How should South Africa redesign education, industrial policy, and fiscal incentives to harness artificial intelligence for productivity growth while limiting labor market disruptions

Postgraduate Category

Entrant No:698

Word Count:3744

1. Introduction

Artificial intelligence (AI) represents both opportunities and challenges for economic development in South Africa. AI has the potential to increase productivity, cut down on costs, drive innovation, and improve the delivery of public services. However, there are concerns about technology progressing quicker than the skills of the workforce develop. Without appropriate skill development efforts by organizations alongside sound government policies that ensure the gains of productivity improvements are distributed equitably, the rewards of technological progress will be unevenly distributed, benefiting businesses and skilled employees more than anyone else. It has been shown that increases in AI lead to large, immediate drops in manufacturing employment, with AI shocks accounting for nearly 30% of the variation in forecast levels of manufacturing employment over 10 quarters (Giwa & Ho, 2026). A significant negative long-run relationship has also been identified between AI investments and employment among low-skilled workers (Giwa & Ngepah, 2024).

The economic development in South Africa is beginning to be highly influenced by AI. Evidence shows that AI is being added into manufacturing, in South Africa, which is leading to productivity, better quality control and better supply chain management (Nzama *et al*., 2024). The question then is “how South Africa should use its institutions to ensure that AI assists with inclusive economic development”.

The essay claims that South Africa should introduce an integrated policy. In the first place, the education system should ensure that workers acquire a solid foundation of knowledge, develop technical skills, and have access to lifelong learning. Second, the industrial policy should ensure that AI is adopted in a way that enhances the country's productive capacity. Tax incentives must be provided to encourage innovations. This will require enough resources for reskilling, social protection, and redistribution so that the productivity increases can translate into economic benefits. It means that artificial intelligence should form a bigger policy strategy, which will not only increase production capacities but also increase economic prospects and welfare in South Africa. The focus should not be on how efficiently machines can produce, instead the focus should be, on how technology can help people.

2. The problem from the point of view of economics: productivity or no employment?

2.1. The dual effects of AI

The way tasks are divided among workers and machines will be influenced by AI. When automation reduces demand for labor because of technological progress, costs will fall. However, if AI is complementary, then workers will become more efficient, their decision-making will improve, and there will be greater demand for new types of tasks. It will be up to the nature of the tasks being automated, the way in which production is organized, and the level of demand for additional output whether employment rises or falls. AI and automation may contribute to economic growth by increasing the amount of capital and at the same time decreasing the use of labor in the production of goods, services and ideas (Aghion *et al*., 2019).

The application of data collected on a quarterly basis between 2014 and 2024 by Giwa and Ho (2026) revealed that employment in South Africa's manufacturing industry responds negatively to AI shocks. This suggests a high likelihood that advancement in technology will result in job loss in a sector already experiencing structural unemployment. Besides, Giwa and Ngepah (2024) highlight long-term employment risks to low-skilled employees. Nevertheless, it does not imply that every investment in AI will result in job losses. It has been shown that the introduction of AI into the manufacturing sector can enhance productivity, quality, and supply chain management (Nzama *et al*., 2024). Additionally, Gonese and Ngepah (2024) also find that the employment impacts of technological change are sector-specific, indicating that the effects of AI adoption are also dependent on the characteristics and production structures of specific industries.

2.2. Need for a separate policy in South Africa

South Africa cannot assume it has the same levels of educational attainment, technological infrastructure and institutional capacity as advanced economies, particularly in providing adequate employment opportunities and supporting workers displaced by technological change. According to Sutherland (2020), there is a lack of skilled people, infrastructure, and policy formulation/implementation issues in the country. A company might want to implement AI for efficiency purposes, but its workers do not have the necessary skills to perform these tasks. Smaller companies will not be able to benefit from technological developments, so larger companies will get further ahead of their competitors. Lastly, in case workers lose their jobs,

they will stay unemployed for a long time because neither the education system nor the labor market can help them get a job.

These barriers can contribute to structural inequalities by making technological development irrelevant to employment and income increase. Thus, the policy should not be about just increasing the level of automation. However, it should be directed toward achieving higher productivity by increasing domestic production, improving workers' capabilities, and providing new opportunities for those who are currently not engaged in productive activity.

3. Reforming education: turning knowledge into useful lifelong skills

3.1. Improving the foundation

In the first place, it should be acknowledged that if workers are to participate successfully in an AI-driven economy, they will need more than just digital skills; they should also possess strong literacy and numeracy, knowledge of specific subjects, and the ability to apply these skills to new situations. Where the education system emphasizes general abilities too much, there could be a problem with not having enough knowledge about concepts (Fataar, 2020). This can become a potential problem for South Africa's AI plan since the workers may not have the ability to analyze the output of a technology, recognize mistakes, and change with the new technology.

