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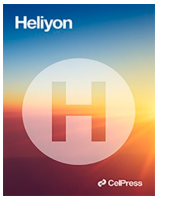

Water entrepreneurship and financialisation: Complexities for the attainment of SDG in sub-Saharan Africa

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A B S T R A C T

This study explores the potential of water financialisation and entrepreneurship in sub-Saharan Africa (SSA) to supplant the traditional responsibility of national, state, and local governments in providing public water supply, aligning with SDG Goals. Despite its typical association with the global north, a shifting landscape reveals emerging financial actors and multinational companies playing a more prominent role, prompting governance and accountability inquiries. Given the dearth of investment and persisting challenges in SSA's water infrastructure, the burgeoning involvement of financial actors and capital management entities in the water cycle seems inevitable. However, this trend raises concerns about exacerbating global water stress. Through qualitative methods, the study engaged 50 SSA participants via open-ended questionnaires, analysed using thematic analysis. The findings underscore a nuanced perspective. While acknowledging the potential of water financialisation and entrepreneurship to drive essential investment in SSA's water sector, the research emphasizes the irreplaceable role of government in policy execution and safeguarding citizens' well-being. Government intervention remains crucial to ensuring equitable water access and sustainability. Additionally, the analysis suggests that overemphasizing water financialisation could divert attention from critical infrastructural and technological advancements needed in SSA's water sector. This underscores the necessity of a balanced and comprehensive approach to address the multifaceted challenges surrounding water availability, governance, and sustainability in the region.

1. Introduction

The United Nations Sustainable Development Goals (UNSDG) set long-term goals to achieve holistic development across the globe through adherence to its ideals and recommendations. One goal that has been implicated in the current pandemic and other SDGs is the availability of safe, sustainable, and clean water. The 2020 COVID-19 pandemic has led to stringent lockdown measures, disruption of economies and consequent financial burden which have slowed the socio-economic development of various countries with serious attendant impacts on the achievement of the SDGs [1]. The pandemic has brought out the need to address and prioritise clean water for sanitation and healthy living. The pandemic management also has provided an unprecedented opportunity to evaluate the impact of human decisions on water availability, affordability and access creation. One such is the need to assess 'water entrepreneurship and financialisation models' being adopted in some developed and developing countries and their impact on the provision of water, and access to water by both the rich and the poor. This is needed as a call for rethink and re-orientation of the societal socio-economic priorities towards the adoption of options for the attainment of SDG on water in developing nations.

The current global movement toward water entrepreneurship and financialisation as a better alternative to meet the SDGs in the short and long term, as reported by the United Nations (2021) in low-income countries, was to reduce the number of socially and economically vulnerable populations lacking access to water. The idea that since water is a valuable commodity that has growing

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demand, lacks substitutes and therefore can be subjected to commercial trading in the same way as other commodities, needs to be contextualised in the interest of satisfying the social needs of poor masses.

No doubt there has been an increasing role that entrepreneurs play in providing water to many people in the developed and developing nations, from pushcart vendors to standpipe operators, from tanker services to those operating small water supply networks. They ranged from small entrepreneurs providing water to tens of thousands of people, in small to medium urban centres, or in the unattended areas of major cities. They equally varied in terms of background, skills and capacity from individuals driven by the need to satisfy community needs, new local entrepreneurs in the water sector, to formal water operators appointed after competitive bidding [2]. Characteristically, these water entrepreneurs are becoming successful and spreading in major urban cities in Africa because they are serving significant numbers of households, using relatively high technical and commercial innovations, exploring available incentives to expand services without relying on government or donor support and sourcing their capital locally thereby becoming an established water supplier in this area [3].

Originally, the responsibility of the provision of urban water supply rests with the State Water Corporations and they have been operating these urban water schemes in cities, and small towns but with the challenge of getting enough budget to process such water into the urban system for public water supply. Urban water supply in most African cities, for instance, relied on old pipeline reticulations that have become challenging as a result of long-time installation and underground breakage and seepages that are affecting the quality of the water. Efforts to get financial resources for the repair or needed buy-in of the upgrade of tariffs for network extension to achieve the high technical standards, prove abortive. This, among other reasons, is enabling 'water entrepreneur' involvement in water provision in Mauritania, Ghana, Nigeria, Mali etc as providers were able to source water, treat it to a standard and cause households to pay as when due [4]. Thus, water entrepreneurs operate both in the formal and informal water sectors in most developing nations as policymakers appear to rely on them as alternatives and saviours of their ineptitude [5].

