

THE DANGERS OF



4!R

is the workforce ready?

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Abstract

The fourth industrial revolution (4IR) comes with technologies that have the potential to drastically change the way of work. The introduction of 4IR technologies like Artificial intelligence (AI) and robotics decrease the labour-intensive need of certain industries thereby boosting productivity while cutting labour costs. While one of the obvious benefits of 4IR is the creation of skill intensive industries, this paper seeks to highlight the consequences of these technologies on the semi-skilled to unskilled segments of the labour market in South Africa and particularly in the Eastern Cape.

Before SA fully adopts 4IR technologies, this paper recommends a strong focus on retraining and upskilling workers in these vulnerable segments to eliminate the continuation of inequality.

Introduction

Researchers and the government in South Africa have hailed The Fourth Industrial Revolution (4IR) as having the potential to help alleviate the triple problems of unemployment, poverty and unequal distribution of income. The new age of technological innovation that comes with 4IR is increasing human-machine interactions, opening new market opportunities, and promoting growth in the global economy.

The Centre for the Fourth Industrial Revolution in South Africa notes that in order to sustain strong and resilient technology governance procedures and developments, industry transformation across a variety of industries as well as government is needed. The Centre thus encourages industry to take advantage of emerging 4IR technologies.

However, the effects of technical advancement on employment and income have generated debate throughout history. This paper examines how past industrial revolutions changed the nature of employment and considers how the Fourth Industrial Revolution may affect South Africa's labour market. The requirement for workers to increase their skill levels in order to prevent job displacement is the golden rule of each industrial revolution. The main concern with the current revolution, obviously, is whether South Africa can handle the 4IR prerequisites to lessen displacement.

Industrial revolutions and changes to the world of work

The term 'industrial revolution' refers to the introduction of production technology in society. Through these technologies, industrial revolutions have caused profound and long-lasting changes in society's fundamental institutions as well as in employment and economy (*Skilton & Hovsepian, 2017*). Prior to the first industrial revolution, small-scale farming constituted the bulk of the economy, and most of the production was carried out by craftsmen with specialized skills. During this period, work was directed by the limitations of available resources. Muscle power—both human and animal—was the primary source of energy at the period.

The first industrial revolution was then marked by the move from rural (manual) industries to more urban and industrial industries. The coal-fired steam engine and associated technology introduced a new, quicker pace for work with the introduction of factory-based industry. The mechanisation of society during this era meant that artisans and craftsmen had to get reskilled to work alongside these machines as mechanics and ironsmiths, or risk being displaced by machines. The idea of workers occupying new industries alongside machines and the prospect of job loss were both present throughout the first industrial revolution.

The second industrial revolution was characterised by the shift from steam power to electricity. It was a period of growth for both old and new industries, such as electricity, oil, and steel. The introduction of electricity now meant that factories were able to mass produce products. The transition from steam to electricity resulted in a decline in the need for steam mechanics and the emergence of a new market for electricians. Likewise, during this revolution, only those workers who were able to pick up these new skills were able to keep their jobs; everyone else was displaced. Additionally, with the advent of mass production, industries began to become less labour-intensive, lowering the cost of labour for the employer (*Mayer, Wegerle, & Oosthuizen, 2021*). This meant that the workers faced low pay, hard hours, and unfavourable working conditions.

The Third Industrial Revolution, also known as the Digital Revolution, refers to the transition of technology from analogue, electronic and mechanical devices to the digital technology that exists today. The personal computer, the Internet, and information and communications technology were all developed during the Third Industrial Revolution (ICT). It was possible to mass produce in small batches but with a wider variety. Jobs were replaced by computers and robots, but if you were not computer literate, you may have lost your job. Once again, new jobs were created that did not previously exist, such as software and hardware engineers. What becomes evident is that with each industrial revolution, the production system becomes more efficient. The employer, however, benefits from this efficiency because better output at reduced labour costs leads to higher economic returns. Nonetheless, workers have had to bear the weight of each industrial revolution, whether it is adjusting to new skill requirements or putting up with unstable working circumstances (*Hattingh, 2018; Makridakis, 1995*).

