The Future of Jobs amidst the Rise of Artificial Intelligence: How ready are Asian Undergraduates?

Ogbolu Anthony Nnamdi[1*], Sukidjo.[2]

[1, 2,] School of post graduate Studies, Yogyakarta State University, Jl. Colombo No.1 Yogyakarta 55281, Indonesia
Email: anthonynnamdi.2018@student.uny.ac.id

Abstract— **Artificial Intelligence (AI) could have far reaching impact on economies and societies across the globe. The current avalanche of technological changes across the workplace demonstrated by AI has rekindled widespread fear of job losses and increase in inequality. This study sets out to analyze the perceptions of Asian undergraduates towards the increasing development of AI technologies in the workplace and assess how confident and adaptable they are in relation to challenges of AI as a viable future job competitor in the labour market. A survey instrument was administered randomly to 84 respondents from Yogyakarta State University and descriptive statistics was used in analyzing the data. The findings from the study revealed that more than 70 percent of respondents possess satisfactory levels of self-confidence and adaptability skills to take on the disruptive forces of AI technologies in the future but exhibits mixed feeling as regard to their perception of AI technologies in the workplace as the margin of difference among the three response options provided (Scared, Confident or Indifferent) were so small and below 50% for each option. This study bridges the gap in the literature relating to undergraduate's perception of AI in the workplace especially in Asia while also providing useful insights and recommendations to ensuring that all relevant stakeholders especially undergraduates maximizes the opportunities brought about by AI while reducing or totally eradicating the threats on their path.**

Keywords— artificial intelligence, technological unemployment, digitalization, robotization, automation, job polarization, perception

I.   INTRODUCTION

"We are being afflicted with a new disease of which some readers may not have heard the name, but of which they will hear a great deal in the years to come—namely, technological unemployment" [1]. Automation and several advances in technology is not a new phenomenon, and questions about its promises and effect has long been asked [2].

Over the last two centuries, there have been periodic warnings about the threat of such automation and other new technologies wiping out a large numbers of middle class jobs [3], and often leading to violent backlash [4]. The Luddite movement and riots of the early 19th century, in which a set of English textile workers protested against the automation of textile manufacturing process by seeking to destroy some of the machines that they perceived to be a threat [5], [3], sure demonstrates the depth of fear in relation to technological changes even at that time.

With the upsurge in recent development of applications with Artificial Intelligence (AI), a sentiment of fear has been created to the effect that such accelerating technological changes will disrupt labour markets in way never seen or imagined before (Ernst, 2018 as cited in [6]). AI and Automation is said to have a far-reaching impact on the global workforce and will continue to penetrate almost every aspect of the new world of work [7]; [8]. Jobs across various spectrum of employment are all been challenged by AI; a technology that effectively combines the speed and efficiency of a machine with the creativity and agency of a human [9]. The fourth industrial revolution has signaled an avalanche of technological changes that will fundamentally alter humanity and will continue to force more businesses to embrace the mantra of "adapt or die" [8], for the world's economies are now transformed into a complex, interwoven and dynamic systems [10].

The current avalanche of technological changes demonstrated by AI has rekindle widespread fear of job losses and increased inequality [6], giving rise to what John Maynes Keynes termed technological unemployment. While such fears have not necessarily proven true for previous technological advances in centuries passed as the creation of new jobs usually outpace the labour saving impact of the adoption of such new technologies, fears have recently been brewing again about the upsurge in recent development in the field of automation and AI with some saying it could all herald the "End of Work" [11]. This is because automation and AI are increasingly penetrating the domain of tasks that until recently has been believed to be genuinely the prerogative of humans such as reasoning, sensing and deciding [11].

This digital age has been deemed to cause more upheaval than previous technological revolutions because the changes are happening at a faster rate than that ever seen before and is fundamentally altering the way we know humanity; work, relationships, ethics, morality and even spirituality are all impacted. This technology is now powering not just the automation of repetitive tasks but also cognitive tasks involving subtle and non-routine judgment [12], case in point would be; the driverless cars, the large autonomous smart factory, service robots and 3D printing [11].

