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ROBOTS INVESTMENT AND DECREASE IN TOTAL EMPLOYMENT

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ABSTRACT

This work explored on the relationship between robots investment and decrease in total employment. The objective of the study was to ascertain if robots investment decrease total employment. The method involved in the study was the use of extant literature on the subject matter (journals, books, internet and other published materials) and qualitative content analysis. The study revealed that robots investment decreases total employment. The study concluded that no one knows with certainty how robots will shape our future society, and that uncertainty itself can be unnerving. Among other things, the study recommended that robots have come to stay, thus high-tech firms should create new tasks where humans can adopt simultaneously with robots to enhance effective operations and productivity while managing their total employment; Firms who are keen to investing in robots or already operates with robots should invest in training and development of their human resources, so as to keep their skills and knowledge up to date, which in turn would motivate them to professionally work in tandem with robots, thus managing total employment.

Keywords: Robots, robots investment, decrease in total employment.

INTRODUCTION

As robotics and artificial intelligence (AI) become increasingly used by firms as the next engine of innovation and productivity growth, their effects on labour, firm practices and productivity have become a subject of growing importance (Jay, 2020). According to extensive anecdotal evidence in the media, robots reduce overall employment and exacerbate income inequality, as rapid advancements in vision, speech, natural language processing and prediction capabilities have achieved parity with or exceed human capabilities across a range of tasks (Jay, 2020).

The above technological advancements have shifted the comparative advantage from humans to machines for a growing list of occupations (Brynjolfsson & Mitchell 2017; Felten et al., 2019; Frey & Osborne 2017), potentially leaving human labour with substantially fewer activities that can add value (Ford 2015). This technology-based labour substitution may displace a significant proportion of the overall workforce, despite generating productivity gains (Acemoglu & Restrepo 2020; Autor & Salomons 2017). If true, robot adoption is likely to cause significant changes in how firms organize production activities and manage their human capital (Bidwell 2013; Puranam et al., 2014).

It is vital to note that much has been written about the threat that robots, defined as "embodied, automatically controlled, reprogrammable multipurpose entities that perform useful tasks for humans or equipment" (International Federation of Robotics, 2017), pose to jobs (e.g., Lee et al., 2018). Frey and Osborne (2017) estimated that in the next 2 decades, robots will replace humans in 47% of jobs, especially manual labor job. Despite the above prediction some investors and high-tech organizations are investing on robotics to enhance higher operations, productivity and performance of their businesses. In light of the above, the researchers were posed to explore on the concept of robots investment and decrease in total employment.

Statement of Problem

Fears of artificially intelligent machines have lingered in the human imagination for thousands of years (Jay, 2020). Greek myths like those of Talus or Pandora told of artificial beings created by the gods wreaking chaos and destruction when they were sent to live among mortals on earth. Recent breakthroughs in artificial intelligence have expanded the production potential of machines. At the

same time, this has focused attention on the potential for robots to wreak havoc on labour markets. Machines imbued with humanlike judgment and flexibility threatens to displace human workers from many of the tasks they currently perform in the economy. However, research examining the effect of robots on labour is still relatively nascent, with only a few studies examining the substitutability of robots on work (Acemoglu & Restrepo 2020; Arntz, Gregory and Zierahn 2016; Frey and Osborne 2017; Mann and Püttmann 2017; Manyika et al. 2017). However, most of these preliminary studies predict dire consequences resulting from the labour displacement attributable to robot adoption. It is on this premise the researchers were geared to ascertain if robots investment decreases total employment in the industrial world.

Objective of the Study

The objective of this study is to ascertain if robots investment decreases total employment in the society.

Conceptual Review

Concept of Robots Investment

A robot is a system that contains sensors, control systems, manipulators power supplies, and software all working together to perform a task (Mohammed & Syed, 2014). Robotics is a branch of engineering that involves the conception, design, manufacture and operation of robots. The objective of the robotics field is to create intelligent machines that can assist humans in a variety of ways (Katie, 2021). Robotics can take on a number of forms. A robot may resemble a human, or it may be in the form of a robotic application, such as robotic process automation (RPA), which simulates how humans engage with software to perform repetitive, rules-based tasks (Acemoglu & Restrepo, 2020). While the field of robotics and exploration of the potential uses and functionality of robots have grown substantially in the 20th century, the idea is certainly not a new one. Interests have risen in investing on robots among high technology inclined organization, hence, the emergence of robot investment.