The world is currently said to be going through the Fourth Industrial Revolution. This current revolution is said to expand on the Digital Revolution by illustrating new ways in which technology is integrated into societies and even the human body (*Hattingh, 2018*). Emerging technological breakthroughs in a variety of fields, including robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, The Internet of Things (IoT), decentralized consensus, 3D printing, and autonomous vehicles, characterize the Fourth Industrial Revolution. Researchers and the government in South Africa have hailed the Fourth industrial revolution (4IR) as having the potential to help alleviate the triple problems of unemployment, poverty and unequal distribution of income.



The argument for the 4th industrial revolution is that the introduction of 4IR technologies, including artificial intelligence (AI), robotics, and the internet of things (IoT) combine the natural and biological worlds to create more efficient production processes thereby generating more growth (Mabasa, 2019; Sutcliffe & Bannister, 2020). For example, the use of automated monitor sensors assists in making sure that crops only receive the necessary amount of water to grow in agriculture. More popularly, the introduction of self-help machines in most fast-food restaurants are all efforts to create a cost and time effective production process.

Nevertheless, as earlier revolutions have demonstrated, more productive manufacturing methods do not always result in benefits for developing countries. Various research studies (Olaitan, Issah, & Wayi, 2021; Marwala, 2019; Adendorff, Lutshaba, & Shelver, 2018; Acemoglu & Restrepo, 2019) have shown that if the relevant resources necessary for its success are not there in the nation, the adoption of 4IR in developing countries may not yield the desired results. Without resources like infrastructure and human capital, the adoption of 4IR is likely to make a country's socio-economic issues worse.

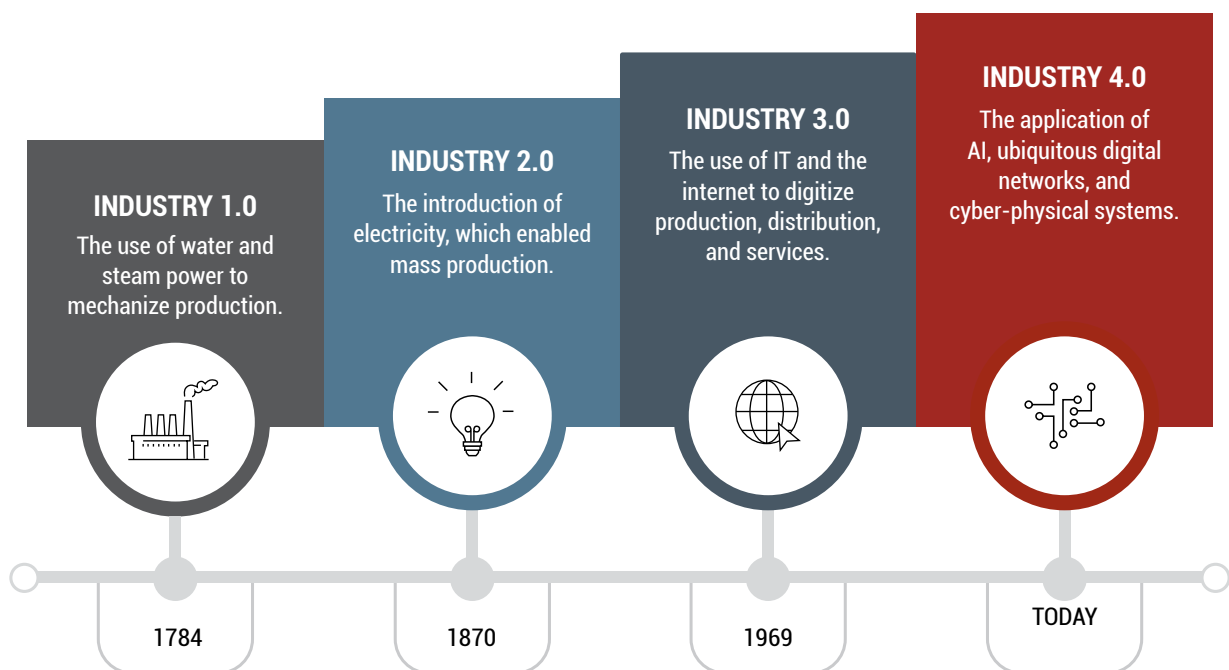


Image sourced from: <https://www.getsmarter.com/blog/career-advice/the-4th-industrial-revolution-will-south-africa-be-ready-for-the-jobs-of-the-future/>

