

Policy Imperatives for African Science, Technology and Innovation: An Analysis of Namibia and South Africa

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ABSTRACT

The potential that Africa holds in contributing to globally competitive knowledge generation is undeniable. The challenges however, remain insurmountable to ensure that prioritised initiatives are implemented and realised. The issue of science, technology and innovation (STI) interventions as critical enablers could transform the overall socio-economic conditions immensely. These STI interventions need attention beyond policy formulation but should place more emphasis on implementation. This paper considers the applicability of African Union's Science, Technology and Innovation Strategy for Africa (STISA) 2024 policy framework on Namibia and South Africa. A Critical Theory perspective is employed as a theoretical approach to the discourse to offer a scholarly reflection on public policy initiatives which relate to STI for Namibia and South Africa. It is clear that adhering to the 1% threshold recommended by the AU policy STISA 2024 remains a difficult task to achieve. In the case of Namibia, its STI system requires time to mature and strengthen its institutional capacity. For South Africa, it is necessary to ensure that STI policy is able to broaden involvement for marginalised communities in rural and peri-urban spaces. The paper concludes with a consolidation of key features of the discourse as embedded in the Critical Theory for STI interventions. The essence is to maintain societal interest and ensure that new value systems on STI are embraced and maintained.

Keywords: Policy, Science, Technology, Innovation, Namibia, South Africa, Critical theory, Societal interest, Targets.

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Received: 07-09-2020

Revised: 09-02-2021

Accepted: 08-11-2021

DOI: 10.5530/jscire.10.3.61

INTRODUCTION

The issues pertaining to science, technology and innovation in Africa present a complex setup. This complexity is submerged by the basic developmental challenges such as poverty, poor education and a lack of infrastructure.^[1] The purpose of this paper is to consider the African Union's initiatives in promoting science, technology and innovation (STI) which are designed to address pertinent African developmental problems. Discussions in this paper are presented with a consideration of Critical Theory as an appropriate scholarly tool to analyse and reflect on STI policy implementation in Namibia and South Africa. A disposition to STI in Africa is undertaken to examine the policy provisions of the African Union's Science, Technology and Innovation Strategy for Africa (STISA) 2024 which set the standards for the member countries. The national STI initiatives of Namibia and South Africa are examined to highlight policy existing gaps that impede maximum impact of STI interventions

and achievements of the STISA 2024. A focus on the policy targets and check points serve to consolidate the discourse and highlight considerations necessary to maintain the STI societal interest and values.^[2]

Critical Theory for Science, Technology and Innovation

Critical Theory has a keen focus on emancipatory interests where reflections on individuals, groups or systemic interventions and constructs are often made. These reflections are necessary when analysing science, technology and innovation (STI) policy in the context of African countries where socio-economic developmental issues remain a challenge. In the application of Critical Theory for discourses of this nature, Antalffy^[3] draws on the scholarships of Jurgen Habermas and Andrew Feenberg where at least two distinct foci regarding the utility of STI studies need to be considered. These focal points are:

- Aiming at societal interest on science, technology and innovation which could be embedded as a societal subsystem.
- Maintaining the social values of science, technology and innovation.

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The development of the Critical Theory in the 1920s and 1930s in Germany was based mainly on Marxism in which the complexity of social relations was often reduced to the interaction or attributes of individuals and technological constructs. Discourses during the era of developing Critical Theory considered the manner in which STI intersected with society in relation to a variety of variables pertaining to scientific and technological revolutions of that period. It is a considered view that familiar themes included: Scientific discoveries, technocracy, the tyranny of expertise, the substitution of knowledge for wisdom and information for knowledge, a vision of the human being and of society as a complex of functional systems, the meaningless of modern life and the obsolescence of man. The appropriateness of these variable at the core of these intersections concern STI's use to benefit society.^[4] Fook^[5] believes that Critical Theory is often undertaken to alter deeply held assumptions to determine how to maintain social or material benefits for the citizens. The primary aim of Critical Theory is to be able to influence or lead to a major change in perspective. Grobbelaar, Tijssen and Dijksterhuis^[6] concur that non-traditional actors form a critical component of any innovation system where addressing certain pressing community problems is prioritised in realising these major changes.

