacturing jobs that could be displaced by industrial robots by 2030 8.5% of the global manufacturing workforce (Oxford Economics, 2019). This study has identified the future disruption of work by the rise of robots while on the other hand, creates new jobs. This shows robots are invented, workers are expected to develop new skills to handle jobs that robot cannot do.

Furthermore, Masayuki (2017) assessed the impact of artificial intelligence on workforce. The results suggest that malleable/adaptable high skills acquired through higher education, particularly in science and engineering, are complementary with new technologies such as AI and robotics. At the same time, occupation-specific skills acquired by attending professional schools or holding occupational licenses, particularly those related to human-intensive services, are less likely to be replaced by AI and robotics.

Tytler, *et al* (2019) examines the future of work in the face of AI revolution in relation to work. The study found that trans-disciplinarity was a major theme, referring to the need for a strong disciplinary base but combined with breadth of knowledge of other areas, with technology skills, and with creativity. Another theme was the importance of human skills, increasingly relevant in a world where machines do the routine work, and relevant also for cross-disciplinary team work. A third theme was the need for flexibility and adaptability in the face of change, and the importance of the capacity to continue to learn, and be strategic about learning, over a lifetime. The

research concludes that the three key forces that will shape the future of work are: automation: ever-smarter machines performing ever-more human tasks; globalisation: our workforce going global and the global workforce coming to us; and collaboration: many jobs, with many employers, often at the same time. Also, Audu, Kamin, and Saud (2013) examined the usefulness of technical skills to fit into the changing demands for employment in 21<sup>st</sup> century. The study focused on Technical Vocational Education (TVE) graduate yearly and increasing unemployment rate among youths in developing countries. It concludes that there is the need for TVE graduates to acquire employability skills in order for them to be gainfully employed to be able to fit into the 21<sup>st</sup> century workforce.

There are a lot of concerns over the future of work as the world turn digital. However, such apprehension that machines would render humans jobless are shortsighted because new inventions require humans with skills to operates because also an operator. It is on this that Chuah, Loayza and Schmillen (2018) discredited the fear for the loss of jobs due to the application of AI in workplaces. They analyzed the history and economic theory and evidence which stated that in the long term, such fears are misplaced. However, in the short and medium term, dislocation can be severe for certain types of work, places, and populations. In the transition period, policies are needed to facilitate labor market flexibility and mobility, introduce and strengthen safety nets and social protection, and improve education and training. The submission underscores the importance of improve education and skills to match the ever-changing innovations in technology. It also shows that education and skills are major jobs protection strategy and future workers need not just education but skills.

In the vein, the disruption of jobs or employment attributed to AI and other technological advancements has not been adequately forecasted by some scientists

that is why the world struggling to address the effects. The barriers overlooked were identified by Frank et al (2019). The study found that the barriers which inhibit scientists from measuring the effects of AI and automation on the future of work. These barriers include the lack of high-quality data about the nature of work (e.g., the dynamic requirements of occupations), lack of empirically informed models of key micro level processes (e.g., skill substitution and human-machine complementarity), and insufficient understanding of how cognitive technologies interact with broader economic dynamics and institutional mechanisms (e.g., urban migration and international trade policy). However, there are studies which assessed the impact of automation on employment in other countries and draw mixed conclusions: Automation will affect 35% of employment in Finland (Pajarinen, Rouvinen, and Ekeland, 2015), 59% of employment in Germany (Brzeski and Burk, 2015), and 45 to 60% of employment across Europe (Bowles, 2014).

Therefore, for workers or potential workers to survive or to secure a job in the fluid world of technology, learning new skills has become imperative because the skill requirements of each job title are not static and actually evolve over time to reflect changing labour needs. For example, workers may require more social skills because those skills remain difficult to automate (Deming and Kahn, 2018). Even if technology depresses employment for some types of labor, it can create new needs and new opportunities through 'creative destruction'(Aghion, and Howitt, 1990; ghion, and Howitt, 1994; Bartelsman, Haltiwanger, and Scarpetta, 2004). For instance, the replacement of equestrian travel with automobiles spurred demand for new roadside amenities, such as motels, gas stations, and fast food (Jackson, 1993).