4IR and Job displacement

Like previous industrial revolutions, the 4IR will undoubtedly have various effects on employment that will affect not just one industry but all industries. The task-based framework is a popular method for analysing how the use of technology affects workers (Acemoglu & Restrepo, 2018; Zeira, 1998; Katz & Murphy, 1992; Sutcliffe & Bannister, 2020). According to this framework, there are two different kinds of technical advancements: automation, which enables businesses to replace labour-intensive tasks with capital-intensive ones, and the development of new jobs that allow for the substitution of low-productive old jobs with higher-productive ones (Acemoglu & Restrepo, 2019; Autor, Levy, & Murnane, 2003). As a result, workers who perform repetitive and routine jobs are more susceptible to being replaced by technology, while the need for skilled workers is rising with technological advancements.

A 2016 study conducted by McKinsey found that with 4IR technologies, 45 percent of the tasks that individuals are paid to do might be automated, and that 60 percent of all jobs could have 30 percent or more of their component tasks mechanized (Chui, Manyika, & Miremadi, 2016). More recently, a 2022 report by the Organisation for Economic Cooperation and Development (OECD) shows that the more labour-intensive jobs – such as food preparation assistants and assemblers – are at the most risk of automation (Lassébie & Quintin, 2022). At the other end of the scale, chief executives, senior officials and legislators are least likely to lose their jobs to automation.

Both these studies indicate that workers in occupations that need them to conduct physical tasks or operate equipment do so in predictable environments. They perform certain tasks in familiar environments where changes are reasonably simple to foresee, making some aspects of their occupations simple to automate. The following figure displays the risk of automation associated with each sector.

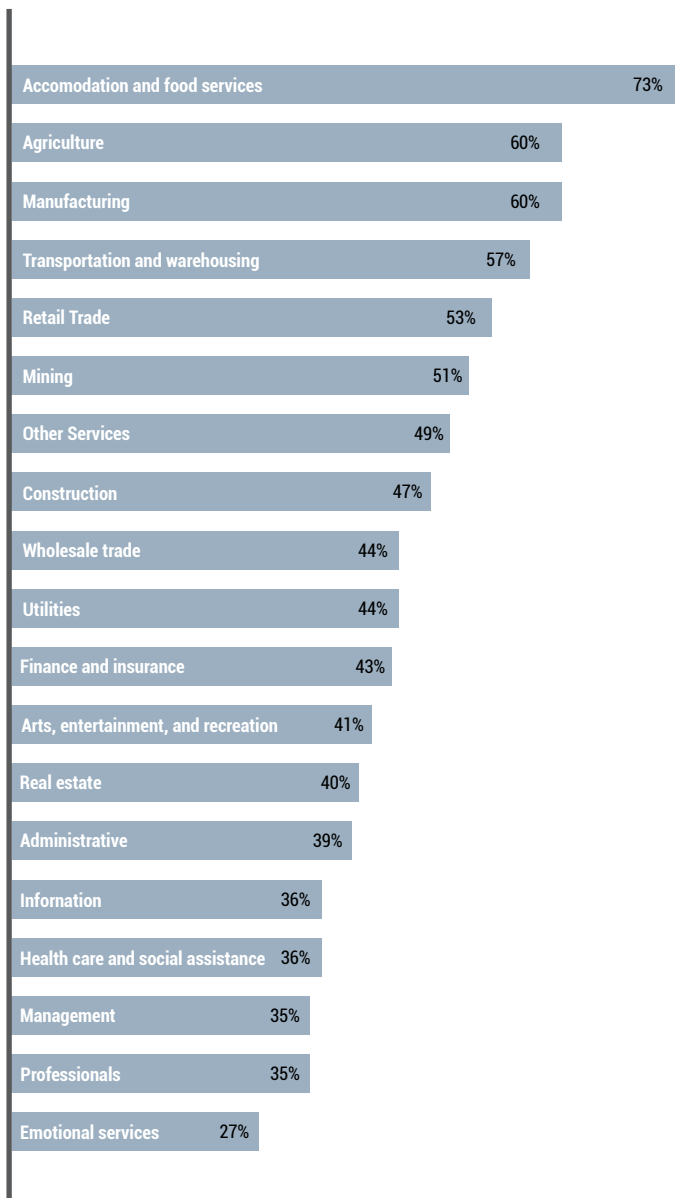
Figure 1 shows the hospitality and food services, manufacturing, transportation and warehousing, and retail trade sectors are the most at risk because these occupations fall into the low-skilled segment. These industries have a stronger production focus and are more routine and predictable than those in the non-production industries, making them more susceptible to automation. Figure 1 also demonstrates that jobs with a strong scientific, analytical, and creative foundation were least likely to be automated.

