Will Employees and Technology Continue to Coexist Despite Historic Tensions?

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Abstract

In developed economies, the integration of technology into the labour force has largely led to massive job losses, and workers have met this with stiff resistance. This has changed the dynamics of industrial relations in this era of digital age. The purpose of this study was to investigate the ways in which digitalisation has been affecting human labour in workplaces in South Africa and what can be done to enable employees–technology coexistence. In the study, I used qualitative data-collection methods—interviews, observation and document collection. I used purposive and convenience sampling to select the participants. Analysis of the collected data yielded six major findings. The major tenets of these findings were that digitalisation leads to job losses in South Africa and that the country was not sufficiently preparing students and workers for human–machine collaboration. Although the study was intended to focus on various sectors of the South African economy, I was more biased towards the local banking sector. This could be viewed as a limitation of this study. The study made practical and methodological contributions. It also made an essential contribution to digital transformation theory and employee relations body of knowledge. A major recommendation is that policymakers should mitigate against technology shocks and uneven geographical phenomenon by connecting major commercial hubs with major labour market hubs. Future studies should focus on the impact of technology on employees in each economic sector in South Africa.

Keywords: technological integration into labour force; industrial relations in the digital age; impact of technology on employees; employees–technology coexistence; technology shocks; uneven geographical development

Introduction, Background and Orientation

Although technology has added substantial value to human lives during the past 200 years, people generally and workers in particular have always been distrustful of and somewhat threatened by technology. Although the role of technology in people's lives is highly treasured, some persons have adopted a love–hate attitude towards substantial technological advancements (shocks) (Frey & Osborne, 2015). This love–hate posture is heightened by threats of and actual job losses, negative attitudes towards (suspected or real) the role of technology in privacy invasion, increasing cybercrimes, emerging infectious diseases, etc. Technological shocks during the industrial revolution led to substantial job losses, massive middle-income job losses, wages lagging behind output growth, widening inequality and political polarisation (Armstrong & Lee, 2023b). Some workers in Britain rioted against mechanised manufacturing firms. Blue-collar workers waged a war against technology (O'Rourke et al., 2023). At the present time even the jobs of white-collar workers have massively been affected by digitalisation (automation of functions) (Armstrong & Lee, 2023a). This has increased the hostility of humans towards technology. In the past and recently, some people, predominantly workers, have been hostile towards technology to an extent that they destroyed machines and technological equipment. People who physically destroy technology are called the Luddites (O'Rourke et al., 2013).

The fourth industrial revolution (4IR) is an era characterised by accelerated technological progress (Dagada, 2021). The 4IR technologies include artificial intelligence, the internet of things, enhanced robotics, big data and decision-making, blockchain, sensors, 3D printing, nanotechnology, biotechnology, material science, quantum computing, and autonomous vehicles, to mention but a few (Dagada, 2024). Even though access to 4IR technologies is not yet widespread, we are living in this era. The 4IR includes the employment of advanced technologies in commercial activities and industrial production. Some scholars and professionals equate the 4IR with Industry 4.0 and refers to the 4IR as Industry 4.0. This term was publicly introduced in 2011 at the Hannover Fair to illustrate the ways in which the use of artificial intelligence would drastically transform the structuring on international value chains (Schwab, 2016). By giving rise to smart factories, the 4IR envisages a universe in which virtual and physical systems interface. This would allow unlimited customisation of services and products, and the formation of innovative operating models. Although the 4IR has many huge advantages, some policymakers, academics and analysts have raised concern about its contribution to massive job losses (Frey & Osborne, 2015).

Broadly, there is consensus that technology has a positive effect on productivity. In his book, former chair of the United States (US) Federal Reserve, Dr Alan Greenspan, asserted that technology boosted the economies of the countries referred to as the Asian Tigers (Taiwan, South Korea, Hong Kong and Singapore) (Carson, 2020; Greenspan, 2007). Undeniably, technology did indeed make it possible for these countries to

significantly escalate their productivity and gross domestic products (Bozkurt & Karakoy, 2022).

Although there is consensus that digitalisation increases productivity, policymakers and economists have been grappling with calculating the exact percentage of economic development which can be ascribed to the role of technology (Greenspan, 2007). This assertion is supported by eminent economists such as the executive chairman of the World Economic Forum, Prof. Klaus Schwab, and Google's chief economist, Prof. Hal Varian. One of the distinct manifestations of digitalisation to economic development has been its immense impact on the exponential rise of digital transformation (Dagada, 2021).

During the past few years, robots powered the internet of things and artificial intelligence have massively boosted productivity in both services and manufacturing sectors (Webster & Ivanov, 2020). Robots have become very advanced and efficient. I observed this in 2019 when I undertook a study visit to the Huawei Manufacturing Campus in Shenzhen, China. This campus had 350 robots and about 21 000 human workers. The following functions were digitalised through advanced robotics: incoming check-ups, printed circuit board assembly (PCBA), PCBA testing, system assembly, system texts, packaging and delivering. In the absence of digitalisation, this industrial campus would have needed a total of 45 000 employees to manufacture thousands of parts and finished products daily. Although the robots have taken about 24 000 jobs, one would argue that the overall input of Huawei in the economy in general far exceeds the loss of jobs. In addition, although jobs would have been lost in this manufacturing plant, many more jobs have been created in the value chain and in the broader economy. It is my considered view that Huawei would not have surpassed iPhone and become the second largest smartphone supplier worldwide if it did not employ advanced robots.

Digitalisation happens when technology enables some complex business activities to be automated and processed with no, little or moderate involvement of employees. Advanced robotics, artificial intelligence, the internet of things and sensors play a fundamental role in the digitalisation of functions and productions (Armstrong & Lee, 2023a). Digitalisation streamlines business activities and processes for simplicity, leads to digital transformation, boosts product and service quality, improves productivity and reduces costs. Unfortunately, in most instances, digitalisation leads to retrenchments of employees (Armstrong & Lee, 2023b).