Robot investment is a measure of robot capital stock was created by using the data that capture imports of robotics hardware and adding all robot purchases by each firm recorded in each year. To adjust the robot capital stock measure for economic depreciation, a useful life of 12 years was assumed based on IFR guidance (Jay, 2020). Robots investment is the procurement of humanlike machine to man some aspects of activities in order to enhance effective operations and productivity. Realistically, according to Philip and Thomas (2021), in the coming decades, investing in robotics and the rising use of automation will be one of the most exciting options for stock buyers. Manufacturers of robotics and automation systems have realized a growing need to improve manufacturing efficiency in several sectors of the economy. The already well-established robotics industry is entering a new phase of long-term expansion due to the rising use of information technology in manufacturing and the Industrial Internet of Things (IIoT) boom, which should motivate many businesses to take action. Not long ago, robots seemed like a technology from the distant future. Today, however, they are all around us, from warehouses and construction sites to hospitals and shopping malls. Investment in robotics is pouring in: last year, start-ups in the field received more than $17 billion, three times more than in 2020. In 2022, the volume of investments decreased slightly compared to last year, but the sector still attracted more than $5 billion. For many years, companies in this field are no longer specialized, and interest in them has increased. Now, robotics isn't just attracting investors focused on cutting-edge technology: in April, Amazon announced its $1 billion Amazon Industrial Innovation Fund, which invests in companies from fields such as customer fulfillment, logistics, and supply chain organization.

Concept of Total Employment

Total employment includes paid employment and self-employment. It is expressed in number of persons. If a person occupies several jobs over the same period, whether salaried or self-employed,

he or she is counted only once, according to his or her main status, i.e. the one that provides the highest income over the year (Mohammed & Syed, 2014). Total employment is measured in the "Employment Estimates", which are based on the social security declarations of companies (Bivens & Zipperer, 2018). Total employment is an economic situation in which all available labor resources are being used in the most efficient way possible (Potters & Costagliola, 2023). Total employment embodies the highest amount of skilled and unskilled labor that can be employed within an economy at any given time. Total employment is an ideal and probably unachievable situation in which anyone who is willing and able to work can find a job, and unemployment is zero. It is a theoretical goal for economic policymakers to aim for rather than an actually observed state of the economy. In practical terms, economists can define various levels of full employment that are associated with low but non-zero rates of unemployment.

Robotics on Employment

Companies such as iPhone manufacturer Foxconn, which has been plagued by a series of labor scandals, has announced plans to add more than one million robots to its workforce. It still has a long way to go, however, as only about 20,000 are currently in use (Purnell, 2013). According to the International Federation of Robotics, overall paid employment has risen in most countries including Brazil, China, Republic of Korea, Germany, and USA, but not Japan, which has seen a decline. The statistics mainly show a reduction in employment in manufacturing in the developed countries, often a small reduction. This coincides with an increase in output and an increase in robotics use, except in the case of Japan. The robot industry itself generates 170,000e190,000 jobs worldwide, to which can be added the support staff and operators, another similar number of people (Mohammed & Syed, 2014). Despite the rapid increase in the use of robots, USA has proportionately half the number of robots used by Germany. Germany itself (partly because of a different industry mix) is third, behind Japan and Korea.

It is important to note that the concept of "jobless recovery", where an industry comes out of a recession leaner, needing fewer employees, is only short term. It is likely to lead to more job creation by the leaner, more competitive companies. At the same time, the service sector continues to absorb most of the displaced people. Some of these new service people owe their jobs to a new robot driven industry. The research by the International Federation of Robotics further points out that, although automation displaces people in manufacturing, it almost always increases output. In some cases this allows such an increase in production and related decrease in unit price that creates a whole new market and generates the need for downstream jobs to get the product to the consumer (Hay, 2013). This releases employees for other, often new jobs outside manufacturing. An alternative view is that this displacement in the future will be more difficult to place, as service robotics may take over some or many of the new job opportunities in human tasks such as in banking, fast food chains, and retailing petrol forecourts (Sims, 2013). David Sims in his blog reports that Drew Greenblatt, the president of Marlin Steel, an American company that manufactures wire baskets and sheet metal products praises the way robots have helped his company grow 25% and increase operational safety (McNickle, 2013).

Greenblatt told Inc.com that when he bought the company, which was the largest bagel basket maker in the country, in the late 1990s, "the most modern technology in the plant was a fax machine," and the top workers could produce a basket by hand every 12 seconds. Today, robots can make five baskets per second, with precision that is "light years beyond what we were capable of before." Greenblatt argues that robots have made his workers more valuable and highly paid than their competitors. Recently, we won a huge order for sheet metal brackets, he noted. The brackets were formerly made in China by workers who earned $2.50 an hour and produced perhaps 50 an hour. Our sheet metal operator earns 10 times that rate, but sets up a robot that produces 2,000 brackets an hour (Greenblatt, 2013). However, critics of the automation boom claim that such technological advancements are killing off middle-class jobs. Robots and automated systems have not only eliminated elevator operators and highway toll collectors, but are also making inroads into

higher-skilled job functions, and the long-term effect in job losses among human workers may be much more severe than most expect (Mohammed & Syed, 2014).