Computational thinking, digital skills, and knowledge of AI should all be part of the curriculum, but mathematics, languages, science, economics, and other subjects should also be retained. People working in various fields should understand how AI systems work, why their output may not be reliable, and that human judgment is still necessary. AI should be used to assist teachers; when properly implemented, such systems can help differentiate instruction, provide feedback, and reduce administrative tasks. As a result, teachers will be able to focus more on the students who require extra support. Nevertheless, there could be problems regarding unequal access to devices, the internet and adequate digital learning environments.

There is limited academic research on how the educational curriculum at all levels of learning in South Africa can be updated to include Fourth Industrial Revolution technology (Adetiba *et al*., 2026). Education should not be confined to higher education alone, but there should be an approach taken by all educational institutions that will enable the learner to develop the required skills.

3.2. Vocational Pathways

One of the major limitations of adopting AI is its perception that it constitutes the major path into technological careers through universities. At the same time, there is a requirement for technicians, craftsmen, operators, maintainers, and individuals who can integrate the digital systems into production processes already in place. Technical and vocational education and training institutions should collaborate with employers from manufacturing and other production industries to offer training programs combining both theoretical and practical learning, apprenticeships and use of AI-enabled technology. The Sector Education and training Authorities (SETAs) could facilitate collaborations between employers and TVET colleges in South Africa to make such collaboration possible. Skills Development Levy could also fund apprenticeships, on-the-job learning and technical training in AI to keep vocational education relevant to the new skill requirements of different industries.

Through these collaborations, there will be an improvement in the partnership between the educational institutions and the industries. An industrial manufacturing firm that needs to adopt artificial intelligence for quality control could work with a technical institute to develop skills in data analytics and machine production. The existing personnel in the company will take up different roles, thus giving the company the skills to implement technology.

3.3. Making lifelong learning part of the system

Education systems are normally built around preparing one for the working years, but the case is different when it comes to AI where requirements can be altered very often. Flexible education systems, continuous learning, and sector-based reskilling are essential (Brollo *et al*., 2024). South Africa needs to have a system of life-long learning. It could provide credits for eligible workers to finish training at accredited institutions. Employers should also foster learning and provide industry-specific re-skilling. Existing fiscal tools could be utilized to incentivize more employers to be part of such programs. For example, the Section 12H learnership allowance is a tax incentive for employers that enter qualifying learnership agreements, which may help foster the development of workplace-based training and reskilling opportunities in AI-related fields. It would ease the financial burden on companies and incentivize investment in the development of their staff.

Evaluation of providers should be carried out by referring to the number of training programs successfully completed, the qualifications obtained by participants, the extent to which they

have helped people to secure employment, and the amount by which they have increased workers' wages. Only in this way can scarce public funds be directed towards programs that make a difference. Life-long learning should be made available to low-income earners. In situations where training would lead to loss of pay and long travel for workers, accessibility becomes difficult. Therefore, there is a need for flexibility, blended learning and funding.

Reforms in education alone cannot create a new job opportunity for every worker that loses one, but it can reduce the gap between technology and the skills of the workers. Success should be measured by whether people have gained the knowledge and opportunities to participate actively in an evolving economy or not.

4. Reforming industrial policy: the use of technology to build up domestic productive capacity

4.1 Promoting innovation in the field of manufacturing

Industrial policy should focus on using AI to increase the productive capacity of South Africa, especially in the manufacturing sector. This sector is likely to benefit from the use of technology which will enhance productivity, quality, reduce wastage, improve planning, and supply chain management (Nzama *et al*., 2024). As a result, this will help make South African firms more competitive and domestic production more reliable. Industrial policy should therefore support the integration of investment in technology and labor skills together with domestic production growth.

It is advisable for South Africa to have a productive AI Partnership Programs that would bring together the government, companies, universities, technical colleges and organized labor. This would be done by providing technical and conditional support for use of AI in manufacturing processes but only on condition that they provide credible plans regarding the training of employees, changing their roles, increasing productivity and upgrading capabilities of domestic suppliers. This partnership should be based on South Africa’s National AI Policy Framework to ensure that industrial AI contributes towards national development goals and responsible innovation. The existing industrial support programs can also be used to provide support to companies making improvements in productivity, domestic technological capabilities and workforce development.