Purpose, Objectives and Motivation for the Study

The purpose of this study was to investigate the ways in which automation affects the functions and employment of workers. The objectives were therefore outlined as follows:

- Undertake a study of the literature to determine the following:
  - the displacement of workers by digitalisation of functions in workplaces; and
  - the emergence of the Luddites.
- Determine by means of the field study the following:
  - how advanced technologies have automated and taken over many functions that were traditionally done by employees;
  - the possible role of corporate South Africa and government to mitigate job losses that are caused by digitalisation; and
  - measures that could be undertaken to secure the continued employment of employees during the 4IR era.
- Determine by means of studying documents collected from organisations of some research participants how they were preparing the workforce for the 4IR era.
- Make recommendations to the policymakers and scholars based on the literature review and findings of the study.

Before embarking on the study, I found that there was a gap in the literature regarding the impact of digitalisation on employees in workplaces. There was no substantive literature which indicated how job losses that are caused by digitalisation could be mitigated at both macro (public policy) and micro (workplace) levels.

In this context, the research question is formulated as follows:

- What is the impact of technology on employees?

To answer the research question, it was necessary to answer the following sub-questions:

- How is corporate South Africa preparing workers for the human–machine collaboration?
- How are basic and higher education systems preparing students for the human–machine collaboration?
- What should be done to ensure employees–technology coexistence?

Definition of Terms

Policymakers refer to politicians who hold executive positions. These include the president of the Republic of South Africa, the deputy president, ministers, premiers, members of executive council (MECs), and mayors.

Lawmakers refer to legislators in the national parliament, provincial legislatures and municipal councils.

Digitalisation, automation and mechanisation are used interchangeably in this article and have the same meaning.

Unless specified, the word "study" refers to the study which this article has been derived from.

Brief Literature Review

This section focuses on the displacement of workers which was caused by the automation of functions in workplaces, and consequently the emergence of the Luddites.

Displacement of Workers by Digitalisation

Some studies have found that almost half of American, Asian and Western European jobs can be executed by advanced robots (Armstrong & Lee, 2023b; Frey & Osborne, 2017). This has led to some highly regarded leaders, including Microsoft founder Bill Gates, proposing that robots be taxed to make up for the income tax that an employee would have been taxed. However, free-market advocates such as the former US treasury secretary, Prof. Lawrence Summers, have vigorously objected to this. In 2017, lawmakers in the European Union voted against a similar proposal which they described as irrational (Domash & Summers, 2022). My view is that taxing robots will hold back both production output and economic growth. This would also reduce the overall tax base and therefore the revenue for governments would also shrink.

Long before the inception of robots in workplaces, technologies such electricity, computers and production machines were expected to reduce the workforce in the economy, but this did not materialise. Even the esteemed economist, John Maynard Keynes, was proven wrong when, in 1931, he asserted that the widespread adoption of technology would lead to massive unemployment (Heilbroner, 1999). The question is: how many jobs will be digitalised in 30 years' time? It appears as if all the jobs will be automated. Nonetheless, jobs that are predominantly knowledge driven and that require personal judgement and discretion will still be done by people. After extensive reading, empirical research, and interacting with policymakers, I have established that most workplace functions in future will require human–machine collaboration to produce certain products and services (Armstrong & Lee, 2023a; Attaran, 2023).

Digitalisation in workplaces will not be fully slowed down through taxation or legislation (Gasteiger & Prettner, 2022). If South Africa wants to increase its productivity and economic growth by blending employees and digitalisation, it should provide the workforce with proper education and skills that are suitable for the 4IR era. The advice offered by the then University of Johannesburg vice chancellor, Prof. Tshilidzi Marwala, of converging various sciences and increasing interdisciplinary studies should be heeded (Xing & Marwala, 2017). Employees who will do well in workplaces when digitalisation become ubiquitous are those who would have gained exposure to both natural and social sciences. Political leaders, learning institutions, civil society and corporate South Africa should do everything possible to

create an environment that is conducive to the harmonious and thriving coexistence of advanced technologies and workers.

Before I go further, it would be essential to give a brief overview of 4IR technologies. The industrial revolutions have moved through various changes and stages (Rymarczyk, 2021; Dagada, 2024). Each of these revolutions built and extended on the previous ones. The First Industrial Revolution used some basic tools or technologies to work on primary production such as agricultural fields, animal husbandry, fishing, hunting and mining. The Second Industrial Revolution employed water and steam power to mechanise production. Electric power and mechanisation were invented, and this made it possible to embark on the mass production of goods (Attaran, 2023; Mokyr, 2018). The Third Industrial Revolution made use of electronics and information and communications technology (ICT) to automate production and service delivery. In contrast, 4IR technologies brought massive digitalisation in service provision and production of goods (Dagada & Eloff, 2013).

Emergence of the Luddites

Frey (2019) asserted that advanced technologies have been worsening inequality and fuelling political revolutions. Frey further claimed that there have been instances where advanced technologies influenced the electoral outcome. He observed that, during the 2016 US presidential elections, the electoral districts in which digitalisation was higher mostly voted for Donald Trump. Three swing states, which had predominantly been dominated by the democrats since the 1992 elections, surprisingly voted for Trump. This was owing to digitalisation in workplaces and unprecedented job losses in those districts and states.

Uneven geographical development goes hand in hand with rapid economic growth which is driven by technology. Major concentrations of productive resources become more concentrated in certain cities, districts, and new developmental nodes than others (Bond, 2018). Massive technology developments rarely occur evenly across a province or city. There are more robots and the adoption of digitalisation in Michigan than the whole of the American West. Dense concentration of the 4IR technologies in some US regions led to enormous job losses. Frey (2019) concluded that it is because of this phenomenon that where there is more digitalisation in workplaces in the US there were many social ills such as high unemployment rates, rising divorce rates, crime and increased suicide rates. In the 2016 presidential election in the US, uneven geographical development has worked against Hillary Clinton. This is because Trump promised radical economic change that will create many jobs, which is what those who were displaced because of digitalisation in workplaces needed to hear.