AI technologies could have far reaching effects on economies and societies not just in Asia [13], but globally given the progresses, breakthrough results, and demonstrations of AI witnessed so far, as well as the

increasingly pervasive products and services already in use on a massive scale [14]; from miners, landscape gardeners to commercial bankers, fashion designers, welders and chief executive officer [2], [15]. Although, AI applications has the potential to transform critical sectors as education, healthcare, finance, mobility, and energy with its capability to accelerate progress in these sectors [14], the fear for technological unemployment as a result of AI powdered robots replacing human workers remains real and has receive significant attention (Brynjolfsson and McAfee 2016; Ford (2016) as cited in [16]).

Amidst all, the move towards a digital society does not consist much in 'getting people to just using technology' but rather to 'impact on and transform people lives' [17]. As robots and other AI technologies take over previously performed tasks by labour, there is an ever increasing concern about the future of jobs and wages [18]. The key questions on people's minds, particularly workers and students, are therefore how quickly will these AI robots and other innovations become a reality in the workplace, and what will their effect be on jobs and productivity in the global economy? [2] Will intelligent algorithms and AI powered production robots lead to mass unemployment? [19] At present, no one can give definite answers to these questions however, some researchers have simply predicted it happening soon [12].

As some researchers are already finding answers to these questions, we are motivated to analyze the perceptions of undergraduates who are potential workers and are likely to be the impacted more direly but still have ample opportunity to reposition themselves for an AI powered future.

This paper seeks to determine the perceptions of Asian undergraduates towards the increasing presence and development of AI in the workplace and assess how confident and adaptable they are to the changing circumstances. To our knowledge, no study has yet analyzed undergraduates' reaction to the increasing phenomenon of AI in the workplace especially in Asia. This study intends to bridge this gap in the literature while providing useful insight and recommendation to ensure that all relevant stakeholders especially undergraduates maximizes the opportunities of AI technologies while reducing or totally eradicating the threats.

II. LITERATURE REVIEW

The name behind the idea of AI is John McCarthy and he began research in 1955 [19]. Artificial Intelligence (AI) refers to any computer program that demonstrates intelligent behavior that may include one or more of the following; ability to learn, maintain a broad storehouse of information, use common-sense logic, apply analytical skills, discern factual relationships, convey ideas to others and understand messages from others, and understand and make sense [20]. Common examples are; virtual assistants, autonomous vehicles and speech recognition tools [21]. AI is not a single technology but simply, a host of technologies [14].

Despite the fact that AI technologies and automation has continued to result in greater output and less time at a lower cost per investment [22], there has been a resurgence of concerns that AI technology might after all result in a jobless future [11]. Researchers crisscrossing the globe have continued to argue that a substantial portion of jobs are at

"risk of AI technologies and automation [11]. Findings from [7], reported that 50% of all current work activities are technically automatable by adapting currently demonstrated technologies, and 6 of 10 current occupations have more than 30% of activities that are technically automatable [4]. The bottom line is that the differential effects of AI technologies depend on the type of occupation in question [23]. In the United States of America (US), [5] estimated that 47% of US jobs are at risk of being automated over the next coming years while [11], estimated that 9 % of jobs in the 21 OECD countries are potentially automated. In 5 ASEAN countries examined [21], researchers found that 56 % of current workers faces high risk of automation.

While history has shown that technological progress has encouraged the development of more jobs than it has ever done away with, has increased productivity, has driven sustained increases in living standards and has contributed to a change in the balance between work and leisure, all these have not been without some cost [4], More researchers today argue that the rate at which mental and physical work are beginning to align this time around is worrisome given the fact the world's economy has never been this intertwined.

Some have rightly asked us to brace themselves, as all countries will experience big changes in the workforce over the next 15 years, as AI technology and automation displace some jobs and shifts in labor demand [4]. A 2017 report from McKinsey Global Institute [4], this also noted that facilitating and smoothing these changes would be a major challenge for policy-makers and business leaders alike. Displacements of this size would only be possible because of the availability of ever larger and more complex datasets, known as big data [5].

While the AI revolution is not in its infancy, much of the recorded economic effect remains to be seen [14]. That has the ability to reshape the global environment of industries, jobs and countries ' economic growth.