Robots investment and decrease in Total Employment in the Society

It is undoubted investment in robotics is fast reducing the employment of humans in high-tech organization. According to Mohammed and Syed (2014), most of the experts interviewed by the Wall Street Journal were worried about all these job-stealing robots. In a time of growing economic inequality, the elimination of these jobs seems discouraging. Although the costs are real, there are also plenty of upsides. The most obvious are the efficiency gains that come with automation. Robots can do some jobs better, cheaper, and faster than humans. They can transcribe and store information of their clients or customers. For example, hospitals that have high tech technology like robots do the works of transcription and information storage of patients. They even diagnose their patients (Mead, 2013). Singularity Hub, a leading technology blog, reports that El Camino Hospital in Silicon Valley is looking to cut expenses, so they've invested in 19 Aethon TUG robots. These smart carts can haul supplies around the hospital, making deliveries and pickups at a fraction of the costs of human workers. El Camino Hospital recently announced that it would further be cutting costs by firing up to 140 workers from its two facilities in Los Gatos and Mountain View. According to a hospital administrator quoted in the Business week article the 19 TUGs perform $1 million of human labor/ year, but only cost $350,000. A 65% reduction in labor costs (Clever, 2022).

Illustratively, a bricklaying robot can work six times faster than the average construction worker, without breaks and benefits (Murphy, 2017). The above implies that the use of robots in bricklaying will drastically reduce employment of humans in the society. It is true that there are some "technophobes" who like the Luddites of the Industrial Revolution explicitly dislike and fear robots (Dekker et al., 2017; McClure, 2018), but little work has examined how working adults generally react to the rise of robots at work. Yam et al. (2022) stated that robot induced job insecurity will be associated with more maladaptive workplace behaviors, including burnout and workplace incivility.

However, it is possible that the impact of robots will not be very different from previous waves of automation that created enough tasks for humans to compensate for the workers that new machines displaced. Although switching workers to other tasks was often fraught and not all of them could benefit, past automation generated a roughly constant share of rapidly increasing output (Jay, 2020). Importantly, investments in robotics may also create demand for human labour and tasks that complement robots. While demand for middle-skilled work may decrease through direct substitution, demand for complementary work either lower or higher skilled may increase with robot adoption. For firms that redesign their production processes to leverage the capabilities that robots can offer, productivity may increase, ultimately leading to increases in employment for specific types of workers. Despite recent technological advances, robots are often unable to fully automate most production processes.

For many of these so-called residual tasks, human labour remains a more efficient and cost-effective solution (Brynjolfsson & Mitchell 2017). For example, Elon Musk famously scaled back investments in automation in the Tesla factory and reintroduced human workers after too much automation slowed the production of the Model 3 electric vehicle and delayed its market launch (Hawkins 2018). To use robots effectively, human capital must also be reorganized and reassigned to assist with production. For example, Amazon significantly redesigned work in its warehouses to use its Kiva Robotic systems effectively. As part of this redesign, robots are used to travel between locations within the warehouse, but human workers pick and pack the products delivered by the robots. In this case, instead of using middle-skilled workers to manage inventory by walking from shelf to shelf to examine and handle products, robots and algorithms can automate this process and bring inventory to human workers directly. These human workers then pick up the items and place them into shipping boxes. Researchers have also systematically matched occupations to what machine learning can do and found that many of the manual skills performed by low-skilled labour cannot be replaced easily with technology (Brynjolfsson & Mitchell 2017; Felten et al., 2019). While machine

learning is not identical to robot technology, robotics relies heavily on machine learning to make inferences, which can be a useful indicator of the potential impact of robots on work.

Theoretical Review

This study is theoretically founded on cognitive appraisal of stress theory. It was proposed by Lazarus and Folkman in 1984 and it explained the mental process which influence of the stressors (Sincero, 2021). According to Lazarus and Folkman (1984), stress is a two-way process; it involves the production of stressors by the environment, and the response of an individual subjected to these stressors. Cognitive appraisal occurs when a person considers two major factors that majorly contribute in his response to stress. These two factors include the threatening tendency of the stress to the individual, and the assessment of resources required to minimize, tolerate or eradicate the stressor and the stress it produces (Sincero, 2021). When an individual encounters a self-relevant stimulus, he or she will engage in appraisal processes (Smith & Pope in Yam et al., 2022), a stimulus is either cognitively appraised as being congruent or incongruent with one's goals.