As Frey (2019) articulated, technology shocks have always led to massive job losses and workers had therefore been resisting excessive employment of digitalisation in their workplaces. Since the advent of the Second Industrial Revolution, blue-collar workers had been hostile towards technology that enables automation of functions in

workplaces. Automation and machine enabled mass production during the Second Industrial Revolution led to the drastic reduction of middle-income jobs (Armstrong & Lee, 2023b). Some workers in British manufacturing firms revolted against mechanised production. They destroyed production machines, and cotton and woollen mills. The term "Luddites" came into being during this time—referring to people who were violently opposed to the introduction of new technology in workplaces which they believed cause job losses and render human labour redundant (Poitras, 2020). Technology did indeed replace human labour during the Second Industrial Revolution and triggered huge misery among the people. That suffering lasted for just over seven decades. The Second Industrial Revolution started around 1870 (Armstrong & Lee, 2023a).

Research Methodology

Research Approach

In this study, I employed qualitative research methodology. This methodology was useful in testing the research questions and sub-questions of the study. The participants also constituted a rich and valuable source of information. This study went "beyond numbers" and statistics (Greenhalgh & Taylor, 1997, p. 741). It took the form of a generic study to examine the impact of technology on employees and the ways in which job losses can be mitigated.

Participants and Sampling

The participants in this study were policymakers, lawmakers, technocrats, academics, unionists and business executives. Convenience and purposive sampling were used to select the participants. It was inexpensive and convenient to interact with them because they were all based in South Africa and most of them had access to online meeting platforms such as MS Teams or Zoom. Convenience sampling as applied in this study might not assure an impartial representation of the South African situation. This perceived limitation was mitigated by purposive sampling (Kenny et al., 2023).

The participants were also chosen on purpose because of the perceived contribution that they could make to the study. According to Truman (2023), the strength of purposive sampling is based on the selection of the participants who will narrate data-rich cases for an in-depth study.

Data Collection Techniques

The data-gathering methods that I used in this study were interviews, observation, and document collection and the analysis thereof. This study complied with the principle of triangulation by employing multiple data-gathering methods and sources (Shrivastava & Shrivastava, 2023).

I conducted semi-structured interviews with 39 participants. This made it possible to get hold of information from the numerous informants. Interview protocols were employed to gather data and to provide responses to the research question and its sub-questions.

The interview is a particularly suitable data-gathering method for the environment concerned, and made it possible to collect valuable information with reference to the types of research question. This provided me with an opportunity for direct exchange with the contributors to the study. It enabled me to obtain facts directly from the research participants.

In the study, I employed observation as one of the data-collection methods. I observed the ways in which some technology applications (apps) function. These include using functionalities of digital banking apps of the five major retail banks in South Africa, namely, Absa, Capitec, First National Bank (FNB), Nedbank and Standard Bank, and the new entrants which dubbed themselves digital banks, namely, Bank Zero, Discovery Bank and TymeBank. Opening bank accounts through the bank apps of the new three digital banks showed me how digitalisation is displacing thousands of workers from the banking sector while at the same time proving great convenience to the customers.

I visited some manufacturing plants, service centres and retail outlets to observe how advanced technologies enable digitalisation of services provision and manufacturing and packaging of products. In the farms and mines, I marvelled at the role of drones in security. During these observation sessions, I asked the managers how many workers would have been required if their facility did not have robots and drones. Their answer indicated that automation reduces the workforce by around 80%. This observation is supported by Armstrong and Lee (2023a).

My attitude in this study was that both observations and interviews complemented each other in the study. They also enriched its findings. During the observations, I took notes. It is in this premise that permission was sought from organisations where data were going to be collected.

Some data in this study were collected by means of document analysis (Grabs & Carodenuto (2021). Documents were collected from independent public policy think tanks, unions, different spheres of government, universities and corporate South Africa.

Data Analysis

The data gained from the interviews were analysed using open coding (Li & Zhang, 2022). A recurrent comparative method was applied to analyse the data in and between the interviews. Content analysis was also applied to analyse the content of the interviews (Merriam, 1998). The process entailed the instantaneous coding of raw data and the formation of categories.

The data were analysed with the objective to discern common patterns and to put together categories. These were weighed against the literature. These categories were used to answer the research question and its sub-questions.

The data collected through document analysis and observation notes were analysed by matching them up with the data collected from the interviews, and through content analysis.

Trustworthiness of the Study

I based the trustworthiness of this study on two fundamental criteria, namely, validity and reliability (Paulus, 2023). Validity is the extent to which the research instrument tests the actual object or subject of measurement. There are two forms of validity: internal and external. Reliability is assessing the accuracy and precision of the research instrument.

It has already been mentioned in the preceding paragraphs that the study employed multiple data collection techniques and gathered information from various sources. This satisfied the principles of triangulation and ensured the reliability and validity of the study (Paulus, 2023; Shrivastava & Shrivastava, 2023). Some organisations and people participating in the study were given the opportunity to examine the evolution of the research report as it was being written up. This made it possible for them to identify information that might not have been a true reflection of what was observed, read, and/or said during the fieldwork. This approach is supported by Schoonenboom (2023).

Research Ethics

I observed the ethical aspects in this research even though some readers may not perceive this study as being sensitive work. Research participants were requested to contribute to the study. The requests were delivered through e-mailed letters. All research participants agreed to take part in this study by providing written approval.