Not all companies need to retain all their current positions. On the contrary, companies should be rewarded when they demonstrate they can increase their productive capacity by adopting new technology and making reasonable efforts to reallocate staff, create more valuable jobs, and support transitions. This would ensure that technology incentives are aligned with broader national development goals, especially productivity growth, workforce development and the expansion of domestic productive capacity.

4.2. Support SMEs

It would be unreasonable for South Africa to expect that only large companies would benefit from industrial transformation, since small and medium-sized enterprises are an important element of the economy. If only a small number of large firms have technological capabilities, then market concentration will increase and productivity gains will decrease. It has been shown that the uptake of AI among small and medium-sized enterprises in South Africa's manufacturing sector is low, indicating that these companies are not innovating and that their productivity is not rising. A lack of an appropriate framework for adoption is a major limitation (Akoh, 2024).

The government ought to offer shared AI extension services to assist smaller manufacturers; these services should include affordable technical assessments, AI implementation, employee training, and appropriate digital infrastructure. This approach would enable the identification of situations in which AI can be used to address real-world problems. A small or medium-sized enterprise could begin by using AI for inventory management or predictive maintenance, which would, in turn, help them identify areas where they can achieve measurable efficiency improvements. Using shared testing facilities can help lower costs, and cooperation with universities is also beneficial. Projects which will improve on both production and learning need to gain the support of the public. Support from the public will allow small firms to become suppliers in the sophisticated technology manufacturing process. This will enable SMEs to improve on the efficiency of their production processes.

4.3. Infrastructure and domestic innovation

AI uptake will depend on adequate infrastructure, connectivity, computing capability, and skill level, among other institutional factors, and this represents a major constraint towards South Africa's aspirations towards the Fourth Industrial Revolution (Sutherland, 2020). This means that industrial policy should not only focus on subsidizing firms but also invest in infrastructure

which will facilitate adoption of productive technology by firms. Digital infrastructure, training centers, applied research and university-industry partnerships will require public investment. Thus, research focus on addressing production related challenges in the South African industries.

The government should also encourage the responsible development of AI applications in the public sector to enhance efficiency. Naidoo *et al*. (2022) examined the application of AI in healthcare. They emphasized the need for appropriate policy frameworks to address data and algorithmic bias, their effects on the workforce, liability and innovation. The same goes for the industry sector. There should be clear rules to keep people accountable, to ensure the right use of data and human involvement. Furthermore, industrial policy must be aimed at technological adoption and learning as this will help build the domestic capacity to operate, modify and improve advanced systems.

5. Reforming the fiscal incentives to encourage productive AI

5.1. Reforms of the incentives to encourage inclusive investment

It also influences what kind of technology companies choose to invest in – and if the fiscal system does not create any incentive to invest in training people rather than replacing them with machines, this could be considered a form of socially inappropriate investment. Governments must undertake fiscal reforms to stop giving companies incentives for investing in technologies that replace people (Brollo *et al*., 2024). Still, taxation of AI is likely to be complicated, as well as to prevent investment in complementary technologies to increase productivity.

South Africa should avoid the use of AI taxes, as this could discourage innovation. Instead, fiscal reforms should be undertaken to encourage productive investments and innovations (Aghion *et al*., 2019). Incentives should be provided based on objective evidence, such as higher productivity potential, successful completion of employee training, research collaboration, increased efficiency and growth of local suppliers (Nzama *et al*., 2024). Publicly funded organizations should be obliged to report on these metrics to prove their compliance with the promise of investing in employee development. A separate review should be undertaken to ensure that the investments are indeed delivering additional benefits.

5.2. Setting up the tax system to promote productivity gains

AI can lead to greater economic benefits for owners of capital than for employees; this may be because companies acquire market power or choose to invest in technologies which automate processes. Having skill policies will not reduce the risks associated with the negative impacts of AI on distribution (Ernst *et al*., 2019). The emergence of these challenges emphasizes the importance of implementing regulation in the digital economy and measures aimed at protecting the data as well as limiting the level of market concentration. Additionally, there should be a mechanism for redistribution of the productivity gains through the tax and labor markets.

In the case where the level of income earned by labor decreases due to technological advances, taxing the capital income becomes important in terms of public revenue and reducing the levels of inequality (Brollo *et al*., 2024). Thus, the government of South Africa needs to take additional measures to enforce the capital income and corporate taxes such that productive enterprises and capital income earners contribute to the public revenue process. It will help increase the amount of tax revenues as well as avoid the issue of tax avoidance without imposing taxes that crowd out technological investments.