The policymakers were quick to consider the need for private investors' involvement in water based on the concept of Public–Private Partnerships (PPP) promoted by international organisations in developing and transitioning economies. The full privatisation processes such as the ones in England and Wales (Bakker, 2005) and in Chile [6,7] made firms such as Suez, Veolia, Thames Water, Saur and AGBAR control various water schemes across Europe till date. According to Ref. [8]; as early as the 2000s corporate strategies in the water sector have been active on world markets and include avoiding risks associated with direct capital investment by adopting management contracts and research-based investment. These corporate bodies invest in assets such as infrastructure and adopt distributing risk techniques such as securitisation wherein revenue sources are packaged into tradable financial products and broken up into earning packages [9]. By the 21st century, traditional transnational water companies have sustained their global role in terms of market share/ownership through the increased financial markets for water-related assets and have had considerable performance indexes which attract a variety of investors [10]. Thus, water financialisation has led to global companies getting exposed to everything from water utilities to water treatment companies and retail and distribution companies that operate in a global water market estimated to be worth around US$360 billion [11]. However, major issues are: to what extent has their involvement reduced the gap between the desired state of attainment of SDG on water and sanitation in developing countries and their present status? Could developing nations dwell more on water financialisation given its benefit in the short, medium and long term or advocate more disciplined social intervention programmes towards the attainment of SDG on water?

This paper delves into the ramifications of water financialisation on vulnerable Sub-Saharan African (SSA) communities, examining water management practices and global interests in the SSA water sector. It investigates water's diverse roles—spanning health, food, energy, economy, and investment—with a focus on SSA's socio-economic implications tied to water exploitation. The study underscores the Western-driven notion of water financialisation. Essential to the discourse are effective government policies, vital for mitigating adverse consequences and guaranteeing fair water availability and sustainability for all. By shedding light on these dimensions, the paper contributes to an enriched understanding of the complex interplay between water, finance, governance, and equitable development in the SSA context.

2. Water constituent - health, food, energy, economy and investment

2.1. Water and socio-economic impacts in sub-Saharan Africa (SSA)

Water is an abundant natural resource vital to life, but this surplus is often overestimated and over-exploited which often results in scarcity [12]. The scarcity of water is one of the global challenges affecting over 1.2 billion people. The United Nations estimated that by 2025, 1.8 billion people will be affected, with more than half of the world's population experiencing water stress. The global figure is predicted to be nearing 2 billion by 2030, pushed by water shocks. This shock will impact Sub-Saharan African countries, being the world's second driest continent, experiencing a rapidly increasing population, especially in informal urban settlements [13]. Moreover, the continent's population is currently experiencing more than 319 million people unable to access safe water and 694 million are impacted by poor sanitation in SSA countries. The figure is mainly driven by poverty, inequalities, and low climate change literacy which is less understood in most African countries [13]. The scarcity of water in urban poor neighbourhoods and the corresponding lack of sanitation and hygiene within these communities where many SSA residents reside lends to the high rate of child mortality.

The availability of water has significant economic implications as the industrial sector competes with domestic water demand [14]. The disparate increase in demand for water and limited supply can be partly linked to a lack of sustainable policies on water provision, waste discharge and investment in the treatment of alternative sources of water. For instance, the illegal discharge of waste into rivers, streams and waterways with attendant impact on environmental pollution is still a huge challenge in sub-Saharan Africa (SSA) [15]. [16], presented a case of waste disposed into Lagos Lagoon causing pollution to both human and aquatic ecosystems. The majority of

countries in SSA, including South Africa with extensive wastewater management facilities continue to fall below the minimum discharge standards. In Angola, all untreated wastewater is directly released into the sea, mirroring a comparable practice in Lake Chivero, Harare, Zimbabwe [17]. Paradoxically, the population increase in areas with low access to water is proportionate to the infant mortality rate [18], an indication of the continued violation of the human right of 20 L of clean water consumption a day [19]. In many rural and poor communities in Africa, women and young girls are responsible for sourcing water for the family, exposing them to violence and time violations [20].

Although Africa experiences high levels of rainfall, rains are often periodical and irregular with cycles of flood and drought (UN, 2015a). Zambia, for instance, is endowed with five river basins namely Kafue, Zambezi, Luangwa, Chambeshi/Luapula and Tanganyika with substantial amounts of water [21]. Yet one in three people is unable to access clean water, thereby exposing the urban poor to the danger of waterborne diseases and high mortality rates recorded especially among children in Zambia [22] n.d.). The levels of overcrowding in these poor parts of the city make it impossible to control sanitation and serve as an impetus for the emergence of diseases [23].