All interviewees consented formally to their participation in the study. They also agreed to the recording of discussions during data gathering. I coded the audio-recorded conversations, and put the recordings in a password-protected computer which was kept in a locked facility. The participants were at liberty to withdraw from the study at any time without being required to give a reason. All necessary measures were taken to guarantee that persons taking part in the study were not caused any harm by participating. For that reason fictitious names were used to protect the identity of the participants and to make sure that any information, either personal or professional, revealed during the interview, was handled as confidential. Ethical clearance was obtained from the University of Johannesburg's Faculty of Humanities Research Ethics Committee.

Findings of the Study

In the study, I found the following:

- digitalisation leads to job losses in South Africa;

- corporate South Africa has been slow in preparing workers for the digitalisation era;

- basic and higher education are not preparing leaners for human–machine collaboration;

- digitalisation could influence the outcomes of local government and general elections in South Africa;

- technology will prevail and thrive; and

- the human touch will remain paramount in workplaces.

Digitalisation Leads to Job Losses in South Africa

The five dominant retail banks in South Africa use various delivery channels, and these include digital (internet and mobile) banking services. TymeBank uses internet and mobile banking. Discovery Bank and Bank Zero only use smart (mobile) phones apps to transact. Internet banking refers to the use of desktop computers and laptops to perform banking transactions, whereas mobile banking refers to the use of smart phones to transact. In this article, digital banking refers to either or both mobile banking delivery channels. Although the three banking entrants do not have branches and automated teller machines (ATMs) (electronic banking outlets), their customers can withdraw money from ATMs and grocery retails such as Shoprite, Pick n Pay, Spar and Checkers.

During the interviews of the study, a participant (Interviewee A) mentioned that in 2019 the South African Labour Court granted an interdict against the banking sector strike that was supposed to have taken place on Friday, 27 September 2019. The strike was being coordinated and led by a labour union—The Finance Union (Sasbo). "For the first time in South African labour history, financial services sector workers wanted to embark on industrial action against increasing digitalisation of functions in their workplaces" (Interviewee A). Sasbo argued that banks have been retrenching workers because jobs were being rapidly automated—mostly by the internet of things, artificial intelligence and advanced robotics.

Interviewee B indicated that

> Even if the Labour Court did not interdict the labour strike, it would not have caused huge disruptions and inconvenience to most of individual and corporate customers because banking services are largely automated currently. Had the industrial action happened, many people would not have noticed that bank branches were closed and that some ATMs were not functioning.

But be that as it may, the intended industrial action was able to draw the attention of the public to the fact that automation is killing jobs in the financial services sector, and that this trend will continue.

"The intention of the banks to digitalise their services is not mainly intended to reduce the number of employees, but rather to increase customer satisfaction" (Interviewee A). Digitalisation offers customers great convenience and saves their time. They can do banking transactions anywhere and anytime. Just before the Labour Court granted the interdict against the strike, a professor who participated in this study quipped: "So the main reason for these banking employees to threaten to strike is that digitalisation is taking their jobs? It seems they would rather have us standing in long queues? No ways" (Interviewee C). "Though the public would be sympathetic to the staff being retrenched, it appears there is acceptance that advanced technologies are inevitable and essential for the well-being of the broader society and economic growth" (Interviewee B).

Owing to the integration of advanced technologies in the banking systems and the high adoption of digital banking services by customers, the four major banks in South Africa, "FNB, Absa, Nedbank and Standard Bank, had been cutting down the number of their branches and laying off some of their employees" (Interviewee D). During the past 10 years, the above-mentioned banks had shut down about 700 branches, and will certainly continue to do so. In early 2019, Standard Bank announced that it was going to close 104 branches. By the end of June 2019, it had reduced its branches from 726 to 525. Absa, which substantially had more branches than any of its competitors has trimmed down its branches from 885 to 187. Nedbank branch reductions began in 2014, and by 2019 it cut down the number of its branches from 764 to 498. Other than reducing the number of its branches, Nedbank had also been cutting down the size of floor space some of the branches occupied. By June 2019, Nedbank had reduced its floor space by 32 971 square metres, representing 14.3% of the total outlets floor space it occupied in 2014. The bank intended to increase the floor space reduction to 45 000 square metres and this equates to its 20% space. FNB has cut down its footprint by shutting down its branches from 775 to 628. It has also been decreasing its branch costs by making some of its branches smaller.

The main reason for shutting down these branches has been the reduction of customer walk-ins to the branches. Owing to the high uptake of digital banking services, customers are no longer compelled to frequent their branches. The biggest losers of the branch reductions are the banking sector employees who get retrenched.

> According to Sasbo, Standard Bank intended to retrench 1 800 workers, and later indicated that 6 000 jobs will be affected by digitalisation. Nedbank had reportedly informed the union that it will retrench 3 000 workers in the first week of September 2019. (Interviewee B)

Other banks were expected to shed thousands of jobs. Before this, hundreds of employees had already been retrenched during the past 10 years in the South African banking sector.

"The replacement of some banking sector workers by robots and artificial intelligence is not just a South African phenomenon" (Interviewee E). According to the report compiled in 2019 by analysts based at Wells Fargo, US banks would reduce more than 200 000 jobs during the next 10 years. Reduction of this magnitude would constitute 10% of the total banking sector jobs in that country. However, "it is envisaged that the increased usage of machines, artificial intelligence, the internet of things, and other relevant 4IR technologies will increase efficiency in the banking sector" (Interviewee C). "Some of the banking functions that would increasingly be done by advanced technologies include transactional banking, call-centre, mortgage processing, target marketing, and cash management" (Interviewee F).

"Digitalisation has increased the profitability and market share of some banks while at the same reducing their cost-to-income ratios" (Interviewee D). While this subsection mainly focused on the South African banking sector, automation has also been killing jobs in sectors and subsectors such as agriculture, mining, security, manufacturing and retail. Having said this, job losses have been more intense in the banking sector.