5.3. Helping Employees Transition

A good fiscal policy can create a conducive environment for productive investments and minimize job displacement, although some job displacement is unavoidable. Therefore, the country's unemployment and social protection policies must cater to the unemployed and those facing difficulties in their income and occupation transitions. Such issues can be tackled by having the right unemployment protection measures in place together with active labor market policies, social assistance and industry-specific skills training (Brollo *et al*., 2024). In South Africa, the Unemployment Insurance Fund (UIF) can give income support to eligible workers who have become displaced, taking into consideration its current eligibility conditions. Moreover, SETAs can offer industry-specific skills development and work-based learning and employment services to such affected workers to find alternative job opportunities.

Better coordination between employment services, training services, and income support should also be considered for the reintegration of displaced workers into the workforce in South Africa. Access to good quality training and assistance in looking for alternative employment should also be provided to displaced workers. It is also necessary that existing mechanisms for

unemployment protection like the UIF should be made use of to provide temporary income support to qualifying workers to minimize financial pressure during the process of transition and to prevent displaced workers from engaging in unsuitable employment.

People who are engaged in non-standard forms of employment and those in the informal sector should also be considered. Offering permanent compensation to those who lose their jobs because of technology or introducing universal subsidies for businesses would be expensive. Assistance should be limited to those who are genuinely affected and who fulfill clear eligibility criteria and this situation should be reviewed frequently. AI could be used to improve public administration by determining needed services and removing inefficiencies. On the other hand, there should be measures put in place to guard against the possibilities of making wrong judgments, exclusion, and abuse of private information. These will ensure that the technological advances are sustainable economically without discouraging investments for productive employment.

6. A coordinated approach to the three reforms

For any success to be achieved, there would need to be synchronization of education, industrial policies, and fiscal incentives. The three policy interventions are interconnected, and they need to have connections among them; the education policy needs to be connected to employment, industrial investments need to be accompanied by work force training, and the fiscal policy needs to offer enough funding for this.

This means that South Africa needs to take an integrated approach in implementing all its reforms. The government's first move should be to work with the departments of education, higher education, trade and industry, labor, and public finance on AI-related productivity and employment matters. This coordination should be based on existing institutional structures such as SETAS and the Skills Development Levy for skills development; TVET colleges for vocational training; the UIF for eligible displaced workers; and existing industrial and fiscal support instruments. Aligning these institutions with the National AI Policy Framework of South Africa will help to avoid fragmented interventions and ensure that education, industrial development and worker protection are mutually reinforcing.

This will aid in coordinating curriculum development, industrial support, tax incentives, and employee transition. Public funding should be introduced in a step-by-step manner. Pilot schemes should be set up in specific value chains within the manufacturing sector and in other

areas with opportunities for commercial AI applications. The schemes should then be assessed with a view to examining productivity, employment, wages, training results, the involvement of small and medium-sized enterprises and the development of local suppliers.

However, this suggested policy framework should consider the distributional impact of the technological shift since an improvement in general productivity may result in adverse impacts on occupations, geographic areas, and income groups. As a result, it becomes clear that the policymakers must identify the winners, losers, and opportunities for the losers to transition. It is crucial to know the impact of AI on employment in different sectors (Gonese & Ngepah, 2024). The policy should be flexible in view of the uncertainty surrounding the pace of AI development and its effect on employment. Given the slow pace of technological change and the considerable disruption of technological effects, governments should realign their incentives and training priorities based on the evidence, reinforcing what has worked and changing what has not, which will turn policy coordination into a useful learning tool.

7. Conclusion and recommendations

South Africa can boost its productivity, industrial competitiveness, and public service delivery by adopting AI. However, it has been shown that there can be negative effects on employment. Studies in the manufacturing sector indicate productivity increases, but there are also negative effects on employment, with low-skilled employment at risk. Education in South Africa ought to be reformed to provide people with the necessary knowledge, technical skills, and opportunities for continuous learning. Industrial policy should assist large manufacturers and small and medium-sized enterprises in investing in AI and promote local research, supplier development, and complementarity among employees. Tax incentives must not only encourage productive investment but also investments in human capital. This must be done through an efficient design of tax and social protection systems.

For this, a comprehensive approach is required that incorporates education reforms, industrial development and programs for displaced workers. Fiscal Incentives must be designed to encourage innovation, develop productive capacity and foster responsible transformation of the labor force. In addition, efficient tax and social protection systems are necessary to finance lifelong learning, provide social protection for vulnerable workers and make sure the gains from increased productivity brought by AI are more equally distributed. The distributional impact of technological change can simply be allowed to take its course or addressed through specific policies and institutions so that productivity gains are channeled back into

development. A comprehensive AI strategy in South Africa must promote technology, develop human productive capacity and contribute to inclusive development. What matters is whether AI helps South Africa become more productive and develop economically.

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