

Fourth Industrial Revolution and gender-responsive budgeting in South Africa: Policy challenges and alternatives

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■ Introduction

Gender-responsive budgeting (GRB) is becoming a necessary instrument that the government needs to employ to engender gender equality across all spheres of society. Pledging to erase the gender gap is not enough, as implementing active instruments to correct gender inequalities is the right step. This need is why several countries embrace active instruments in their fight against gender inequality, such as gender mainstreaming as a targeted measure to achieve this. Weaponising gender mainstreaming enables the government and relevant stakeholders in society to direct specific

How to cite: Ojo, TA & Olaitan, ZM 2024, 'Fourth Industrial Revolution and gender-responsive budgeting in South Africa: Policy challenges and alternatives', in B Ndzendze, A Singh & S Timm (eds.), *The 4IR and the Humanities in South Africa: Perspectives on innovation, power and potentialities*, AVARSITY Books, Cape Town, pp. 3-18. <https://doi.org/10.4102/aosis.2024.BK431.01>

instruments towards addressing the gender imbalance across all spheres and to dedicate resources to ensuring the success of such policy. Gender budgeting, which falls under the gender mainstreaming strategy, allows for the equitable allocation of resources based on gender. It is one of the numerous instruments often used to actualise gender mainstreaming, primarily within the government's fiscal policy. It deals with allocating resources to address the gender imbalance within society.

Technological space is one of the many spheres within which GRB can be used. Looking at the gradual popularity of the Fourth Industrial Revolution (4IR), 4IR signals the movement from previous technological developments to more advanced ones like artificial intelligence, big data, the Internet of Things (IoT) and other innovations. Interestingly, as with other spheres, women have historically been excluded and underrepresented in technology, with most technological innovations and substantive professions dominated by men. The science, technology, engineering and mathematics (STEM) sector that informs these innovations has more men than women, resulting from gendered norms of the kind of professions men and women can engage in. With this gendered narrative, women often do not venture into STEM-related studies, which invariably affects their participation in related professions.

Drawing from the above, South Africa as a country is not immune to this reality, as there are more men than women engaging in the technological space. The question then is, how do we resolve this gender imbalance considering the gradual popularity of the 4IR? We cannot have gender inequality in the First (1IR), Second (2IR) and Third (3IR) Industrial Revolutions. Yet, we are about to venture into the 4IR with no workable actions or policy to avert this. Gender mainstreaming-cum-GRB can be focused on to aid in strategically including women as participants in the 4IR. It is based on this that this chapter intends to look at the 4IR and how GRB can be used to correct the gender imbalance inherent within that space. The chapter looks at the potential GRB offers in balancing gender inequalities in the 4IR. It further explores the policy on digital economy and 4IR by the South African government and how they intend to ensure the inclusion of women in the sphere using GRB. We ask if there are any policies targeted towards this goal and what are the various policy actions that will correct the low participation of women in the 4IR. By examining these efforts by the government, there can be a discussion on the policy challenges that bedevil such efforts at employing GRB to ensure the increased participation of women in the 4IR. By identifying the policy challenges, this work will recommend alternatives that will consolidate the current policy to ensure that the inclusion of women in the 4IR is achieved through GRB and gender mainstreaming strategy.

Research needs to be carried out to document the efforts that the government and other relevant stakeholders are making to ensure that women are not seen as benchwarmers and to investigate if the policy on GRB in South Africa is suitable enough to respond to the exclusion of women in the 4IR and achieve an equitable representation of women. This chapter will start by understanding South Africa's stance on women in the 4IR. It stems from recognising the minimal space women currently hold in the tech space; it then highlights the government's reaction and pledges to improve the situation. This chapter examines GRB, what it is about, how it works and other issues to establish that there is an instrument that can be used to carry women along in the 4IR. This chapter will discuss how GRB can be used to enable the increased inclusion of women in the 4IR. Policy challenges and alternatives will be looked at to determine obstacles limiting the potential of GRB working to include women in the 4IR and what alternatives exist to mitigate this.