The disposition of Science, Technology and Innovation in Africa

The ushering of the 21st century has brought about significant STI changes and advancements as enablers to socio-economic development. Deliberate STI interventions are needed to contribute to the emerging societal subcultures and interests for most African countries which are experiencing stagnation in their socio-economic issues. The prevailing conditions are that access to technological devices, data and internet usage have become a problem despite that these are considered basic needs for realising any developmental goals. In fact, the Agenda 2063 highlights critical problems of ICT penetration and access which is still considered to be at 5% of GDP on the African continent. Accordingly, internet penetration is placed at 16% as opposed to developed nations at 80%.^[7]

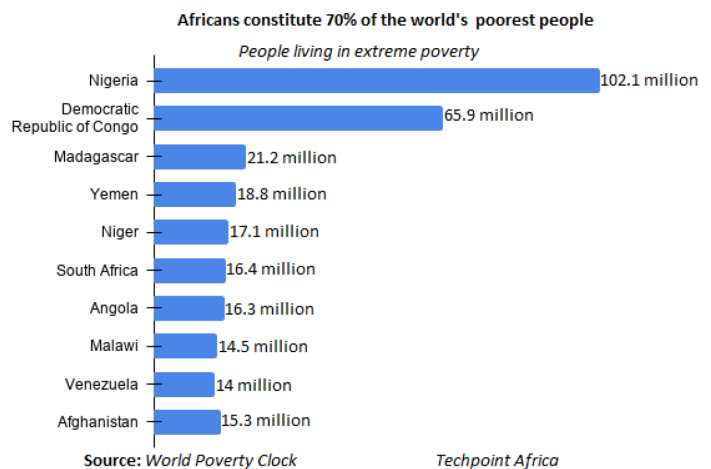
The World Bank^[8] makes provision for an up-to-date data on African countries and highlights the following indicators on internet, broadband and mobile access:

- Individuals using internet from the period 1996–2017 were 25% of the population. Namibia and South Africa were placed at 51% and 56% respectively in this regard.
- For access to fixed broadband subscription for a period of 2010–2018 which are averaged 0.44. Namibia has 2.53 while South Africa is at 1.92 respectively.

- Mobile subscription from the period 2010–2019 per 100 people was at 82, with Namibia having 113 and South Africa having 160.

The above indicators and Figures are necessary to assist in the characterisation of the conditions that need to be considered when policy interventions and societal interests are taken into account in designing the STI Policy. In essence, the above data reveals that Africans access to STI tools is a serious concern except for mobile phones. However, the issue of access to mobile phones does not include smartphones which is a key STI device in providing internet access and may be considerably low.^[9] While indicators above show Namibia and South Africa are mostly above average, their poverty, unemployment and inequality problems remain at crisis levels. Kolawole^[9] considers poverty as a single most contributor to the problem of access and a lack societal interest on STI issues. Figure 1 provides details of data regarding the highest number of poorest individuals and their countries where Africans contribute 70% accordingly.

Figure 1 above is used to place an emphasis on poverty as a crisis point in African countries which include South Africa. This Figure shows the number of individuals living in extreme poverty per country. Poverty translates to problems of access to STI tools which are enablers for improvement of the living conditions. One key reason Namibia is not showing on this list is due to its small population which could offer a different perspective when observed on a percentage of the population. It is clear that these numbers of individuals in extreme poverty are frightening because poverty is a key factor in impeding socio-economic progress for many Africans. In addition to challenges posed by poverty, lack of access to quality education which is intertwined to STI tools needs to be addressed. UNESCO^[10] further provides some insights on the overall education challenges in Africa:



Source: (Kolawole 2020)^[9]

Figure 1: Data on number of people living in extreme poverty.

‘Of all regions, sub-Saharan Africa has the highest rates of education exclusion. Over one-fifth of children between the ages of about 6 and 11 are out of school, followed by one-third of youth between the ages of about 12 and 14’ (UNESCO 2020.^[10] According to UNESCO Institute for Statistics (UIS) data, almost 60% of youth between the ages of about 15 and 17 are not in school and ‘without urgent action, the situation will likely get worse as the region faces a rising demand for education due to a still-growing school-age population’.^[10]

From this UNESCO’s crystallised assertion, it is clear that the education problem and poverty are critical impediments at the centre of the socio-economic development in Africa. Fostering societal interest and embedding STI subsystems as necessary 21st societal values means that targeted policy interventions are required to build a continental capacity in improving the quality of education and create measures to eradicate poverty. Capacity should be prioritised to stimulate and maintain competitiveness of African countries at a global stage of STI activities. Goal two of the Agenda 2063 states that:

‘Well educated citizens and skills revolution underpinned by science, technology and innovation. The priority area for realising this goal is ‘education and science, technology and innovation (STI) skills driven revolution’.^[11]

This goal is articulated to indicate how African Union seeks to support countries to realise STI goals. In fact, the African Union’s Science, Technology and Innovation Strategy for Africa (STISA) is considered to be a transformative and emancipative tool and facilitates such in the context of individual countries. STISA 2024 (2014–2024) is a short-term initiative meant to “Accelerate Africa’s transition to an innovation-led, knowledge-based economy”.^[7] The conceptualisation of the STISA as a transformative and emancipative tool links to the Critical Theory of Marxism where individual or group interests are prioritised accordingly.^[3] Its ultimate measure needs to be on the enhanced societal interest and established subsystem which are able to promote STI participation of Africans and bring about better living conditions.

Considering 2020 as the sixth year since the inception of this initiative, it therefore becomes imperative to reflect on the progress to determine whether African nations have progressed in the implementation of this STISA policy. The focus of this paper uses Critical Theory to reflect on the implementation of STISA 2024 in Namibia and South Africa. Namibia is considered to be in its formative stage because of R&D inactivity in the mid-2000s, South Africa is generally recognised as a leader on the African continent in terms of Research and Development (R&D) due to its policy, institutional factors and funding variables.^[12] STISA 2024 policy implementation has taken place since 2014 despite

the varying levels of progress realised in these two respective neighbouring countries.

At its core, this paper undertakes to address the applicability of STISA 2024 policy framework on the abovementioned countries through Critical Theory perspective. This theoretical approach offers a scholarly reflection on public policy initiatives which relate to STI for Namibia and South Africa. As earlier indicated, the essence of reflections in this context needs to be premised on the contribution to shape societal interests which embed STI as a subculture and emerging societal values which embrace intersections of existing norms and new STI phenomena.

What many African countries consider as an equalising factor for implementing STISA 2024 policy is the commitment made by individual countries as early as 2007 for investing at least 1% of their Gross Domestic Product (GDP) into R&D.^[13] Implementing this commitment consistently means that an estimated GDP of \$2.4 trillion across Africa, close to \$12 billion a year could be potentially invested into R&D.^[13] When this pledge was done by AU member states (in 2007) it was two years into the implementation of the Consolidated Plan of Action (CPA) (2005–2014), the predecessor of STISA 2024.¹ The core assumption that most African states could invest 1% of their GDP in R&D was a critical recommendation that requires critical reflection. For instance, considering how many African countries economies are fragile, the question is can systemic and regular investment be maintained? Moreover, even if certain countries do achieve this threshold, does that guarantee socio-economic improvement in societies that have structural inequalities? Does investing the required 1% of GDP on R&D serve as a good indicator of societal economic development or advancement? Can the benefits of investing in R&D trickle down to the most vulnerable groups in postcolonial African societies? What do individual countries consider as investment in R&D and how can this be measured accurately?^[14]

Addressing some of these questions in a systematic manner is necessary to maintain a focused attention on whether commitments are honoured. Regular monitoring and evaluation of funding commitment and interventions are necessary to build resource base as a bedrock for STI implementation of policy. Table 1 below provides the priorities with articulated research and innovation foci in each area of the STISA 2024 in guiding implementation of this policy.

These priorities are succinctly outlined and their realisation is intended to grant Africans socio-economic liberation where

1 The Consolidated Plan of Action was established on three conceptual pillars namely STI capacity building, knowledge production and technological innovation.

Table 1: Summarised STISA 2024 Priority areas.

Priorities	Research and/or innovation areas
1. Eradicate Hunger and ensure Food and Nutrition Security	- Agriculture/Agronomy in terms of cultivation technique, seeds, soil and climate - Industrial chain in terms of conservation and/or transformation and distribution infrastructure and technique
2. Prevent and Control Diseases and ensure Well-being	- Better understanding of endemic diseases - HIV/AIDS, Malaria Hemoglobinopathie - Maternal and Child Health - Traditional Medicine
3. Communication (Physical and Intellectual Mobility)	- Physical communication in terms of land, air, river and maritime routes equipment and infrastructure and energy - Promoting local materials - Intellectual communications in terms of ICT
4. Protect our Space	- Environmental Protection including climate change studies - Biodiversity and Atmospheric Physics - Space technologies, maritime and sub-maritime exploration - Knowledge of the water cycle and river systems as well as river basin management
5. Live Together – Build the Society	- Citizenship, History and Shared values - Pan Africanism and Regional integration - Governance and Democracy, City Management, Mobility - Urban Hydrology and Hydraulics - Urban waste management
6. Create wealth	- Education and Human Resource Development - Exploitation and management of mineral resources, forests, aquatics, marines, etc. - Management of water resources