A. What impact will AI have on work and why?

The potential impact of AI and automation on employment varies by occupation and sector [7]. Technology can make industries and various products obsolete, even eliminating industry-specific occupations but it can also change the organization of work, shifting work between occupations, between industries, or from producers to consumers [24]. These technological changes are vital to the success or failure of any nation as a technological gap would also translate into a political, economic, and social gap [25].

The McKinsey Global Institute [7], has reported that just about half of all the activities that people are paid to do globally could theoretically be automated using available demonstrated technologies. Chief Executives Officers (CEOs) have been shown to display an overwhelming sense of optimism placed in AI and automation despite the negative impact on workers these technological shifts may bring to the workplace [8]. The reasons may include projected cost savings, increased efficiency, improved performance outcomes, dealing with insufficient numbers of workers in certain domains, the need to stay innovative and remain an attractive employer [16]. It is abundantly clear and definite that in the next few years, AI and automation will have a profound impact on the global labor market, not just in manufacturing employment but also in the center of human

activities in the service sector that had been considered 'untouchable' until now [19].

B. Will there be enough work in the future?

Recent research are increasingly reporting that disruptive technologies of which AI and other technologies like predictive analytics, additive printing, the Internet of Things, nanotechnology and robotics, are not only getting smarter, but are also being combined [21]. This raises concerns about whether there will be satisfactory number of jobs for workers, even though theses disruptive technologies will lead to decrease in the costs of production and increase in the accessibility of a promise future of prosperity [21].

What some analyzes have shown, however, is that, with rapid economic growth , innovation and investment, there is the possibility of creating enough new job opportunities to offset the negative impact of IA and automation, especially in emerging nations, the key challenge will be to ensure that workers have the required skills and support to transfer to new jobs [7].

In order to ensure a smooth transition to the future in which AI and automation likely dominate possibly all aspects of humanity; enterprises, governments, policy-makers, workers and jobseekers should proactively adapt to the fast-encroaching AI technologies with a view to maximizing the opportunities that abound while minimizing the downsides [21]. Some researchers [9], [26], have also introduced the Universal Basic Income definition as a way to mitigate the stresses of future massive technological unemployment. This would entail the regular and unconditional redistribution of income to each person in society by the government.

III.   METHODOLOGY

In order to develop a better understanding about the perceptions of Asian undergraduates in relation to AI technologies in the workplace and how confident they are in their capabilities to take up unforeseen challenges that may arise, this study explores the following sets of research questions:

1) What is the self-confidence and adaptability skill level of Asian undergraduates?
2) What are the perceptions of Asian undergraduates with regards to the increasing utilization of AI technologies in the workplace?

This study adopts a quantitative research approach to data collection and descriptive statistics is used to analyze the data collected. A questionnaire was distributed randomly to undergraduates at strategic central on-campus locations at Yogyakarta State University. The respondents cut across various departments of the University. A total 84 duly completed questionnaires out of 90 distributed were used in this study. The result is shown in Table 1.

TABLE I. DEMOGRAPHIC INFORMATION OF RESPONDENTS

Parameter	Freq.	Parameter	Freq.
Age		**Study Prog. (Faculty)**	
Mean Age	20 (3)*	Science Education	1
Gender		Language & Arts	8
Male	29	Math & Natural Sciences	43
Female	36	Economics	21
Religion		Engineering	9
Muslim	78	Sport Science	1
Christian	6	Social Science	1

* Standard deviation in brackets

In addressing the first research questions; (Questions 10, 15 & 18) measuring self-confidence and (Questions 13 & 19) measuring adaptability skill on the Entrepreneurial Self-Assessment survey developed by Women's Initiative for Self Employment, [27] was used to assess the self-confidence and adaptability skill level of the respondents. The Entrepreneurial Self-Assessment survey is one of the best survey instruments available to measure various characteristics of entrepreneurs and has been adapted by various researchers and institutions [28].

The total score for each characteristic was measured using a 5 - point likert scale, and responses were aggregated based on their total score for each characteristic's corresponding questions and then categorized into 'High', 'Moderate' or 'Low' levels for the said characteristic.