■ South Africa's stance on women in the Fourth Industrial Revolution

With the advent of the 4IR, South Africa has entered a new era of technology that is bringing about the changing nature of work and new modes of living (Chauke 2022, p. 1). During the 4IR, gender inequality has not been as important and, therefore, has been overlooked. Little attention is paid to the pervasive low participation of women in STEM-related jobs and the eradication of gender inequality in the technology space. Women are vastly underrepresented in STEM, which forms the basis of the 4IR (University of Johannesburg 2021). UNESCO (2019) noted that less than 30% of the researchers working in STEM are women, and South Africa is no different. The studies on the 4IR in South Africa concerning women are structured in a manner that identifies a gap in 4IR perception in the country. General discourse on technology and the 4IR often do not include women's significant role, adversely affecting the recommendations for further development.

PricewaterhouseCoopers (PwC) reports that only 19% of jobs related to information and communications technology (ICT) are held by women (Chauke 2022, p. 1). The lower number of women working in the ICT sector is a result of the extreme inequality in access to job opportunities within this sector. Compared to their male colleagues, women in this industry currently earn lower incomes. According to Malinga (2022), there is a gender pay gap and gender inequality in the ICT industry, with women in the sector earning up to 25% less than men. As a result, the gender divide will continue to widen in 4IR unless appropriate measures are taken to adopt sustainable

digital policies relating to gender. Speaking on the importance of 4IR on the economy, South African President Cyril Ramaphosa states, 'South Africa must be a technologically driven country that finds solutions that move us forward, with 4IR as a pivot for economic recovery' (cited in Chauke 2022, p. 1). In addition, he stated that while women have made progress towards equality in sectors like the government and the legal system, it has been challenging for them to obtain equal opportunities in the digital economy. In South Africa, women are no longer producing technology; instead, they are becoming consumers. Today, women must embrace technology and develop tech-related abilities to function as important makers of technologies. To incorporate women into the national technological innovation process, the ICT sector must play a significant role in this. The government of South Africa hopes to have completely realised the promise of technological innovation to boost its economy and improve the lives of its citizens by 2030 (Brookings Institution 2020). To actualise the creation of a comprehensive national response plan, the president formed the Presidential Commission on the Fourth Industrial Revolution.

One question that comes up when reading about the 4IR in South Africa, its pillars and the recommendations is, 'Where do women fit in all this?' This question comes after reading the report from the 4IR commission, which dates back to 2020. Firstly, the commission acknowledges the inequality in the country, that there are more women than men in the country and that women's life expectancy is generally longer than that of men (Republic of South Africa [RSA] 2020a). The challenge is that despite acknowledging inequality in this country, which largely stems from gender lines (Matotoka & Odeku 2021), there is little said about how the 4IR will improve women's position in society or at least include them in various ways. This is alarming because factors such as gender stereotyping, digital illiteracy, inaccessibility to data and discrimination have confirmed digital exclusion in the country. Also, finding information on women related to the 4IR in South Africa on the Internet is not easy. There is no clear indication of where women fit into all this or the government's approach concerning women. This is an indication that needs to be clear, considering the vulnerability of women in this instance. This is further alarming as women have already been left out in various platforms in 'professional' South Africa, including managerial positions (Matotoka & Odeku 2021). Furthermore, even the fact that this work attempts to justify why women should be included is a fundamental problem. It demonstrates how society has been gendered and how that has been accepted as a norm.

There are concerns that work primarily done by women will be among the first to be automated, and the 4IR might make gender inequalities worse. On the contrary, 4IR offers incredible benefits and is likely to improve the quality of life of people, women included (Chiweshe 2019, p. 3).

Nevertheless, threats are inevitable. Jobs within these industries are undergoing a transformation, becoming more decentralised and diverse. This shift in employment dynamics raises concerns about instability, particularly for women. For instance, the increasing fragmentation of work, marked by heightened competition for individual tasks, poses a potential threat to the strides made by women in securing continued employment through paid maternity leave. In many parts of Africa, women face challenges in owning assets such as houses and cars, which are essential for active participation in emerging shared economies. Prevailing patriarchal norms and practices have primarily marginalised women, especially in terms of ownership of productive assets like land, as highlighted by Chiweshe (2019). However, the technological advancements of the 4IR present specific opportunities to enhance the quality of life for women across the African continent.