Figure 1 results are perhaps best explained by Braverman's account of the labour process in a capitalist society. According to Braverman (1974) the adoption of new management practices (technology) led to the routinization and deskilling of jobs carried out by both lower-level white-collar office employees and blue-collar workers in factories. According to Braverman (1974), deskilling and task routinization takes place to cut production costs and increase worker efficiency. When workers no longer need to use their intellectual skills to perform their jobs but instead merely need to obey managers' orders, workers become easy to manage and replace. As a result of the automation of low-skilled jobs like farming and retailers under 4IR, these workers may wind up making less money because all they are doing is assisting the machine, which anyone can do.

From this perspective, the 4IR tendency to displace low-skilled to semi-skilled workers may be viewed as another capitalist tendency to degrade and exploit labour. The concentration of persons with low education levels in professions with a higher likelihood of automation makes this situation worse. Workers with lower levels of education are more likely than those with higher education levels to work in high-risk professions (Hattingh, 2018; Arntz, Gregory, & Zierahn, 2016). This indicates that these workers may not have many employment options due to their poor levels of education and will therefore accept any type of employment. Thus, the danger of automation is increasingly resting on low-educated workers, as corporations reduce reliance on human labour and contact between workers.



FIGURE 1: RISK OF AUTOMATION BY SECTOR



Source: (Chui, Manyika, & Miremadi, 2016)

The South African Labour market and 4IR

The 4IR Technology will undoubtedly replace some low-skilled workers who perform repetitive, uncomplicated activities. The justification offered by proponents of capitalism is that the use of machines and new technologies may result in the displacement of employees from one industry, but this should only free up workers to work in new, much more efficient and high - tech industries. But the majority of South Africans still have low levels of schooling and weak technical (i.e., essential numeracy and literacy) and fundamental skills, making them unemployed. Figure 2 illustrates the education profile of South Africa's working population.

According to figure 2, "some secondary" and "secondary" (Grade 12 or equivalent) were the top levels of education attained by employed people aged 25 to 64 in the fourth quarter of 2021. Similarly, 8.3% of individuals in employment had a diploma, compared to just 10% of those with a degree. Moreover, data from Statistics South Africa indicated that the populations of coloured and Black Africans had the lowest levels of educational attainment. On the other side, Whites and Indians/Asians had the highest levels of educational achievement. Over 30% of White people in 2021 had a degree, compared to less than 4% of Coloured and Black African people (*Department of Higher Education and Training, 2021*)

Figure 2 also shows that only 22.5 % of the workforce have some post matric qualification. However, even with this supply of these graduates who may be able to meet the 4IR skills demand, the unemployment rate of graduates was 38 % in 2021 (*Khuluvhe & Ganyaupfu, 2022; Statistics South Africa, 2022*). In simple terms, graduates are not being fully absorbed in the labour market. This may be attributed to a mismatch of what the industry requires in terms of skills and what the higher education sector is producing. If this is the case, even with some level of higher education training, the average South African may still not be able to occupy these 'new' 4IR industries.