In Africa, the major concern is the availability of the skills to handle inventions brought by artificial intelligence. There is skills shortage in developing countries in Africa because the educational system in continent has not fully incorporated the AI

components in its curriculum. Workers in this part of the world require more than college or university education to secure jobs and sustain it. Corroborating the foregoing argument, in their study, Samans and Zahid (2017) submitted that despite the fast growth of AI technology, few countries including developed countries have the education and skills systems in place to equip their workers to reap the benefits. Applications of AI are poised to change the nature of work in ways education systems are not yet prepared to grapple with.

In Sub-Saharan African which is part of it, growth, particularly in manufacturing and the service sectors, requires skilled labor. Yet, the relatively low levels of education in many Sub-Saharan countries are constraining this growth. In an environment where job seekers lack the necessary skills or where wages are high because of a demand for specific skills, rapidly advancing automation technology offers an alternative both as substitute for missing skills and as replacement for high-wage workers (Gaus and Hoxtell, 2019). This study depicted the existence of skill gap in the sub-region. It also shows that AI encourage the existing and potential workforce to learn skills that would match the jobs created by the emerging technology. The study further established that the future of work in Sub-Sharan Africa would feel the effect of AI innovations because the sub-region is still lagging behind compared to other continents in terms of infrastructure and skills needed for AI function in all sectors. This is because existing industrial policies in Sub-Saharan African countries, even those from Kenya, South Africa, Ethiopia, and Nigeria, are currently not conducive to greater automation. At this point, no African country has an official industrial policy that promotes the use of automation technology or that positions itself in a global economy that increasingly leans toward greater automation (Gaus and Hoxtell).

Similarly, In India, a study by EY and the Indian National Association of Software and Services Companies (NASSCOM) found that by 2022, 9 percent of the workforce will be engaged in entirely new jobs that do not exist today, and a further 37 percent will be deployed in jobs that have radically changed skillsets. These jobs of the (near) future will be different. Routine tasks will increasingly be executed by or with the aid of AI-driven processes, meaning that workers can be more productive, but also will have to shift to cognitive aspects of those same tasks (EY and NASSCOM, 2017). This depicts that Asia and India in particular, appreciable efforts are in place to redefine the jobs and training the personnel to be prepared for the task ahead if they secure jobs or retain theirs by the already employed.

A cross sectional study conducted in European Union on impact of AI on labour market revealed that 90% of jobs requires information technology skills from the workers. However, 61 million people in the EU have insufficient requisite skills for the available jobs created AI. From 2007-2017, 2 digitalization has created two million new jobs in the European Union and the report forecasted that by 2030, 1.75 million jobs are expected to be created by Information Communication Technology (Servoz, n.d). A study in the United Kingdom revealed that the attention of the employers' demands from job seekers has shifted from only the academic qualification to cognate skills to handle jobs in the 21<sup>st</sup> century. Lowden, Hall, Elliot, and Lewin (2011) found that employers expect graduates to have technical and discipline competences from their degrees but require graduates also to demonstrate a range of broader skills and attributes that include team-working, communication, leadership, critical thinking, problem solving and managerial abilities. The shift to technical skills is perhaps to have workforce who are AI compliant to keep pace with the dynamic innovations in the world of work.

## Discussion of Findings

Findings of the study have revealed that AI revolution in the world of work has generated mixed feelings: positive and negative. The fourth industrial revolution has replaced some jobs in social institutions while on the other hand, it has created new jobs which are computer or ICT base. This correlates with the conclusion of Acemoglu and Restrepo (2018) who stated that AI has substituted some jobs in the short run and created new in the long run especially in developed economies. In the short run, AI substitutes labour in performing specific tasks that are automated. This can lead to job losses (displacement), reduce the share of income that flows to workers (compared to owners of capital) and falling earnings. This negative impact on labour is offset by the following countervailing effects: Productivity effects: goods and services whose production is increasingly automated become cheaper or increase in quality. This leads consumers to demand more products, either from sectors that are increasingly automated or from other sectors. Consequently, demand for labour increases. Introduction of new tasks: as new technology is introduced and demand increases, new activities emerge. This signifies that AI would displace labour who lack the skills to handle the jobs created by it. In turn, job seekers or employees with the required skills found new opportunities waiting for them.