Furthermore, the gendering of STEM could be another reason why it seems as though women are left out in the 4IR or why there are no visible policies on the place of women in the 4IR. Studies demonstrate that women remain underrepresented in the sector, with only 23% of women visible in core STEM occupations (Chiweshe 2019). Findings also indicate that only 13% of STEM graduates in South Africa are women (SkillsPortal 2022). It is argued that women are underrepresented in the top ten global tech companies and only hold 28% of the managerial positions therein (Letsebe 2018). This underrepresentation of women in this field in South Africa seems to have been institutionalised; hence, it is unsurprising that women are not visible in conversations around the 4IR in South Africa. What is alarming is the consequence of this, that we are growing and creating a future that has perpetuated the exclusion of women.

It is not about only thinking of women in STEM but also how women can be involved in this digital advancement to ensure that they are not disadvantaged more than they are right now and remain employable. Research has demonstrated that the existing gender gap in South Africa means that women will be left out of digital work opportunities, as jobs at the greatest risk of being replaced by automation are those that women have traditionally occupied (Adams 2021). This is once again alarming as this could potentially harm many women, particularly black women in South Africa. The leaving out of women raises concerns about the continued perpetuation of the inequality (socio-economic and gender) that exists and puts women at risk of harm, like gender-based violence. This is of interest as research has demonstrated that gender inequality is a leading cause of violence against women (Nyoka 2022). These consequences are a big problem in a country like South Africa, where gender-based violence is rife, with an average of 123 cases per day reported between October and December 2021 (Nyoka 2022).

■ Gender-responsive budgeting

Gender budgeting came into being in the international context of economic globalisation; efforts at gender equality used this approach to respond to the ongoing restructurings and imposed structural adjustment programmes to reduce public tasks. Quinn (2009) defined it as a gender-based assessment of budgets, incorporating a gender perspective at all levels of the budgetary process and restructuring revenues and expenditures to promote gender equality. Gender-responsive budgeting is an initiative that uses fiscal policy and administration to address gender inequality and women's advancement (Stotsky 2016, p. 1). These initiatives believe that gender equality can be promoted by influencing gender budgeting (International Labour Organization [ILO] 2006). Gender-responsive budgeting aims to promote accountability and transparency in fiscal planning, advance gender equality and women's rights, and increase gender-responsive participation in the budgeting process (European Institute for Gender Equality n.d.). When funds are distributed in a way that ensures gender parity and promotes equal opportunity for everyone, a gender-responsive budget will benefit all females and males, adults and children alike (Stephenson 2018). Analysing government budgets for their impact on various genders, as well as the norms and roles that go along with them and the interactions between them, is a crucial part of GRB, which is necessary for both fiscal and gender justice (Stephenson 2018). It also entails changing these budgets to guarantee that promises made on gender equality are fulfilled. Gender-responsive budgeting can take many forms and governments can carry it out locally or nationally. Parliamentarians and civil society organisations can play an essential role in putting pressure on the government to carry out GRB by performing the necessary oversight functions. Gender-responsive budgeting involves considering the gender impact at all stages of the budget process for gender to be reflected in budget decisions. The gender budgeting process does not aim at gender equality directly but operates to prioritise resource policies (Downes, Von Trapp & Nicol 2017). This is because the participation of men and women in public decision-making is dependent on the distribution of resources in a society, which also informs their social status. Gender-responsive benefits are that it creates greater transparency regarding the criteria that form the basis for budget-related political decisions. It facilitates increased accuracy and sustainability because funds are more precisely tailored to the real needs of the different social groups. This approach aims to expedite the institutional change necessary to eradicate the systemic disparity that exists between men and women. Its focus is on the whole budget, making sure that every facet of the budget and the ensuing expenditure or usage of resources benefit both men and women equally. It starts with the idea

that the current budgets are gender biased in favour of males and works to change this reality so that females and males can gain equally.