For the measurement of self-confidence of each respondent, a total score above 10 points, equates to High levels of Self-confidence, between 6 – 9 points equates to Moderate levels of Self-confidence and below 6 equates to Low levels of self-confidence. While for the measurement adaptability levels of each respondent, a total score above 7 points, equates to High levels of adaptability skills, between 5 – 7 points equates to Moderate levels of adaptability skills and below 5 equates to Low levels of adaptability skills.

In addressing the second research questions; respondents were asked for their feelings about the possibility of AI technologies taking over their future jobs in the labour market with the following three response options; 'Scared', 'Confident' and 'Indifferent'.

IV.   ANALYSIS AND RESULTS

In analyzing the self-confidence and adaptability skill level of the respondents that shown in Table 2, results show that more than 70 per cent of respondents both have moderate levels of self-confidence and adaptability skills with more that 20 percent reporting Higher levels.

In analyzing the perceptions of the respondents with regards to the increasing utilization of AI technologies in the workplace that shown in Table 3, the results showed mixed feelings as the margin of difference among the three responses (Scared, Confident or Indifferent) by respondents was very small. Thus it is difficult to determine in absolute terms how the respondents feel about AI and the Future of their Jobs.

TABLE II. RESULTS TO RESEARCH QUESTION ONE BY RESPONDENTS

Self Confidence	Frequency	Percentage	Adaptability Skill	Frequency	Percentage
Low	1	1.2	Low	1	1.2
Moderate	62	72.6	Moderate	59	70.2

High	22	26.2	High	24	28.6
Total	**84**	**100**	**Total**	**84**	**100**

TABLE III. RESULTS TO RESEARCH QUESTION TWO BY RESPONDENTS

	(All respondents)		(Based on Gender)	
Perception of AI	**Freq.**	**Percentage**	**Male (%)**	**Female (%)**
Scared	32	38.1	14 (44)	18 (56)
Confident	29	34.5	7 (24)	22 (76)
Indifferent	23	27.4	8 (35)	15 (65)
Total	**84**	**100**	**29**	**55**

V.   DISCUSSION

This study relates to people's perception about the threats that AI technologies brings to the workplace especially to those who it matters most, 'the undergraduates' who are still been shaped and groomed for the already highly competitive jobs in the labour market. Hence it is imperative to determine the perception of these undergraduates, so that better decisions can be taken now to prepare them for the challenges that AI technologies will bring to the future labour market. Although no one can actually say with certainty what will prevail in the future with regards with AI technologies [9], it is always better to understand these technologies and to plan in advances for any eventualities.

Asian undergraduates have shown satisfactory levels of self-confidence and adaptability skills to take on the disruptive forces of AI technologies in the future, but still do not know what approaches to utilize. Some researchers have predicted that they would seek new and more relevant education and training to excel against these disruptive challenges posed by AI technologies [21].

Researchers from the McKinsey Global Institute [7], has estimated that between 0 to 30% of the hours worked globally could be automated by the year 2030 along with the displacement of between 400 to 800 million workers around the world, but these workers will need to upgrade their skill sets to take advantage of the new jobs that will also be created. The question now for undergraduates is how will they prepare themselves for these changes and who is responsible for helping.

Either way, undergraduates will need to continually develop themselves and their soft skills if they are to win against AI technologies in the labour market, for these skill sets are difficult for AI technologies to replicate at this time. The OECD [29], has also recommended that education system in the Southeast Asia region needs to be upgraded with the provision of the necessary information and communications technology (ICT) skills if students wishes to remain internationally competitive in this digital age. Generally, technological development such as the driverless cars, autonomous smart factory, service robots and 3D printing, etc. all have major implications for the labour markets [30], and there will always be winners and losers whenever a new technology is introduced into the labour market [31].

VI.   CONCLUSION

This study set out to analyze the readiness of Asian undergraduates, perception-wise towards the increasing presence and development of AI technologies in the workplace, while assessing how confident and adaptable they are to the changing circumstances. The study was also aimed at bridging the gap in literature as well as providing useful insight and recommendation to ensure that all relevant stakeholders especially undergraduates maximize the opportunities of AI technologies while reducing or totally eradicating the threats that AI technologies may pose to their success in the future labour market.