Source: (AU Commission 2014).^[7]

increased societal interest in STI and a progressive system as a subculture would be notable as per the discourse of the Critical Theory. However, with perpetual poverty and the looming target of 2024 timeline with only four years remaining, it is clear that achieving these priorities may require urgent revisions. The outbreak of COVID-19 in Wuhan China which became a global pandemic has indefinitely impacted negatively on the development plans and priorities of this nature. The new normal where adherence to health regulations of maintaining social distancing and use of personal protective equipment in social, economic and employment premises require normalising before performance of public sector institutions is restored. This means Africans are likely to suffer setbacks in various sectors where advancements of the STI initiatives are prioritised. A country focus for Namibia is undertaken below to analyse a policy.

Research and development in Namibia (2013-2020)

Despite the STISA 2024 policy framework, gauging the contribution of AU member states in R&D is a complex process. Despite this complexity, other countries such as Namibia have established systems of R&D where funding investments can be better quantified and traced due to the efforts used to streamlining of R&D investments through specific entities that focus on funding STI on behalf of the state. One such entity is the National Commission on Research, Science and Technology (NCRST) an emerging Science Granting Council (SGC) and primary vehicle through which the Namibian government funds R&D in the country.

The NCRST was established through the Research, Science and Technology Act, 2004 (Act No. 23 of 2004). Although the Act came into force in 2004, the NCRST was only established in 2013.² The establishment of the NCRST in 2013 slightly preceded the launching of STISA 2024, making Namibia an ideal case to assess the applicability and implementation process of STISA 2024 in as AU member state, particularly with regards to the recommendation of spending 1% of GDP on R&D. Upon its establishment in 2013 the NCRST created the National Programme on Research, Science, Technology and Innovation (NPRSTI 2014–2017). The major objectives of the NPRSTI are to:

- Enhance coordination, thus increasing efficiency in resource use;
- Facilitate scientific human and institutional capacity building;
- Ensure sustained financing of priority R&D projects; and
- Promote science as a preferred area of study

In addition to the NPRSTI activities, several key research priorities which are meant to address the country's primary social and economic challenges were considered.^[15] These research areas include health; agriculture and fisheries; water; energy; geology and mining; indigenous knowledge; social sciences and humanities, logistics; environment and tourism; manufacturing technologies; information and communication technology; biotechnology and space science.^[15]

To ensure that programmes such as the NPRSTI succeed it would require sustained funding. In this case, Research, Science and Technology Act, 2004 (Act No. 23 of 2004) makes provision for a National Research, Science and Technology Fund (RST Fund) meant to be capitalised by the government and other stakeholders from the private

2 The NCRST's line ministry is the Ministry of Higher Education Training and Innovation (MHETI). MHETI oversees NCRST's activities through a board of directors appointed by the Minister. Moreover the MHETI is responsible for allocating NCRST's annual budget which includes research funds and operational expenses.

sector (Republic of Namibia 2004).^[16] Having considered the background regarding the establishment of the NCRST, it becomes imperative to further undertake a critical reflection on how this public institution has performed considering the recommendations of STISA 2024. One fundamental question would relate to funding in accordance with STISA 2024 of 1% of GDP on R&D expenditure. In the context of impact on Namibia, this question on funding remains relevant adherence to the key STI policy (especially considering NCRST and NPRSTI).

The publicly available information regarding the overall expenditure on R&D of GDP is contained in a national survey where other stakeholders (private sector) were considered. This national survey was published during 2016 and considered Gross Domestic Expenditure on R&D where the findings indicate that direct expenditure of government, higher education, business enterprises accounted for 0.34% of GDP for 2013/2014.^[17] Although this is far from the 1% threshold recommended by the AU's STISA 2024, for Namibians it is being considered to be a significant increase bearing in mind the steady increase since its recent Independence in 1990 where R&D as a percentage of GDP was 0.02%, the stagnation period of the 2000s and a modest increase to 0.18% in 2010.^[17] The establishment of the NCRST^[15] is credited with a positive impact due to this drastic increase. In fact, during 2013/2014 financial year the government expenditure on R&D was N\$216.6 million with a substantial portion of this amount directly funding the activities of NCRST.