UN Women (2015) argued that:

[G]ender-responsive budgeting is not about creating separate budgets for women or increasing spending on women's programmes. Instead, it seeks to ensure that the collection and allocation of public resources are carried out in ways that are effective and contribute to advancing gender equality and women's empowerment. (p. 1)

This budgeting is essential, particularly in countries like South Africa, with high inequality levels based on gender lines; for instance, close to 42% of women live below the lower-bound poverty line, compared to 38% of men (Statistics South Africa 2015). Gender mainstreaming that includes GRB has become mandatory under various international instruments binding on South Africa.

Australia pioneered attempts at gender budgeting from 1984 onwards in response to calls from women's rights activists. Over the past decade, more than 90 countries have experimented with some form of gender budgeting (Downes et al. 2017). While Australia was the first country to attempt these gender-responsive budget initiatives in the 1980s through the Women's Budget Statements (ILO 2006), South African women have also been fighting for this type of equality for a considerable amount of time. This has taken place through adapting the South African Women's Budget Initiative (SAWBI) in 1995, which was also modelled based on the Australian version (Commission for Gender Equality 2021). This initiative aimed to be intentional about the inclusion of gender into government budgets; this was done so that gender would be a priority in government and budgets and not something that was side-lined (Commission for Gender Equality 2021).

Despite the failure of the SAWBI, the South African government showed interest in GRB by approving the Gender Responsive Planning, Budgeting, Monitoring, Evaluation and Auditing Framework, and Country Gender Indicator Framework in 2018. This framework recognises that a number of the policies for women are outdated, such as (Department of Women Youth and People with Disabilities 2018, p. 5):

- the South African policy framework for women's empowerment and gender equality, which dates back to 2000
- that South Africa has experienced a regression in gender mainstreaming, a consequence of which is the reinforcement of existing gender inequality and norms
- that there is very little evidence of gender mainstreaming in practice across the country.

This shows that very little work may have been done since the failure of the SAWBI. Furthermore, there is little accountability in the responsible organisations, and not much work is being done to ensure that GRB is prioritised in South Africa.

Lastly, this report is further accompanied by the country's goals and strategy concerning GRB. The short-term goal would be to focus on gender mainstreaming within existing government-wide planning, monitoring and evaluation systems and institutions (DWYPD 2018). The medium-term goals would last until 2024 and are also in line with the National Development Plan (NDP). These goals involve a change in legislature, evidence-based diagnostics and a gender audit of the government, as well as the development of an implementation plan and a monitoring and evaluation plan (DWYPD 2018). Lastly, the development of a gender indicator framework is based on an overall theory of change, where programme outcomes would contribute towards gender outcomes and lead to this impact at the country level (DWYPD 2018).

■ Fourth Industrial Revolution gender budgeting and South Africa's response

The 4IR will impact all aspects of society, yet little attention has been paid to how these developments will affect women. The technological advancements of this era include biotechnology, artificial intelligence and the IoT. The advances shape cities, government systems, social relations, media and the economy. The determining factor of the revolution is to make life easier and better for all. The world of science and technology is male-dominated and rides on the back of unpaid labour, which is likely increasing in an environment where women have little access to the Internet and technology (Adams 2019). The phrase 'digital divide' was created to characterise the disparity in access to technology, particularly ICT, that results from a divide between those who have and do not have access to information (Mulrean 2020). The lack of female representation in STEM is one of the biggest barriers for South African women to pursue a career in such subjects. Women are generally underrepresented in the STEM field, which has negative consequences for ensuring gender parity in the digital economy. A report by the International Development Research Centre (2019) noted that no African country is ready to reap the full benefits of artificial intelligence (AI) and that women run the risk of being left behind by advances in AI (Mulrean 2020). The World Economic Forum (WEF) (2018) stated that data science and AI are part of eight professional clusters forming part of the new economy; however, women only represent 26% of that cluster. As demands continue to rise for individuals with machine learning and data science skills, the nature and quality of women's career prospects are shifting.