Our findings from the study reveals that majority of the respondents exhibits moderate to high levels of self-confidence and adaptability skills as more than 70 per cent of respondents reported having moderate levels of self-confidence and adaptability skills with more that 20 percent reporting Higher levels. However, the respondent's exhibits mixed feeling went it comes to their perception about AI technologies in the workplace. The margin of difference among the three response options (Scared, Confident or Indifferent) was insignificant and below 50% for each response category. Thus we could not determine in absolute terms how the respondents feel about AI technologies and the future of their jobs.

How AI technologies progress in the twenty-first century will massively impact on labour markets and possible outcomes remains to be seen but we are confident that whatever challenges that these technological progresses throws at Asian undergraduates, they are capable of weathering the storm, for they possess sufficient levels of self-drive to face their future head-on especially in the face of rising AI technologies. However, Asian undergraduates should never stop looking toward their economic and social well-being through continuous and rigorous analysis of the technological landscape, peer learning, sharing of knowledge as regards to AI technologies and other areas of interests.

REFERENCES

[1]   J. M. Keynes, "Economic Possibilities for our Grandchildren," *Revisiting Keynes*, 1930. Available: http://www.econ.yale.edu/smith/econ116a/keynes1.pdf

[2]   J. Manyika, *et al.* "A Future That Works: Automation, Employment, And Productivity," *McKinsey Glob. Inst.*, Jan. 2017.

[3]   D. H. Autor, 2015. "Why Are There Still So Many Jobs? The History and Future of Workplace Automation," Journal of Economic Perspectives, vol. 29, no. 3, pp 3-30, doi: 10.1257/jep.29.3.3.

[4]   J. Manyika, *et al.* "Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation," *McKinsey Glob. Inst.,* Dec. 2017.

[5]   C. B. Frey and M. A. Osborne, "The future of employment: How susceptible are jobs to computerisation?," *Turkish J. Endocrinol. Metab.*, Sept. 2013.

[6]   E. Ernst, R. Merola, and D. Samaan, "Artificial intelligence: Implications for the future of work," *International Labour Organization,* 2018. Available: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms_647306.pdf

[7]   McKinsey Global Institute, "Jobs lost, jobs gained: What the future of work will mean for jobs, skills, and wages," 2017. Accessed: May 1, 2020. [Online]. Available: https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the-future-of-work-will-mean-for-jobs-skills-and-wages

[8]   Economist Corporate Network, "AI, automation and the future of jobs and skills: The role of the CEO in shaping tomorrow's workplace in Asia," Oct. 2018.

[9]   E. P. G. Bruun and A. Duka, "Artificial Intelligence, Jobs and the Future of Work: Racing with the Machines," *Basic Income Stud.*, vol. 13, no. 2, Nov. 2018. doi: 10.1515/bis-2018-0018.

[10]   OECD, "Economic Outlook for Southeast Asia, China and India 2018: Fostering Growth Through Digitalisation," *OECD Publishing, Paris*, 2018. doi: http://dx.doi.org/9789264286184-en.

[11]   M. Arntz, T. Gregory, and U. Zierahn, "The Risk of Automation for Jobs In OECD Countries: A Comparative Analysis," *OECD Social, Employment and Migration Working Papers*, no. 189, OECD Publishing, Paris, doi: https://doi.org/10.1787/5jlz9h56dvq7-en.

[12]   C. B. Frey and M. Osborne, "Technology At Work: The Future of Innovation and Employment," *Citi GPS: Global Perspectives & Solutions,* Feb. 2015.

[13]   AlphaBeta, "PREPARING FOR AI: The Implications of Artificial Intelligence for Jobs and Skills in Asian Economies," Aug. 2019. [Online]. Available: https://www.alphabeta.com/wp-content/uploads/2019/08/ms-ai-report.pdf

[14]   International Telecommunication Union, "Assessing the Economic Impact of Artificial Intelligence," *ITU Trends Emerging trends in ICTs*, Sept. 2018. [Online]. Available: https://www.itu.int/dms_pub/itu-s/opb/gen/S-GEN-ISSUEPAPER-2018-1-PDF-E.pdf