Corporate South Africa Has Been Slow in Preparing Workers for the Era of Digitalisation

"In endeavours to prepare students for the jobs in highly digitalised economy, the country's main aim should not be to teach them skills on specific technologies" (Interviewee G). This will be a futile exercise because technologies and industry trends change continuously. It would be unfair to expect higher education institutions (HEIs) to catch up with the fast-changing practices of various commercial sectors. The main purpose of education is to teach graduates to think analytically so that they can be equipped with skills on problem-solving, collaboration and analytics. In other words, HEIs should produce graduates who are trainable.

Corporate South Africa and some analysts have been arguing that HEIs are not producing graduates equipped with specific and practical industry skills. "I do not agree with this sentiment which emanates from a wrong set of expectations of higher education" (Interviewee H). The role of HEIs is to provide students with broad theoretical perspectives, for example, principles on software development. Their function is not to equip students with practical skills; employers themselves have a responsibility to do so.

It is wrong, for example, to expect a software development graduate to possess Oracle Primavera skills. The least a university should do is to equip their students with principles on software development and some basics on programming languages. It would be the responsibility of the prospective employer to provide Oracle Primavera training to their relevant employees. (Interviewee H)

Corporate South Africa should also appreciate that the government has played its role by opening the doors of HEIs to all our youth through inclusive policy, subsidies, and bursary schemes such as national student financial aid scheme. (Interviewee G)

"Other than pointing fingers, companies are cannibalising each other by poaching skilled labour from each other instead of growing their own timbers" (Interviewee I). This has led to an artificial high cost of skilled labour, especially among black South African professionals. When these professionals take advantage of huge salary offers, some commenters accuse them of job-hopping.

Corporate South Africa should start to play a significant role on skills development by growing its own timber. This can be achieved by enhancing skills and knowledge of the graduates who are unemployed. Part of this training should prepare workers for increasing digitalisation. (Interviewee E)

Whereas some of the HEIs have sought to close the gap between secondary and higher education by offering bridging programmes, corporate South Africa has largely neglected to do the same by providing necessary industry related training to new graduates. (Interviewee H)

"Employers should fast track the reskilling of their workforce so that they can work collaboratively with the machines" (Interviewee K). In other words, technology will augment the skilled labour instead of replacing them. On the other hand, workers whose functions will be fully replaced by technology should be reskilled and repurposed to other jobs. Policymakers and HEIs should ensure that the country is producing employees who are trainable and adaptable. As it has already been mentioned in the introduction of this article, exposure to multidisciplinary education would go a long way to achieve this. Employees who perform routine or repetitive jobs that can be easily automated should therefore be retrained.

As already stated, most banks, and some retail outlets, service centres, and manufacturing firms are using artificial intelligence, internet of things, and advanced robots to automate processes. The manufacturing sector will be highly affected by robots. (Interviewee H)

Machines will continue to revolutionise the way assembling of various production parts, packaging of finished goods, supply chain, logistics and inventories are done by factories. Amid all these developments, employees will continue to play meaningful roles in the workplace, and, therefore, employers should upskill and transition to workers prepared for digitised workplaces. The 4IR era will increasingly become fast-

paced, and workers should either speedily adapt or be left behind. This will require workers to be equipped with skills suitable for the automated working environment as firms employ advanced technologies to boost productivity and competitiveness.

Basic and Higher Education Are Not Adequately Preparing Students for Human–Machine Collaboration

It has been stated in the preceding subsections that the increasing use of advanced technologies and digitalisation of functions have led to massive job losses in some South African banks, manufacturers, service centres and retail outlets. This country cannot afford to have more people getting retrenched. "The number of unemployed people has grown to about 12 million people and is increasing" (Interviewee J).

The coronavirus (COVID-19) outbreak and subsequent measures to mitigate against the rapid spread of the virus made unemployment worse. There is no other upper-middle-income country which has a sophisticated economy such as South Africa with a large proportion of its population without jobs for as long. "In January 2020, only 62% of adults were employed, a percentage that compares poorly against trends of around 90% worldwide and higher in some emerging markets" (Interviewee J). This was before COVID-19 related lockdowns. These claims are supported by Armstrong and Lee (2023a). Of the potential labour force in South Africa, 38% was unemployed, a figure that is among the highest globally. "Urgent measures should be taken to prepare workers for the human–machine collaboration" (Interviewee I).

"Drastic improvement of early childhood education, primary and secondary education is of paramount importance" (Interviewee I). "Technical colleges should be overhauled urgently" (Interview J). A major factor in the reduction of poverty, mitigating inequality and reducing the impact of 4IR technologies on job losses is the provision of good quality education. This is one area in which the African National Congress (ANC) government has failed dismally since 1994. Quality education must be provided and there is no shortcut about this. Unfortunately, the "ANC has allowed the South African Teachers Union (SADTU) to highjack the management and governance of our schools" (Interviewee L). The whole primary and secondary education has become a fiefdom of SADTU.

What seems normal for most countries with sophisticated economies is a rare occasion in South Africa. In predominantly black schools where most teachers are SADTU members, there is little teaching and learning. "According to the School Monitoring Survey 2017, on an average day, 10% of South African teachers do not go to school. It is even worse in the Eastern Cape where about 6 483 teachers do not show up at their schools every day, yet they get their full salaries and fringe benefits" (Interviewee G). It is only at 20% of the functional schools in the country where almost all teachers regularly go to work and teach the learners. Absenteeism is very prevalent in the other 80% of the schools. Then there are teachers who go to school, mark themselves present, but never really fulfil their duties. Of course, owing to legitimate leave, illness, family

responsibilities or tragedies, some teachers would be absent from predominantly white schools. However, unlike their counterparts in predominantly black schools, there would be substitute teachers to temporarily take over the teaching responsibilities. There is too much abuse of leave systems by some public servants in South Africa.