Consequently, they run the risk of being negatively impacted (WEF 2019). Artificial intelligence has a gender bias in personal assistants like Siri, and these concerns may impact South African women's livelihoods (Adams 2021). The difficulties women encounter in achieving digital inclusion reflect the pervasive gender inequality in the real world. While technology and digitalisation provide women and girls many opportunities, they can also exacerbate gender-based inequality. The 2030 sustainable development goals (SDGs) are an international acknowledgement of the role that gender equality and ICTs play in advancing sustainable development on a global scale. According to a 2017 survey, women in South Africa are closer to parity when it comes to Internet usage, with 50% of them compared to 57% of men (Mulrean 2020). Compared to other African countries, South African women have the highest degree of Internet access. Considering the high unemployment rate in South Africa and the existing lack of talent with digital skills, enhancing women's digital fluency can have a big impact on economic growth. Gender-responsive budgeting and legislation can address gender bias and discrimination in the 4IR. Gender-responsive budgeting is a step towards accountability for women's underrepresentation in the technology sector and towards greater public transparency and can shift economic policies to increase the role of females in the 4IR. There is a renewed push to build GRB and planning within the broader public policy cycle because of the realisation of the gender gap in the country. The cabinet approved the gender-responsive planning, budgeting, monitoring, evaluation and auditing framework (GRPBMEAF) in 2019 to ensure the formalisation of the country's strategy (Clifton et al. 2021). In addition to mandating the National Treasury to take the lead in this policy, this framework encourages the advancement of GRB.

In 2019, a Presidential Commission was established to guide policy response to the 4IR. White Paper was then published by the Department of Science and Innovation, outlining the state's trajectory during the 4IR. The department contends that the 2019 White Paper's main aim is to encourage and enable scientific and technological innovation for an inclusive and sustainable South Africa. President Ramaphosa stated that one million people will be trained in data science and related skills by 2030, albeit policy conditions that are neither conducive nor inclusive of digital reskilling by neglecting the lived experiences of women and other marginalised groups as the difference in access to digital technology (Devdiscourse 2019).

The policy is meant to address the issues of unemployment, inequality and poverty as outlined by the NDP of 2013; however, Gillward (2019) contended that eradicating the triple threat is impossible without an intersectional understanding of the group within which development is sought. Gillward (2019) further postulated that technological transfers

without a localised understanding of communities, value systems and social roles would result in increased workloads, subordinate positions within the family and a loss of rights to resources for South African women. South Africa is ranked highest in gender-based violence, and there is a link between the societal treatment of women and socio-cultural-technological phenomena and how world views and relationships are structured.

Hildebrandt (2015) argued that technology reinforces cultural myths through virtual assistants (e.g. Siri), whereby women are commanded to be submissive and their place and role in society are delimited and subjugated (Adams & Loidean 2019). According to James et al. (2006), managerial positions in ICT are male-dominated. The *Employment Equity Act 55 of 1998* was promulgated to address historical and systemic discrimination in the workplace; 24 years later, females, especially black females, are lagging and disproportionately underrepresented in both the public and corporate sectors (Matotoka & Odeku 2021).

The NDP identifies digital transformation as a critical feature in transforming South Africa into a more digital society. The pillars are divided into three, and digital access outlines the right to digital access by all citizens as well as the potential for a better quality of life using ICT (National Planning Commission 2017). Additionally, digital inclusion is mandated to ensure no exclusion from the benefits of a digital economy and knowledge.