[15]   J. Hendler, "Avoiding Another AI Winter," *IEEE Intell. Syst,* vol. 23, no. 2, pp. 2-4, Mar. 2008. doi: 10.1109/MIS.2008.20

[16]   J. Smids, S. Nyholm, and H. Berkers, "Robots in the Workplace: a Threat to—or Opportunity for—Meaningful Work?," *Philos. Technol.*, Nov. 2019. doi: 10.1007/s13347-019-00377-4

[17]   R. Evangelista, P. Guerrieri, and V. Meliciani, "The economic impact of digital technologies in Europe," *Econ. Innov. New Technol.*, *Taylor & Francis Journals,* vol. 23, no. 8, pp. 802–824, Nov. 2014. doi: 10.1080/10438599.2014.918438

[18]   D. Acemoglu and P. Restrepo, "Robots and Jobs: Evidence from US Labor Markets," *NBER Working Paper Series,* Mar. 2017. doi : 10.3386/w23285.

[19]   G. Wisskirchen *et al.*, "Artificial Intelligence and Robotics and Their Impact on the Workplace," *IBA Glob. Employ. Inst.*, April 2017.

[20]   Reference for Business, "Artificial Intelligence (AI)," *Encyclopedia of Management, A-Bud, Artificial Intelligence.* [Online]. Available: https://www.referenceforbusiness.com/management/A-Bud/Artificial-Intelligence.html.

[21]   J. Chang and P. Huynh, "ASEAN in Tranformation - The Future of Jobs at Risk of Automation," *International Labour Organization,* July 2016.

[22]   M. Haseeb, Sasmoko, L. W. W. Mihardjo, A. R. Gill, and K. Jermsittiparsert, "Economic impact of artificial intelligence: New look for the macroeconomic assessment in Asia-pacific region," *Int. J. Comput. Intell. Syst.*, vol. 12, no. 2, pp. 1295–1310, 2019.

[23]   E. Dahlin, "Are Robots Stealing Our Jobs?," *Socius,* May 2019. doi: 10.1177/2378023119846249

[24]   J. Bessen, "How Computer Automation Affects Occupations: Technology, Jobs, and Skills," *Boston University School of Law, Law and Economics Research Paper,* No. 15-49, Oct. 2016. [Online]. Available: https://scholarship.law.bu.edu/faculty_scholarship/813

[25]   International Labour Organization, "Digitalization and Decent Work: Implications for Pacific Island Countries," *ILO Office for Pacific Island Countries,* July 2019.

[26]   Q.-C. Pham, R. Madhavan, L. Righetti, W. Smart, and R. Chatila, "The Impact of Robotics and Automation on Working Conditions and Employment [Ethical, Legal, and Societal Issues]," *IEEE Robot. Autom. Mag.*, vol. 25, no. 2, pp. 126–128, Jun. 2018. doi: 10.1109/MRA.2018.2822058.

[27]   Women's Initiative for Self-Employment, "Entrepreneurial Self-Assessment Survey Instrument." [Online]. Available: https://s3-us-west-2.amazonaws.com/oerfiles/WMBusiness/Entrepreneur-Self-Assessment-Survey.pdf

[28]   Federal Reserve Bank of Kansas City, "Entrepreneurial Self-Assessment Survey Instrument." [Online]. Available: https://www.kansascityfed.org/~/media/files/publicat/education/teachingresources/entrepreneurial-self-assessment.pdf?la=en.

[29]   OECD, "Economic Outlook for Southeast Asia, China and India 2020: Rethinking education for the digital era," *OECD Publishing.* [Online]. Available: https://www.oecd.org/dev/asia-pacific/SAEO2020_PRELIMINARY_VERSION_FOR_WEB.pdf.

[30]   G. Petropoulos, "The impact of artificial intelligence on employment.," *Praise for Work in the Digital Age,* pp. 119–132, 2018. Available: https://www.bruegel.org/wp-content/uploads/2018/07/Impact-of-AI-Petroupoulos.pdf

[31]   M. Webb, "The Impact of Artificial Intelligence on the Labor Market," *Stanford Univ.*, Jan. 2020. [Online]. Available: https://web.stanford.edu/~mww/webb_jmp.pdf