It could also be deduced that AI shaped the focus of the employers of labour from reliance on educational qualification to skills. This has compelled employees and their employers to initiate training programmes that would keep their labor force abreast with the latest technological innovations and development regarding their jobs. A conscious decision and deliberate strategy to develop the capacity of the workers to have the skills and knowledge to operate or handle complex machines and gadgets in their place of work. This is line with the submission of Australian National Initiative and Performance Directorate (2017) which stated that profound changes ahead demand an education approach that will provide young people with

enduring capabilities and skills to harness the opportunities of technological change. This starts with the educational foundations of strong literacy and numeracy, and goes well beyond these skills. The next wave of education reform will need to lift the bar higher and make education 'smarter' to ensure that today's kindergarten students have the skill and confidence required to navigate an increasingly complex world.

## **Conclusion**

The paper concludes that the world work witnessed unprecedented developments as a result of inventions in science and technology in 18<sup>th</sup> and 19<sup>th</sup> centuries. However, the advancements in Information and Communication Technology in 20<sup>th</sup> and 21<sup>st</sup> centuries have redefined and restructured work, jobs and discharge of tasks in factories and offices. The invention of automated machines has shifted employers' focus from educational qualification to skills possessions from workers and job seekers to discharge new tasks, jobs and automated machines. This is because the new jobs that ICT base creates need for updated skills from workers. Therefore, employee or potential employees are compelled to update their skills. In this sense, in addition to educational qualification, skillsets have become a survival imperative for workers.

Similarly, the shift from concentration on certificates to skills, informs the educational sector to be restructured and adjusted to meet the needs and demands of future jobs which are skills-based. This is observed in the literature that educational institutes are under extreme pressure to transform their offerings from employability-enhancement skills to those related to the thinking, complex problem solving, and decision making among others. Therefore, AI could be described a double-edge sword, it disrupts some jobs and creates new ones at the same time. However, for the new jobs, complex and updated skills are required from workers and job seekers

to fit in. The future of work would only be safe and secured for employees who possesses the needed skills. And these skills need to be updated frequently to be in line with the scientific breakthrough in AI for industrial and office applications. Work relation in offices and factories would be between humans and automated machines which would reduce or eliminate interpersonal relationship between co-workers in the place of work.

### **Recommendations**

1. Educational institutions should keep pace with rapidly evolving technology, to enable individuals to be future ready and reduce their rate of obsolescence.
2. Employers who have the intention of using AI in their place of work should retrain their staff to new tasks when the old ones would be taken over by automated machines.
3. There would be less interactions between human beings in offices and other places of work as automated machines takeover most of the jobs. This will reduce the spirit of camaraderie at the place of work which boost the morale of staff.