Figure 3 shows that in Q1: 2021 compared to Q4: 2020, the highest decline in employment is in the Elementary professions, followed by Domestic worker, Craft and associated trade, and Skilled agriculture. Only the professions of technician and professionals had increases in employment in Q1 2021 compared to Q1 2020. Interestingly, the occupations that recorded a high decline in employment are those ranked as highly susceptible to automation in the previous section of this paper. Similarly, the increase in professionals and managers may indicate an increased demand for more skilled works in the labour market. When applying the task-based framework, these employment statistics show that the introduction of technologies tends to decrease the demand for low skilled and semi-skilled occupations as well as increase the demand for middle to high -skilled occupations.

Given that the majority of South Africans hold elementary-level jobs, and that secondary education is the highest level of education held by those in employment, the country does not have the necessary skills to fill up such industries. Because of this, a significant portion of workers in jobs that will be automated may become unemployed and abandoned. The vulnerable parts of the labour market may not necessarily reap the benefits of this revolution; instead, it may serve as a tool to further marginalize them

FIGURE 2: NUMBER AND PERCENTAGE OF PERSONS AGED 25-64 YEARS WHO ARE EMPLOYED BY HIGHEST LEVEL OF EDUCATIONAL ATTAINMENT, 2021.

HIGHEST LEVEL OF EDUCATION	NUMBER	PERCENTAGE
NO SCHOOLING	209 674	1.5%
LESS THAN PRIMARY	713 614	5.2%
PRIMARY	416 625	3%
SOME SECONDARY	4 548 177	33%
SECONDARY (MATRIC OR EQUIVALENT)	4 685 953	34%
CERTIFICATE	576 478	4.2%
DIPLOMA	1 142 111	8.3%
DEGREE	1 373 104	10%
OTHER	100 212	0.7%
TOTAL	13 765 947	100%

Source: Statistics South Africa Quarterly Labour Force Survey:2021

FIGURE 3: OCCUPATIONAL EMPLOYMENT PROFILE 2020-2021

OCCUPATION	Q4 2020	Q1 2021	CHANGE
ELEMENTARY	3 393	3 317	-77
SALES AND SERVICES	2 476	2 483	+7
CRAFT AND RELATED TRADE	1 660	1 630	-30
CLERK	1 579	1 595	+16
TECHNICIAN	1 352	1 399	+47
PLANT AND MACHINE OPERATOR	1 257	1 285	+28
MANAGER	1 324	1 342	+18
PROFESSIONAL	952	990	+38
DOMESTIC WORKER	897	848	-49
SKILLED AGRICULTURE	85	62	-23
TOTAL	15 024	14 995	

Source: Stats SA 2020; 2021

4IR and the Eastern Cape Labour market

The Eastern Cape labour market has similar trends to that of the South African one. In that the working population of the eastern cape has low levels of education with little technical skills. In line with the national context, Figure 4 demonstrates that of the 1 379 792 employed people in the province, the highest levels of education acquired by those working in the province were “some secondary” and “secondary”. The data further shows that 5.8% of the 1.1 million unemployed persons in the province have tertiary education, while 53.7% have an incomplete secondary school.

Previous sections have highlighted that prerequisites of the fourth industrial revolution are higher educational attainment and technical skills. The province's working and unemployed populations' educational levels indicate a major lack of readiness for 4IR. For example, if 4IR technologies were to be adopted by the province's manufacturing industry.

There won't be enough qualified candidates in the province to fill those new posts. Because of their educational backgrounds, it would be even harder for the displaced workers to obtain employment, which would add to the high unemployment rate in the province. The following table provides a breakdown of the skill composition of individuals employed in the province.