Water challenges are multifaceted and intricate to the drive for a green economy which is critical to SSA's nascent growth and the global call for nations to reduce environmental risks and ecological scarcity crucial for sustainable development. This narrative on sustainable water management and usage seems to also fuel the need for water privatisation and financialisation. The introduction of these strategies by water players according to Allen and Pryke, (2013) has brought many consumers closer to water insecurity.

2.2. Water in the context of concepts of green and circular economies

The critical role of water in the green economy cannot be overemphasised, particularly as it relates to its impact on global food and energy consumption. Water demand is on the increase, 56% rise projected for 2025 [24] and about 70% utilised for agriculture, exacerbated by urbanisation, globalisation, and population growth [25–27]. The water and food-security nexus presents the contentious nature of water and the rift that may ensue between regions due to the negative impact of climate change and heavy reliance and demand on water for economic productions such as in energy creation and agriculture [28]. Other contrary results are noticeable in what water represents as a potential driver for a sustainable ecosystem (renewable, recycling, and reusable) and how this is exploited by nations using a circular economy approach [29]. Achieving a green economy is feasible but demands strong climate policies, institutions, and high-level enforcement to attain SDG goals.

The European Commission's outlook on a circular framework is an example of a strategy being championed for global competitiveness and resource maximisation, a shift from less efficient traditional ways of water utilisation [30]. However, considerable effort is required in realising a circular economy as observed by Kirchherr et al. (2018), who mentioned that issues such as culture, regulations, market, and technology need reviewing before implementation. Therefore, a newly customised framework which incorporates the role of community and faith-based organisations may be required to address the challenges of water stress and sustainability in SSA. Further consideration by Ref. [29] suggested a gradual approach mentioning the need to review economic, social, and water quality risks and technical implications of circular repositioning. Although water management in some countries such as Israel takes a different approach, embedded in Israel's water law of 1959 where water is regarded as a public commodity characterised by scientific innovation, practice, and policy [31]. Overall, this transformational shift towards a green or circular economy requires investment in water infrastructure (Hoff, 2011) and national resilience, particularly in sub-Saharan regions that are at risk of huge public debt and pandemics [32]. While the mortality impact of COVID was relatively low in SSA between 3 and 4% of global cases as of April 2021, the economic consequences were huge and many countries resulted to borrowing to finance health infrastructure (mostly from China), which saw general debt of sub-Saharan Africa grew from 55.4 to 60.3% between 2019 and 2021 (ibid).

However, water is crucial to improved health, well-being, and sanitation including addressing SDG such as ending hunger, education, and inequality, and crucial to SDG 6 which proclaim to ensure "*ensure availability and sustainable management of water and sanitation for all*" [15,33,34]. In Nigeria, less than 30% can source quality water and 34% are exposed to 'time poverty' in rural areas (2 h spent on water collection). These adversely impact health such as malnutrition - 37 % of children under five are stunted; 18.5 % are wasted and 29 % are underweight [35].

The human development cost of unsafe water in sub-Saharan Africa is immense, with 1.8 million children lost to diarrhoea, 443 million school days per annum unaccounted for and close to 5 % of GDP lost to health spending (UNDP, 2020). Water though seems abundant and often exploited, which raises questions about water security and alternatives such as green water (Hoff, 2011; [36]. Water for example in Nigeria is supply-biased rather than demand-oriented raising questions of governance and weak policy, exacerbating the country's water scarcity and sometimes attributed to the rise in insurgency and terrorism (Boko Haram). In particular, the Northernmost and arid part of the country is witnessing the loss of farming families and the search for greener pastures by herdsmen creating tensions in neighbouring communities [15]. Some other alternatives being suggested to address the impact of heavy reliance on unsustainable water consumption are water entrepreneurship and financialisation [37]. While these latter options may have the potential to sustain water issues in the short term, they also raise issues of strategies to adopt in the mid and long term, the problem of water management and governance including water ethics [38]. Current and future water plans however should be robust and review local assessments and inclusivity of water including informal settlements, with less-risky finance sourced locally for infrastructural projects.