## References

- Acemoglu, D. & Restrepo, P. (2017). Robots and jobs: evidence from US labor markets. *National Bureau of Economic Research, NBER Working Paper*, (23285).
- Acemoglu, D. & Restrepo, P. (2018). *Artificial intelligence, automation and work*. NBER Working Paper, 24196. Cambridge, MA: National Bureau of Economic Research
- Aghion P, & Howitt P (1990). *A model of growth through creative destruction*. NBER Working Paper 3223. Cambridge, MA: National Bureau of Economic Research.
- Aghion P, Howitt P (1994). Growth and unemployment. *Rev Econ Stud* (61),477–494.
- Audu, R., Kamin, Y.B, and Saud, M.S. B. (2013). Acquisition of employability skills in technical vocational education: Necessity for the 21st century workforce. *Australian Journal of Basic and Applied Sciences*, (7):6, 9-14.
- Australian National Initiative and Performance Directorate (2017). Education: Future frontiers. The implications of AI, automation and 21st century skills need. *Discussion Paper*, 1-14.
- Bartelsman E, Haltiwanger J, & Scarpetta, S. (2004). *Microeconomic evidence of creative destruction in industrial and developing countries*. Washington, DC: World Bank.
- Bowles, J. (2014). The computerisation of European jobs. Bruegel blog. Retrieved from [bruegel.org/2014/07/the-computerisation-of-european-jobs/](http://bruegel.org/2014/07/the-computerisation-of-european-jobs/). July 24.
- Brzeski, C., & Burk, C. (2015) Die Roboter kommen: Folgen der Automatisierung für den deutschen Arbeitsmarkt (he Robots are coming: Consequences of Automation for the German Labor Market). *INGDiBa Econ Res* (30), 1–7. German.
- Chuah, L.L., Loayza, N.V. & Schmillen, A.D. (2018). The future of work: race with— not against—the machine. *Research & Policy Briefs from the World Bank Malaysia Hub*, (16), 1-4.
- Deming, D, & Kahn, L.B (2018). Skill requirements across firms and labor markets: Evidence from job postings for professionals. *Journal of Labor Economics* (36): S, 337–S369.
- EY & NASSCOM (2017). *Future of jobs in India: A 2022 perspective*. Kolkata: Ernst and Young LLP.
- Frank, R.M., Autorb, D., Bessenc, J.E., Brynjolfsson, E., Cebriana, M., Deming, D.J Feldmanh, M., Groha, M., Lobo, J., Moroa, E., Wangk, D., Younk, H., and Rahwana, I. (2019). Toward understanding the impact of artificial intelligence on labor. *PNAS Perspective*, 1-9.
- Gaus, A. & Hoxtell, W. (2019). *Automation and the future of work in Sub-Saharan Africa*. Berlin: Konrad-Adenauer-Stiftung.
- Jackson, K. (1993). The world's first motel rests upon its memories. *Seattle Times*. Retrieved from [community.seattletimes.nwsourc.com/archive/?date=19930425&slug=1697701](http://community.seattletimes.nwsourc.com/archive/?date=19930425&slug=1697701). April 25,

- Levy, F. (2018). Computers and populism: Artificial intelligence, jobs, and politics in the near term. *Oxford Review of Economic Policy* (34):3, 393–417.
- Lowden, K., Hall, S., Elliot, D., & Lewin, J. (2011). *Employers' perceptions of the employability skills of new graduates Research commissioned*. London: University of Glasgow SCRE Centre and The Edge Foundation.
- Masayuki, M. (2017). Who are afraid of losing their jobs to artificial intelligence and robots? Evidence from a survey. *RIETI Discussion Paper Series* (17), 69.
- Mckay, C., Pollack, E. & Fitzpayne, A. (2019). *Automation and a changing economy. Part I: The case for action*. Washington DC: Future of the Work Initiative, The Aspen Institute.
- McKinsey Global Institute (2017). *Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation*. Retrieved from: <https://www.mckinsey.com/~media/McKinsey/Global%20Themes/Future%20of%20Organizations/What%20the%20future%20of%20work%20will%20mean%20for%20jobs%20skills%20and%20wages/MGI-Jobs-Lost-Jobs-Gained-Report-December-6-2017.ashx>.
- Osoba, O. A. & Welser, W. (2017). *The risks of artificial intelligence to security and the future of work*. RAND Corporation, 1-23.
- Oxford Economics. (2019). *How robots change the world what automation really means for jobs and productivity*. Oxford: Oxford Economics 1-64.
- Pajarinen, M., Rouvinen, P., & Ekeland, A. (2015). Computerization threatens one-third of Finnish and Norwegian employment. *ETLA Brief* (34).
- Petropoulos, G. (2017). *The impact of artificial intelligence on employment*. Brussels: Bruegel.
- Samans, R. & Zahid, S. (2017). The future of jobs and skills in Africa: Preparing the region for the fourth industrial revolution. *World Economic Forum*, 14.
- Servoz, M. (n.d). The future of work? Work of the future: On how artificial intelligence, robotics and automation are transforming jobs and the economy in Europe. *AI Report, Online Version*, 1-160.
- Tytler, R., Bridgstock, R., White, P., Mather, D., McCandless, T., & Grant-Iramu, M. (2019). *Jobs of the future*. Burwood: Deakin University.