Figure 5's breakdown of employment by occupation reveals that, in the province, two occupation categories account for nearly half of all workers (46%): those in elementary occupations (28%) and service & sales workers (19%). The analysis of skills available in the province reveals that, of the 1 379 792 people employed in the Eastern Cape, only 20% are skilled workers, 46% are semi-skilled workers, and 34% are unskilled workers.

When applying the OCED automation risk table to the Eastern Cape labour market status, almost half of the employed population are in occupations that are at high risk of automation. Moreover, the high rates of illiteracy among working and unemployed people render the EC labour market less prepared for 4IR. With already high levels of inequality and poverty in the province, an adoption of 4IR technologies without the prerequisite could make this situation worse.



FIGURE 4: EASTERN CAPE LABOUR MARKET EDUCATION STATUS

HIGHEST LEVEL OF EDUCATION	EMPLOYED	UNEMPLOYED
NO SCHOOLING	151 777	5020
LESS THAN PRIMARY	910 662	90 360
PRIMARY	703 693	53 212
SOME SECONDARY (NOT COMPLETED)	4 953 453	539 148
SECONDARY (MATRIC OR EQUIVALENT)	4 387 738	254 012
TERTIARY	2 731 988	58 231
OTHER	110 383	0
TOTAL	1 379 792	1 004 000

Source: Statistics South Africa Labour Force Survey, authors own calculations.

FIGURE 5: EASTERN CAPE OCCUPATIONAL PROFILE, 2022

OCCUPATION	2022	PERCENTAGE
ELEMENTARY	386 341	28%
SERVICE WORKERS AND SHOP AND MARKET SALES	262 160	19%
CRAFT AND RELATED TRADE	132 629	9.6%
SKILLED AGRICULTURE AND FISHERY	9 734	0.7%
TECHNICIAN AND ASSOCIATE PROFESSIONALS	113 683	8.2%
CLERKS	127 506	9.2%
PROFESSIONALS	72 349	5%
PLANT AND MACHINE OPERATOR	101 092	7.3%
DOMESTIC WORKER	82 883	6%
LEGISLATORS, SENIOR OFFICIALS AND MANAGERS	94 585	6.9%
TOTAL	1 379 792	100%

Source: Statistics South Africa Labour Force Survey, authors own calculations.

DISCUSSION AND CONCLUSION

Evidently, advanced education and technical skills are a prerequisite for a country to benefit from the possible opportunities that come with the fourth industrial revolution. As it stands, the current outlook of the South African labour market implies that even the future workforce may not possess the necessary skills to adapt to 4IR industries. This paper recommends that the first starting point is an alignment of all impacted stakeholders (government, industry, and labour) to create mutually beneficial 4IR implementation strategies.

At national and provincial levels, the risk of automation is the highest for workers in the; hotel and restaurant, wholesale and retail trade, construction, and manufacturing sectors. These high-risk occupations are typically the most exploited and underpaid workers, similarly, these industries account for a large portion of the economy. As such, an investment in the education and reskilling of workers in these industries would guarantee that technology enhances, rather than displace labour in these vulnerable segments.

The discussion in this paper has highlighted that 4IR favours highly skilled individuals and as such occupations that require these skills have a lesser risk of automation. So, it becomes essential to increase post-school institutions' capacity to interact with the business industry and comprehend their existing and prospective future skill requirements. The list of occupations in danger of automation makes it evident that those requiring knowledge of creative, scientific, and mathematical concepts are less vulnerable to automation. As a result, a reform in the curriculum that prioritizes these topics would guarantee that the future workforce has the requisite competencies.

While it is important to keep up with the latest developments in the global economy, it is important to ensure that their implementation does not perpetuate the exploitation of the working class. For South Africa, the preconditions needed to secure workers from somewhat feeling the consequences of this current revolution, are poorly met. The 4IR and its comprehensive transformation may only serve to further entrench power imbalances and widen income gaps if its changes to the workplace are not controlled carefully.



4!R



The 4IR and its comprehensive transformation may only serve to **FURTHER ENTRENCH** power imbalances and widen income gaps if its **CHANGES** to the workplace are not controlled carefully.





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