"Unlike in professions such as legal, medical, and engineering, South Africa does not have a strong system that holds teachers in public schools to account for their teaching responsibilities" (Interviewee K).

> What we have is a strong union which protect these teachers no matter how they shun responsibilities they are handsomely paid for. This should be attributed to political expediency. The ANC is in a tripartite alliance with Congress of South Africa [COSATU] and the South African Communist Party [SACP]. (Interviewee M)

This alliance provides the ANC with election campaign funding and votes. The problem is that this partnership is costing the country dearly. The influence of COSATU and the SACP on public policy formulation has been enormous, and they actively protect teachers who are members of SADTU. This has led to the production of public policy which is counterproductive. Labour laws were crafted in favour of workers and stifle the overall socio-economic development of the country. "The worst by-product of this toxic tripartite alliance is that it has resulted in our children receiving poor quality education which is worse than the one offered during the apartheid era" (Interviewee L).

"In predominant black schools, SADTU has enormous influence of who becomes a head of department, deputy principal, and principal" (Interviewee G). The government, school governing bodies and parents are afraid of SADTU. "In the absence of the provision of quality education in most black schools, many students drop out before they reach grade 12" (Interviewee J). The government has failed to resolve these problems. If South Africa wants to prosper in the 4IR era, the government should produce practical interventions to improve early childhood, primary and secondary education without pandering to SADTU and bowing down to political expediency, as it happened for more than 29 years after the attainment of the democratic dispensation. Having said this, "various spheres of government—national, provincial, and local—should be commended for various initiatives and programmes related to universal access to technology" (Interviewee M).

In April 2019, President Cyril Ramaphosa appointed members of the presidential commission on 4IR to recommend policies, strategies and plans to position South Africa as a significant player in the digitised space (Commission on the Fourth Industrial Revolution, 2020). The report was issued in January 2020. Before this, a study published by the World Economic Forum reported that around 6 million workers will be at risk of being replaced by digitalisation (World Economic Forum, 2019). This includes the jobs of maintenance staff, clerks, construction workers, cashiers, miners and bank tellers. The national Department of Basic Education has embarked on various

programmes to empower the youth with skills that would enable them to function in a mostly digitised economy.

Responding to Ramaphosa's call to get the country prepared to adapt to the 4IR era, the national Department of Basic Education initiated a project to pilot coding and robotics as a learning area in 1 000 schools from the 2020 academic year for grades seven to nine (Department of Basic Education, 2020/21). This would include training at least three teachers in each of the 16 000 schools to teach coding. Various private entities, including Teen Geeks and Google were working with the government to develop a coding platform which uses artificial intelligence and machine learning to customise teaching and learning. By April 2019, the provincial departments of education had already trained 44 000 teachers in basic, intermediate and advanced computer skills. The project to train teachers on coding started from June to September 2019.

The then Gauteng MEC of education, Panyaza Lesufi, has implemented two technology programmes which would go a long way in empowering our youth with cutting-edge technical skills (Gauteng Department of Education, 2018/19). The first programme involves the roll-out of digital learning in about 400 schools with special attention being given to rural and township schools. Each learner is given a tablet and each teacher is given a laptop. These devices are connected to a free broadband network between 05:00 and 21:00 every day. Blackboards are replaced with smart boards.

The second programme involves establishing specialised schools. So far, schools focusing on niche learning areas, such as nuclear energy, aviation and ICT, have been established. The Gauteng Department of Education is implementing this programme with private sector partners. These specialised schools are a new phenomenon in South Africa.

Lesufi is implementing the above-mentioned programmes within the parameters of the development plan of the Gauteng city region and the strategy of eGovernment. Most importantly, Lesufi's programmes are responding to the national development plan (NDP). The NDP advocates the provision of technologically advanced skills. If the rest of South Africa implements digital learning and specialised schools, the country will be riding the 4IR wave soon, and its workforce will be able to adjust to the increasing human–machine collaboration.

Digitalisation Could Influence the Outcome of the Future Local Government and General Elections

"In 2016, South Africa's politicians watched in awe how rapid implementation of digitalisation in manufacturing plants, utilities, public services, retail outlets, and other sectors led to Clinton electoral defeat by Trump in the US" (Interviewee M). This possibly explains why ANC leaders get weary and rush to companies that are intending to retrench staff and try to discourage them from going ahead. Most liberals and analysts often criticise these leaders for interfering with the running of companies. It is apparent

that the ANC is aware that retrenchments in the private sector can lead to its downfall from the national and provincial governments. This brings one to the question: will rapid digitalisation in the South African economy affect the outcome of future local government and general elections? Your guess is as good as mine.

Could technological shocks have contributed to the decline of the ANC's and the Democratic Alliance's electoral support during the 2019 general elections and 2021 local government, while at the same time boosting the vote share of the Economic Freedom Fighters (EFF)? The EFF advocates radical economic transformation. Among other things and according to the EFF, this would be achieved through the nationalisation of the land and other strategic sectors of the economy. "EFF's success was instructive. The party has undisputed popular leader, Julius Malema, and a very strong message appealing to most of the population which comprises black youth that are socio-economically marginalised" (Interviewee M). "Although EFF's socialist-oriented policies have dismally failed in many socialist countries and are wildly unrealistic, they look tantalising to those have been retrenched, are unemployed or are victims of grinding poverty" (Interviewee N).

Technology Will Prevail and Thrive

Outside of the workplace, the era of COVID-19 was characterised by many conspiracy theories which were spreading rapidly and causing major damage in the process. "One of the fabrications that was spread was that COVID-19 was caused by 5G technology. This led to the return of the Luddites. In the United Kingdom, they burnt several base stations of mobile networks to mitigate against further spread of COVID-19" (Interviewee O). Ironically, the present-day Luddites were using the mobile network infrastructure and internet as the source of information, including spreading their conspiracy theories. "They also used technology apps to plan how they would go about demolishing the base stations" (Interviewee N).