Implications of the theory to the Study

It is important to note that decrease in total employment is a subjective appraisal, thus a perceived threat to the continuity and stability of human employment to this jet age where robots or human-like machines are carrying out human activities in the workplaces. Job insecurity prompted by decrease in employment is a function of threats that surrounds industrialization. Cognitive appraisal theory of stress enables us to understand how environmental stimuli (being exposed to robots) might affect employees' perception of decrease in total employment. It is perceived that robots investment would influence reduction in employment of humans as they (robots) tend to carry out human activities even for longer hours than humans as far as they are programmes appropriately. Frey and Osborne (2017); and Murphy (2017) asserted that robots can outperform humans in manual labour. Much investment in robotics may cause people to appraise the rise of robots as a threat to their jobs, leading to a goal incongruent appraisal which results in decrease in total employment.

Empirical Review

Jay (2020) conducted a study on employment consequences of robots with reference to firm-level evidence. A dataset created by Employment and Social Development Canada, which contains ratings of the level of manual dexterity and verbal ability associated with over 920 distinct occupations on a four-point scale was used for the study. The regression model was adopted in the analysis of data. The study revealed that investments in robotics are associated with increases in total firm employment, but decreases in the total number of managers. It also finds that robot investments are associated with an increase in the span of control for managers remaining within the organization. This study provides evidence that robot adoption is not motivated by the desire to reduce labour costs, but is instead related to improving product and service quality. These findings are consistent with the notion that robots reduce variance in production processes, diminishing the need for managers to monitor workers to ensure production quality. Decreases in managerial headcount may also arise from changes in workforce composition. This study finds that investments in robotics are associated with decreases in employment for middle-skilled workers, but increases in employment for low-skilled and high-skilled workers, potentially changing managerial activities required by the firm.

Yam et al. (2022) examined if the rise of robots increases job insecurity and maladaptive workplace behaviors with multimethod evidence. 6 studies including two pilot studies, an archival study across 185 U.S. metropolitan areas (Study 1), a preregistered experiment conducted in Singapore (Study 2), an experience-sampling study among engineers conducted in India (Study 3), and an online experiment (Study 4) find that increased exposure to robots leads to increased job insecurity. Study 3 also reveals that this robot-related job insecurity is in turn positively associated with burnout and

workplace incivility. Study 4 reveals that self-affirmation is a psychological intervention that might buffer the negative effects of robot-related job insecurity. Their findings hold across different cultures and industries, including industries not threatened by robot.

Mohammed and Syed (2014) examined the impact of robotics on employment and motivation of employees in the service sector, with special reference to health care. The study adopted an exploratory research design, based on secondary data, such as books on topics related to robotics, websites, public websites of concerned departments for data and statistics, journals, newspapers and magazines, websites of health care providers, and different printed materials (brochures, etc). The impact of robotics has both positive and negative impacts on the employment and motivation of employees in the retail sector. So far, there has been no substantial research done into robotics, especially in the health care sector.

Acemoglu et al. (2023) estimated the effects of robot adoption on firm-level and worker-level outcomes in the Netherlands using a large employer-employee panel dataset spanning 2009-2020. The dataset contains all firms that have 50 employees and above, and a representative sample of firms smaller than 50 employees per year for the 2000-2020 period. The study observed around 55 thousand unique firms per year. The study also focused on manufacturing, energy, water and waste, construction, mining, and transportation firms. The firm-level results confirm previous findings, with positive effects on value added and hours worked for robot adopting firms and negative outcomes on competitors in the same industry. The worker-level results show that directly-affected workers (e.g., bluecollar workers performing routine or replaceable tasks) face lower earnings and employment rates, while other workers indirectly gain from robot adoption. We also find that the negative effects from competitors' robot adoption load on directly-affected workers, while other workers benefit from this industry-level robot adoption. Overall, our results highlight the uneven effects of automation on the workforce.

CONCLUSION

No one knows with certainty how robots will shape our future society, and that uncertainty itself can be unnerving (Knyazev et al. as cited in Yam et al., 2022). Technology may have fundamentally changed the nature of work, but people seem fundamentally unchanged: We still fear that a workplace with robots is a workplace without us. However, Jay (2020) averred that whether robotic automation will lead to a permanent decline in the role of labour or play out like its non-robotic predecessors depends on how firms reorganize production after adopting robots.

RECOMMENDATIONS

Based on the explorative study, the following were recommended:

1. Robots have come to stay, thus high-tech firms should create new tasks where humans can adopt simultaneously with robots to enhance effective operations and productivity while managing their total employment.
2. Firms who are keen to investing in robots or already operates with robots should invest in training and development of their human resources, so as to keep their skills and knowledge up to date, which in turn would motivate them to professionally work in tandem with robots, thus managing total employment.
3. Government institutions should start collaborating with the manufacturing and service sector so that industry specific and futuristic courses are introduced for employees, as this will enhance competent workers to compete not only amongst themselves but with robots in the near future, as robots alone cannot do the job except they are manipulated or programmed.
4. Empirical research should be conducted to ascertain it robots investment decreases total employment in Nigerian manufacturing industry.

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