However, the consistency in funding that saw institutions like the NCRST contribute to an increase in R&D activity was not sustained as government began to systemically reduce funding the NCRST in the most recent past three financial years of 2016/17, 2017/18 and 2018/19. For the 2017/18 financial year, allocation was significantly reduced which meant that NCRST could mainly use its budget for operational expenses to keep itself afloat. The explanation for this reduction is attributed to economic recession which started in 2016 to the current financial period of 2019/20 which is also expected to continue and thereby jeopardising chances of recovery and improved R&D funding (World Bank 2020³).^[18] A case of South Africa is outlined below.

Science, technology and innovation in South Africa

Whilst Namibia's challenges in R&D are attributed to low GDP expenditure on R&D (0,34% in 2014) and further reductions in direct government funding, its southern neighbor South Africa has over time increased its expenditure on R&D with the country's Gross Domestic Expenditure on Research and

Development (GERD) as a percentage of GDP standing at 0.83% in the 2017/18 financial year.^[4] This means South Africa is close to achieving the 1% threshold recommended by the AU policy document STISA 2024. However, there are important policy imperatives to be taken into consideration in realising the AU's 1% threshold recommended of STISA and maximisation of the STI impact.

The matter pertaining to STI is pertinent for developing countries such as South Africa because it is necessary to drive their socio-economic development. This means legislation and institutionalisation of this matter requires careful attention to realise STI that is able to address pertinent needs of the community. The question of improvement of the living conditions of the citizens requires innovative plans and initiatives which are science driven and are able to adapt to the changing technological conditions.

The White Paper on Science, Technology and Innovation released in 1996 was meant to serve as a framework to guide scientific development. The focus of this was to ensure that the necessary system of innovation for the country was being institutionalised to ensure that scientific endeavours are supported for the advancement of the socio-economic wellbeing of South Africans (Republic of South Africa 1996).^[19] Other key issues include the establishment of the Department of Science and Technology which was tasked to, among others:

- Implement the provisions of the White Paper and maintain South Africa's competitiveness regarding issues of technology development and innovations.
- Ensure capacity development that serves to sustain science and technology for socio-economic development.
- Enhance global competitiveness, maintains research output and train the next generation of researchers.
- Ensure South Africa is a strategic partner and maintains collaborations and partnerships with other international communities of researchers.
- Maintain sustainable investments in science, technology and innovation.
- Ensure a linkage with the basic education system and participation of learners and teachers to stimulate grassroots participation.

The above elements are some of the key founding provisions which were used to approach the improvements of STI within the South African public arena. The National Development Plan which was subsequently adopted in 2012 recognises that:

3 <https://www.worldbank.org/en/country/namibia/overview>

4 <https://www.gov.za/speeches/science-and-innovation-south-africas-expenditure-research-and-development-25-oct-2019-0000>

'Research and innovation by universities, science councils, departments, NGOs and the private sector has a key role to play in improving South Africa's global competitiveness. Coordination between the different role-payers is important'.^[20]

Furthermore, there are issues which the National Development Plan considers necessary where higher levels of education, skills, research and innovation capacity are also required:^[20]

- The transition to a low carbon economy and meeting the greenhouse gas emission targets
- Tackling health challenges
- Developing new and utilising existing technologies
- Taking advantage of the opportunities that arise from economic growth.

The above are necessary since they embed that STI are critical education means required to facilitate relevance in the various sectors of the society in which government is expected to play a developmental role. In this case, South Africa needs to ensure that the adoption of any technology or innovative approaches is linked to its pertinent socio-economic development considerations as outlined in the National Development Plan. However, due to the high levels of inequality as well as urban-urban divide, issues pertaining to access by many communities in rural and peri-urban communities remain a challenge. Government policy needs to consider these imbedded conditions in order to address problems of inequality which also manifests themselves through STI access or lack thereof.

The White Paper on Science, Technology and Innovation released in 2019 further seeks to ensure the following key focus (Republic of South Africa 2019):^[19]

- Maintaining a coherent and inclusive national system of innovation
- Enabling innovation environment in South Africa
- Increased human capabilities and expanded knowledge enterprise
- Financing science, technology and innovation.