In South Africa, some 5G technology infrastructure of Vodacom[1] and MTN[1] was destroyed owing to falsehood linking 5G with the cause of COVID-19. "Some base stations belonging to these mobile network operators were burnt down in January 2021" (Interviewee P). This was despite the fact that mobile network infrastructure was contributing immensely to sustain the economy and to fight against the pandemic. "This infrastructure also enabled people to do work and socialise during the lockdowns" (Interviewee O).

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1   South African mobile network operators.

Scientists of good standing both locally and internationally refuted theories that claimed that 5G technology caused COVID-19. Mobile technology would not be stopped from thriving because of the Luddites. In fact, the use of technology multiplied substantially than never before during the height of COVID-19. (Interviewee K)

The Luddites will not succeed in stopping technological advancements. The same applies to the workplaces—digitalisation will continue.

Despite the Luddite's riots, smashing of machines, and petitioning the British parliament to block the increasing use of technology in factories during the First Industrial Revolution, they were not able to stop technological advancement. Industrial action by employees against digitalisation in various sectors may still happen in future, but this will not stop the integration of advanced technologies into service provision and the production of goods.

Human Touch Will Remain Paramount in Workplaces

"As part of preparing the current and future workforce for the digitalised workplaces, attention should be paid to in-person services because they are difficult to automate" (Interviewee M). Although the 4IR will lead to some job losses, it would have a positive impact in terms of boosting economic growth and creating new jobs in the value chain. The 4IR technologies will generate a high demand for professional and in-person services. These services require cognitive skills, and such skills can only be in human beings.

> Although technology is increasingly getting cheaper and pervasive, employees will never be fully replaced by machines. It is only humans that can adequately dispense advance level of creativity, out of box thinking, contextualisation, and problem-solving skills. Machines cannot imitate these skills. (Interviewee P)

"People will remain irreplaceable asset amid digitalisation and rapid growth of digital commerce. It should also be borne in mind that the 4IR technologies are the product of people, and not vice versa" (Interviewee K). Human beings can do without advanced technologies, but technology needs people to continue to exist and move forward. Of course, technology has done more to improve human lives and driving economic growth. "This is in line with what Winston Churchill once said in the British House of the Commons in 1943: 'We shape our buildings; thereafter they shape us'" (Interviewee J). We should avoid looking at digitalisation as a battle between man and machine.

"One advantage of employees is that they can learn how to manage hundreds of skills within their lifetime, whereas machines can only master a few specific tasks" (Interviewee M). Unlike humans, machines cannot multitask spontaneously. It takes a long time to programme the machines algorithms to prioritise and perform various responsibilities. A robot will never be able to do decision-making because it is a human

skill which is learnt through various experiences and contexts. This demonstrates that people will still be needed during the height of digital commerce.

"An important aspect about people is that we are social beings. Interacting with fellow human being is sacrosanct. We need each other's attention, care, empathy, companionship and emotional connection" (Interviewee L). Machines can neither provide these nor create brand loyalty. They cannot close deals and they must be programmed to perform specific tasks. Technology will never be able to evoke emotions. This is because robots lack humans' five senses—touch, sight, taste, hearing and smell. "No matter the significant role of 4IR technologies, they will never be able to fully replace the human touch and evoke emotions. As behavioural economists have asserted, emotions are very important in commercial transactions" (Interviewee M). Technology is not employed in business to replace employees, but rather to collaborate with and assist the workforce.

Recommendations to South African Policymakers

I mentioned in the literature review that the uneven geographical phenomenon tends to manifest owing to technology driven economic developments. I also stated that this could lead to job losses and associated social ills. My major recommendation is that South Africa should mitigate against this by connecting major commercial hubs with major labour market hubs.

"The apartheid system fragmented urban planning and recent technology shocks have enlarged the uneven geographical development phenomenon" (Interviewee Q). This should not necessarily be corrected by having residents of the Johannesburg metropolitan area who live in Soweto migrating to Sandton, or residents in Tembisa relocating to Midrand. Local and provincial governments should rather ensure that Soweto is interconnected to Sandton, and Tembisa to Midrand through reliable and affordable public transportation. There should be integrated spatial development. This would enable most residents to continue living in Tembisa and Soweto where housing is relatively cheap and to commute to Sandton and Midrand where there are more employment opportunities.

Midrand and Sandton are major commercial hubs, and Tembisa and Soweto can supply these hubs with employees in manufacturing plants, retail outlets, security companies, cleaning services, and other sectors. Because people mostly spend their money where they live, local township economies will be boosted. Employers will see Tembisa and Soweto as their labour markets. This will create a much-needed virtuous circle.

Connecting commercial hubs and labour markets that are far from each other will be crucial during the 4IR era. The then executive mayor of the City of Johannesburg, Parks Tau, who served as the mayor of Johannesburg from 2011 to 2016, was working on this when he lost the 2016 local government elections (City of Johannesburg, 2016).

Around 2007, the then MEC of finance in the Gauteng Provincial Government, Paul Mashatile, wanted to roll out the monorail project that would have connected Soweto to Johannesburg's central business district (CBD) (Gauteng Provincial Government, 2009). The plan was to ensure that no person travelling from Soweto to the CBD would have to wait for the monorail for more than 15 minutes. The intention was for the monorail to ferry about 1.5 million people per day. There were going to be 39 passenger stations along the rail network route. Homes would not have been relocated to give way for the construction because the rail network would have been on elevated pylons which are on municipal land.

The public-private-partnership model would have funded the monorail project. Unfortunately, the project was abandoned after failing to get the approval of the national government. The main reason for the cabinet's refusal to approve the project was that the Gauteng Provincial Government did not sufficiently consult other relevant stakeholders. In a normal democracy, the stakeholders could still have been consulted after the initial failure to obtain approval and the project could still have continued a little bit later than planned. I have used the connection of Soweto and Tembisa to major commercial hubs just to make a point. This model could be used throughout South Africa.