Implementing these reforms has been delayed; thereby, women are still saturated in routinised work and secretarial positions in the digital market, as outlined by Matotoka and Odeku (2020). Antonio and Tuffley (2014) posited that women in developing countries are not placed to benefit from knowledge and technology because they have little access to scientific and technical education. The Worldwide Web Foundation (2015) reported that women lack confidence in accessing online resources and education. There is a direct correlation between access to ICT and social development (Esselaar et al. 2010, p. 23). With a feminised poverty rate of 71% in South Africa, the objectives of the 2017 NDP are far from being realised (National Planning Commission 2017). The 4IR's technological advancements present unique chances to raise women's standards of living throughout Africa. With more equipment at home and in the office being connected to the Internet, women may now work from home and set their own hours, improving their work-life balance. This is made possible by the IoT. Connectivity will also give professional African women in metropolitan areas access to resources for education and mentoring, which will help them become more marketable and skilled. Research indicates that educating women in STEM fields early in life and providing them with sufficient preparation for the job can lead to increased opportunities for

economic growth and development. For women who lose their employment to automation, there are options for retraining programmes. These strategies ought to concentrate on combining sectors like renewable energy and encouraging female entrepreneurs, particularly in rural areas.

South Africa created commissions on the 4IR in response to the World Economic Forum 2018 report, emphasising the need to become future-ready. However, gender was not central in setting up the commission, but there is scope to advocate for gender mainstreaming in its actualisation. Chiweshe (2019, p. 3) argued that in the 4IR, the assumption is that computer programmes are bias-free and algorithms can reduce the influence of gender, race or any factors that may affect how people are evaluated. However, these programmes are created by humans with an in-built gender bias in their language or indicators, which may perpetuate inequalities. This is why it is essential to make extra effort to ensure that these biases are prevented at the root. The sociocultural structures that support gender inequality and women's exclusion in Africa have not changed to keep up with technological progress. Since women still do not have equal access to resources like land, credit or technology, there is a risk that these new technologies would further reinforce patriarchal inequities. Because women's exclusion from the workforce was largely replicated by earlier industrialisation processes in Africa, which resulted in their being assigned to low-paying jobs and further entrenching their underrepresentation, Bhatasara and Chirimambowa (2018, pp. 23–28) noted that the 4IR is likely to perpetuate the structural inequality.

■ Policy challenges

South Africa's policy on GRB is still encountering several challenges hindering its actualisation, specifically regarding how it can help ensure the inclusion of women in the 4IR. Some of these challenges will be discussed to help understand what the problem is and what solutions there are.

There is a lack of aggregated data to assist in reviewing and analysing the entire planning and budgeting process (Department of Women, Youth and Persons with Disabilities 2018, p. 5). When instituting GRB, necessary and up-to-date data regarding the number of females excluded are needed and disaggregated based on demography. This ensures that the relevant department possesses all the required information to make accurate and informed decisions. Most notably, during the analysis and budget planning process, these data will feed the approach to addressing the problem and how resources should be allocated based on the data collected. However, without such detailed data, GRB will not be possible. Data are crucial in implementing policy because it is based on the collected data, ensuring that the authorities can understand how and where to focus.

Lack of adequate formulation, allocation and expenditure of budgets results in the exclusion of females in planning and budgeting processes that hold potential developmental opportunities for women (Department of Women, Youth and Persons with Disabilities 2018, p. 5). A primary principle of gender budgeting is that the fiscal budget can be used as a strategy to cater equitably for the needs of marginalised groups, in this case females. Thus, drafting the budget and carrying it out must be guided to ensure that the intention is fulfilled. If women were considered in formulating a budget to ensure that they are catered for and resources have been highlighted towards this end, it would be problematic if this is not executed. It becomes a huge problem when the government pledges that it will formulate and implement a gender-responsive budget. Still, in the actual allocation of the budget, the needs of women are not targeted and the resources are not equitably allocated for the identified problem. What happens is that there will be no improvement to the problem as the proposed resources needed to drive the solution have not been actualised.

A lack of necessary gender-aware indicators to inform the relevant inputs, outputs and outcomes of plans and budgets (i.e. having equity as an explicit performance indicator) (Department of Women, Youth and Persons with Disabilities 2018) would make it impossible to ascertain the extent to which the approach has been successful. Therefore, it is essential for there to be gender-conscious indicators that guide the monitoring and evaluation process. When measuring the success of a policy, relevant indicators must be stated; in this case, equity must be outlined as an indicator to look out where the budget was equitably allocated and how it was able to address the intended problem. This challenge points to a lack of adequate policy formulation because when formulating the question of what the outputs are, intended outcomes and indicators are determined.