The critical role that STI can play in improving the socio-economic circumstances cannot be overstated. For instance, the economic growth and development that come through STI can lead to employment creation.^[21] For a country like South Africa where unemployment is rife (29%) this would be an important development that would have multiple benefits including lifting people out of poverty while simultaneously reducing the inequality gap.

Furthermore, developments which led to the discourse on the Fourth Industrial Revolution (4IR) needs attention to ensure that countries such as South Africa have access to

cutting edge technologies to enable their participation in these global matters. The 4IR is highly complex as it requires smart technology and devices with access to reliable basics such as electricity, internet bandwidth and 5G services for the entire society. Thus, substantial investments in infrastructure development serve as precursor to maximise benefits of this 4IR and therefore it means that many in South Africa will not be able to derive socio-economic development benefits since they remain excluded due to factors such as their location, poverty and education levels.^[22]

It is clear in this case that the introduction of the White Paper on Science and Technology in 1996 as well as the National Development Plan of 2012 with the institutionalisation of several other policy interventions have not succeeded in ensuring maximisation of STI benefits to citizens. This is manifested in part due to a significant number of South Africans in rural and peri-urban areas where problems regarding educational resources remain overt. Again, the problem of access to cutting edge technologies by a significant part of the population means that policy interventions and approaches are required to permeate spaces which are considered to be disadvantaged.

Policy targets and checkpoints on science, technology and innovation

The discussion on policy targets and checkpoints seeks to consolidate several key issues and this paper has raised in the context of Namibia and South Africa to ensure a realisation of the STISA 2024 generally and national STI policies which benefit their citizens. This is in accordance with a focal vantage of this paper in analysing the applicability of STISA 2024 on Namibia and South Africa through a Critical Theory perspective. It is clear that the African Union as a presiding institution on the STISA 2024 targets needs to strengthen its own capacity to upscale performance of member states on the set collective goals. An overreliance of AU on donors have compromised its ability to be independent and functionally astute. A well-resourced AU could use its softpower and offer incentives to countries adhering to its own policies such as STISA 2024.

For national governments, it is necessary that any public policies are developed to contribute meaningfully to the socio-economic wellbeing of the citizens. Since government functions through public institutions,^[23] it is imperative that the question of social capability characterised as managerial and technical competence, a stable and effective government, financial institutions, and markets capable of mobilising capital on large scale and the spread of honesty and trust in the population be maintained.^[24] This means that countries such as Namibia and South Africa need to generate measures

necessary to ensure the functioning of STI institutions. In view of this, the following has been taken into consideration:

- The need to maintain societal interest and values through strengthening of public STI institutions. The strength of institutions determines institutional character and applicable initiatives and in this case the applicability of STISA 2024 policy framework with national STI targets.
- Utilisation of STI to address urgent issues such as poverty and diseases to ensure realisation of improved living conditions. Since the STI have become a foremost enabler to better socio-economic developments, national governments need to prioritise such (STI) skills for their citizens over rolling out social welfare programmes mainly for purposes of political expediency.
- Conditions which push countries to reduce STI funding require reprioritisation of STI as an essential enabler to strengthen the national response to better socio-economic conditions. The Finnish example in the 1990s on investing in the STI initiatives despite recession offers a compelling case to consider the long-term benefits of knowledge-based economy.^[14,25]

CONCLUSION

This paper was undertaken to analyse the applicability of STISA 2024 policy framework on Namibia and South Africa through Critical Theory perspective. The Critical Theory highlighted societal interest with the applicable subsystem and influencing existing societal values and norms through STI policy interventions. A disposition of STI in Africa demonstrates that a policy is required at the AU level to guide countries. However, inconsistency and non-adherence to STISA 2024, especially the 1% threshold recommended by the AU % remains a strong feature for Namibia and South Africa. It is therefore clear that the national STI initiatives of Namibia and South Africa as examined highlight policy gaps that impede maximum impact of STI interventions and achievements of the STISA 2024. These gaps often manifest where economic conditions for Namibia are a factor while a lack of universal access for South Africans is a feature. In the final analysis, a focus on the policy targets and checkpoints serve to consolidate the discourse and highlight considerations necessary to maintaining the STI societal interest and values as espoused by the Critical Theory in the context of this discussion.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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