Efficient and affordable public transport will be effective in driving economic development and mitigating against the impact of uneven geographical development and technology shocks. It will also reduce the migration to major commercial hubs, prevent the decline of townships, and boost local economic development. "In the US, it would take a passenger six hours to travel from Cleveland to Chicago. The 2019 feasibility study recommended the construction of a hyperloop which would connect the two cities" (Interviewee R). This will convert the six-hour travelling to just 28 minutes, which is reasonable to commute to work. The hyperloop will result in two labour markets becoming one. "China has used rail infrastructure to connect major labour markets with major commercial hubs. Policymakers should revisit the monorail concept" (Interviewee S).

Transport infrastructure could be rolled out through public–private partnerships to lessen the pressure from the fiscus. In my view, the best model for this would be the build, operate and transfer (BOT) model. The BOT model would make it easy for the private sector investors to recoup their capital investments. The balance sheet of government will also be strengthened after acquiring fixed assets.

If South Africa wants to mitigate against the unintended effects of uneven geographical development and increasing automation in workplaces, it should invest heavily in its rail transportation system. This will also boost economic growth. While investing in affordable infrastructure, efforts to prepare the workforce for the 4IR era should be increased. This should be done by offering quality education and corporate training.

SADTU and other labour unions should stop holding the country's development to ransom.

Ideas for Future Research

A few ideas have emerged for future research regarding employees–technology coexistence. First, future research can build and extend on this study by employing objective measures to determine the impact of technology on employees. This could include the use of quantitative research methods.

Second, future studies may use a longitudinal approach to examine the impact of South Africa's education system on and corporate South Africa's role in preparing students and employees for human–machine collaboration in this digital era.

Lastly, future studies are recommended to specifically target each of the economic sectors in South Africa and investigate the impact of technology on employees. The key economic sectors in the country are mining, agriculture, services, energy, tourism and manufacturing (Dagada, 2021). Each of the studies focusing on a particular economic sector should be distinct and stand-alone to enable more rigour.

Contributions of the Study

This study made theoretical, practical and methodological contributions. First, the literature review yielded a typology reflecting on the global and local trends regarding digitalisation of the workplaces and the ways in which this affects employees. A search on various research databases revealed that there is no single study that contains such typology.

Second, policymakers, lawmakers, technocrats, academics, unionists and business executives in South Africa shared their perspectives on the perceived and real impact of digitalisation on the employees and the ways in which this could be mitigated. A search on various research databases revealed that there was no single study that has been done in the context of South Africa integrating positions from the aforementioned stakeholders dealing with the impact of technology to employees.

Third, the originality of this study regarding the digital transformation theory and employee relations body of knowledge benefited from additional contextualised descriptions that could contribute to the understanding of the intricacy of employing advanced 4IR technologies in workplaces and industrial relations in the digital age. This article made recommendations to the policymakers and scholars. Recommendations to policymakers partially constitute contributions to the development economics theory.

The study has achieved something that has not previously been undertaken by integrating various traditionally unrelated concepts—public policy, education, human resources, industrial relations, and digital transformation—into a single digital transformation methodological approach. Practical contributions to technocrats in the public sector, executives in corporate South Africa and academics in higher education embody the main contribution of this study to the digital transformation theory and employee relations body of knowledge.

Limitations of the Study

Although I paid attention to various sectors of the economy, I was more biased towards the banking sector. It is on this premise that the findings of this study may not be sufficiently transferable to other economic sectors in South Africa. However, these findings provide some potential solutions on how to mitigate job losses that are caused by digitalisation in various economic sectors.

During the planning of the study, I had intended to conduct at least three focus-group interviews; the first one with policymakers, the second one with private sector executives, and the third one with union representatives. The logistics to do any of these focus-group interviews became impossible. This has disadvantaged the depth and richness of the study.

Summary and Concluding Remarks

It was stated in the introduction of this article that, although technology has added tremendous value to humanity, people tend to be somewhat suspicious and sometimes hostile towards technology. There are various reasons for this and includes the fact that digitalisation leads to job losses. Retrenchments and unemployment that resulted from mechanisation during the Second Industrial Revolution caused hardships which lasted seven decades. Nowadays, although technology does cause job losses, more jobs are quickly created in the value chain. This happens because of the massive boost that technology injects into economic growth. Two hundred years ago, technology innovation was very slow and took a long time to show a significant impact on the overall economic development. However, policymakers and business leaders cannot leave this to chance.

Policymakers should create an environment that is conducive to connecting major commercial hubs with major labour market hubs through market-friendly public policies. Business leaders should ensure that employees receive the necessary training. Some of them should receive training on entrepreneurship as part of retrenchment packages.

While this article has reflected on the unintended consequences of technological advancements and digitalisation, it offered the following potential solutions:

- basic and higher education should be improved to produce trainable graduates;

- corporate South Africa should train and prepare workers for digitalisation and the 4IR era; and

- policy formulators should create linkages between major commercial hubs and major labour market hubs.

Workers have resisted technological advancements in workplaces during the past 200 years, but they failed. The Luddites' destruction of technology outside of the workplaces was also a futile exercise. Technology is here to stay, and it will thrive. Most importantly, technology will increasingly add value to humanity (Dagada, 2024).

Human labour will remain paramount going forward. It is therefore important for workers to remain ahead of the workplace game so that machines do not lead them—people should lead the machines. It can be done! The human species has survived natural disasters, famine, wars, dictatorships, slavery, oppressions, land dispossessions, natural disasters, epidemics, pandemics, and four industrial revolutions (Dagada, 2021). Not only are people survivors, but they also adapt to changes. This endurance and adapting abilities will always make people crucial assets in business and socio-economic development. Both employees and technology will prevail and coexist in workplaces.

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