A lack of political willpower forms a more significant part of this challenge, as the bulk of implementing GRB lies in the readiness and intention of the government. Without the willingness of the government to implement, policy formulation ends at formulation; therefore, the first significant challenge to employing GRB to ensure the inclusion of women in the 4IR is government commitment through active measures. The success of a policy depends significantly on how committed the relevant stakeholders are in the implementation phase, as the willpower behind it is the primary driving force for adequate implementation. Gender-responsive budgeting needs action-oriented stakeholders to actualise it before achieving the desired aim, as it is an actionable strategy for mainstreaming gender in fiscal budget allocation.

Gender-responsive planning and budgeting-related activities continue in South Africa, although the intensity and scope of activities have

diminished over time. South Africa has had two GRB initiatives, one led by the National Treasury, a government initiative and the other led by non-governmental organisations and parliamentarians (Women's Budget Initiative) (Department of Women, Youth and Persons with Disabilities 2018). In South Africa and internationally, it has been concluded that top managers' commitment is critical if the process of gender mainstreaming is successful and sustainable. It is, therefore, necessary to raise awareness among decision-makers that gender matters in terms of policies and budgeting and that there are clear implementation guidelines developed in this regard, with continued engagement from the related stakeholders.

Other challenges include, firstly, the absence of an integrated meaning of gender and its role within the development objectives of the country and its economy so that gender mainstreaming can be delivered efficiently and effectively. Secondly, the existing departmental initiatives are not coherently aimed at ensuring that all plans, policies and programmes are directed and produced as a government-wide budgeting framework. Thirdly, the National Treasury needs to be enabled to prescribe a set of minimum standards for government departments so that they can be tracked and observed in a gender-equitable manner that considers the unique needs and priorities of males and females, both adults and children (Department of Women, Youth and Persons with Disabilities 2018).

■ Alternatives or recommendations

Gender-responsive budgeting is a process of continuous learning and not a one-time project; therefore, lessons learnt and good practice models must be shared and repeated year in and year out to improve subsequent efforts. On that basis, this section makes recommendations on consolidating current efforts at GRB.

In 2019, McKinsey Global Institute published a report titled 'The future of women at work: transitions in the age of automation'. It recommends that to ensure the inclusion of women, there is a need for concerted and creative new solutions that will enable them to seize new opportunities in the automation age. This is because women may fall further behind in the world of work if they do not possess the needed skills to transition. Between 7% and 24% of those will likely need to transition into their position before 2030 if they stay relevant (McKinsey Global Institute 2019). This transition into the 4IR working world of the future is going to require greater mobility and flexibility, the ability to be tech-savvy, and the acquisition of new and more skills. While this may be difficult for many, given the socio-economic constraints women experience globally, there are still opportunities.

Any attempts at correcting gender inequality to ensure the inclusion of women in the 4IR using gender budgeting must first work on the societal narrative and norms. The patriarchal norms, narratives and attitudes in society that place women in inferior status, which reinforces the unequal gender relations, need to be discarded. This process must start with the sensitisation of key government officials who are often in charge of the policy process. Before officials can be saddled with the responsibility of implementing GRB, they must understand the importance of GRB and how it will aid in fostering gender equality. Proper training must be done for them to understand the mechanisms involved in developing GRB to advance the participation of women. Secondly, there needs to be the development of a transversal digital policy that is comprehensive and inclusive. In trying to be inclusive, this digital policy must explicitly state how it intends to include women and equitably ensure that resources are allocated to this effect.

Furthermore, the Department of Women, Youth and Persons with Disabilities should take more active steps in leading and bringing together the various role players and assisting them in implementing a gender-responsive planning and budgeting strategy. The department should undertake functions designed to inform and govern all matters relating to women's economic empowerment through developing an implementable national GRB. The planning process must inform resource allocation, enabling effective implementation of programmes that can be better assessed and monitored to inform further planning and consistent improvement. Gender-responsive budgeting is often handled by the relevant financial and gender mainstreaming department. All officials should be conversant with and must adhere to the framework's principles (Department of Justice and Constitutional Development 2005).

Through GRB, funding can be channelled towards training more STEM professionals who are women. For instance, there is a gendered stereotype regarding who can and should enrol in STEM subjects in schools. This gendered stereotype restricts access of certain people who are mostly women into the field such that they are significantly underrepresented. Gender-responsive budgeting can be applied to ensure that females are visible within this field. The National Treasury and the Department of Higher Education and Training can set up a scholarship fund that will motivate females to enrol in the STEM field. Budgeting provisions can be made to ensure that funds are specifically directed to increasing the number of females in the tech space.

There needs to be the implementation of robust policy frameworks for social inclusion programmes in education to train more young females in STEM. The 4IR commission should be re-organised with a key objective to

ensure the inclusion of women through gender mainstreaming (Chiweshe 2019, p. 7). The South African government should endeavour to work on gender representation in the national institutions in charge of technology and innovations, organise programmes dedicated to spotlighting women in the energy sector and employ gender quotas to increase the presence of women in the 4IR by compelling the need for the presence of women in the STEM space and create a special fund for women to promote female entrepreneurship in STEM (Chiweshe 2019):

Push for gender-sensitive research agendas; provide targeted support to women researchers and techno-entrepreneurs; develop gender-sensitive monitoring and evaluation mechanisms; put mechanisms in place to unearth bias against women in science and technology. (p.1)

Appropriate measures must be developed to address the risk of gender biases being perpetuated in AI programmes.

■ Conclusion

The problem of the underrepresentation of women in most sectors is not a new phenomenon, as scholars have sought to understand the reason for this. However, as this underrepresentation deepens in specific sectors, more research is carried out to allow for a detailed understanding of why this is inherent. The technology space is often not identified as one of the major sectors in which females are underrepresented; as such, focus is placed on politics, economy and public decision-making. This underestimation has encouraged the further increase of gender inequality in STEM-related studies and, invariably, the technology sector. It becomes imperative to understand why women are not participating and the policy efforts the government is instituting to address this problem. Recognising that often the exclusion of women from spaces is rooted in systemic patriarchal norms and attitudes does not take away the fact that something can be done.

Hence, this work examined South Africa's readiness for the 4IR and the various efforts by the government to demonstrate this preparedness. It focused on governmental and policy actions that aim to ensure the parity of gender representation in the 4IR. It notes that whatever measures are being employed must first understand why there is a prevalence of low women's participation and find ways to address it adequately. By focusing on gender mainstreaming strategy, it explored how GRB is a needed instrument that can be used to ensure the increased participation of women in the 4IR. By equitably allocating resources and guiding the drafting of budget and other related fiscal issues, GRB provides a framework for how the government can direct resources to cater for the needs of females, which would alleviate the common reasons for why they do not or cannot

participate in the tech space. For instance, to encourage more female children to study STEM-related subjects, resources can be directed to provide funding for them so they do not have to worry about how to fund their degrees. This will also include providing resources to actively include women already working in STEM-related fields in the digital economy policy project to create more recognition for their work.

The effectiveness of any policy majorly depends on the degree of political willpower behind it; merely formulating a policy does not guarantee its success. Therefore, this work highlighted specific challenges hindering the operations of GRB as a tool to foster women's increased participation in the technological space, especially the 4IR. Policy approaches to addressing these challenges were also recommended to consolidate the current policy efforts by the government and other relevant stakeholders. Including women in the 4IR is not a one-off project because the barriers that limit them are systemic. Therefore, the solutions must be bottom-up, inclusive and specific to ensure that the barriers restricting women are efficiently and duly tackled. Even though women are the key beneficiaries of GRB, its impact benefits everyone.