2.3. Water Financialisation and Western hegemony

The concept of financialisation according to Refs. [39,40] though conceived in the early '90s and broadly embraced by many

interdisciplinary disciplines, has often been reflected through the lens of Western hegemony, particularly in the United States with huge impact and fewer voices by emerging economies. Epstein (2005), after reviewing key themes such as shareholder influence, power dynamics (political and economic), corporate governance, capital market versus banking systems, financial trading and instruments, advanced by (Krippner and Hilferding), defines financialisation as "the increasing role of financial motives, financial markets, financial actors and financial institutions in the operation of the domestic and international economies''. Other researchers such as Costas Lapavitsas define financialisation as "profiting without producing", and "growing importance of interest-bearing capital" [41]. This domination and pressure of the financial market over the economy were also supported by Refs. [42,43]; and [44] when exploring its possible influence on polity and societal exposure to capital market risk.

These trends, according to Epstein, emanate from the transformation of world economies (globalisation and liberalisation) and as a consequence of heavy reliance of government on market economies, huge global financial transactions and eroding roles of policy-makers and the banking system [39]. further document the contrasting nature of financialisation among developing countries (East Asia, Latin America, ex-Soviet nations, and South Africa) and their exposure to the forces of financial deregulation, liberalisation, foreign financial inflows, the economic shift from bank to market financial systems, the rise in household financial interaction and enterprise debt (large, medium, small, and micro). They further stress the need for inward-looking and strengthening of local capacity against exposure to financialisation in developing countries, considering links to economic uncertainties, market derivatives, neo-liberalisation, internationalisation, globalisation, poverty and impact on global power dynamics and national policy.

While multiple commodities and natural resources such as crude oil, liquified natural gas, palladium, nickel, wheat, gold, currencies, and diamond have been financialised and traded in the stock market causing huge revenue generation and uncertainties among many nations, water according to March and Purcell, (2014) is yet to undergo such exposure on the global financial stage. This view was disputed by Ref. [45] who raised the concern that water financialisation is on the rise but less researched compared to commercialisation, commodification and privatisation of water. Bayliss stated numerous water investment funds including the Sarasin Sustainable Water Fund, Pictet Asset Management, ABN Amro Water Stocks Index Certificate, BKB Water Basket, ZKB Sustainable Water Basket, Wagelin Water Shares Certificate, acWater Strategy Certificate and the use of exchange-traded funds from 2005 by water companies such as the PowerShares Water Resources with assets of (>US$895 million) and PowerShares Global Water Portfolio assets of (US$257million) were in existence (Justetf, 2022).

The similarities of the water industry to many traded commodities are emerging, with many actors (water entrepreneurs) well-positioned for geographical competitive advantage (ibid). When water financialisation does occur, the impact on multiple sectors of the economy could be sudden and nebulous, particularly in vulnerable communities of SSA and emerging markets. The fate of global water security and governance may be left with global financial players (capitalist, neoliberalist) driven mainly by financial gains [46]; Orobello and Cirrela, 2021). Alternatively, it could also strengthen water policies and governance in many regions and review the resilience of current water models, players, and strategies. However, the plight of the water sector and the investment required is a factor in the debate for public-private partnership [9], a step towards water harmonisation in the short term. However the public sector has always dominated the provision of water in urban and rural areas and the private sector is withdrawing from participating in the water sector due to low returns (Hall, 2006). Water governance encompasses processes, stakeholders, and policies for sustainable resource management and equitable access. It promotes collaboration and transparency but faces challenges. Fragmented authority leads to conflicts and inefficiencies, while privatisation raises equity concerns. Climate change and population growth strain resources. Sub-Saharan Africa faces specific hurdles due to limited infrastructure and socio-economic disparities. Effective governance requires adaptive strategies prioritizing efficiency, equity, and sustainability. Addressing fragmentation, the private sector's role, and climate impacts is pivotal for balanced and forward-looking water management.

The deterioration of water infrastructure and institutions in SSA, along with insufficient global investment in the sector, contradicts the pivotal role water holds as an irreplaceable commodity essential to human survival [15]. This vacuum allows for government borrowing and the gradual interest of private companies in the water sector. The collaboration between government and private entities may inject new funds into the water sector for example to stabilise the price of water and manage ailing infrastructure affecting supplies. Privatisation, according to Allen and Pryke, (2013), lessens the role of government in public activities and gradually transfers ownership to individual or private entities. Thus, raising the issues of water environmentalism, access, and affordability [47]. Considering that most private investors are profit-oriented, this strategic partnership may come at a cost and could attract other actors, whose interests are for profit or power dynamics. Occupying a shareholder position could exert pressure on the government and may later initiate the sales of shares or request for accrued dividends, a situation likely to complicate water governance and poverty.

Public-private partnership (PPP), as elucidated by Ref. [48]; is a strategic tool employed by governments to efficiently manage public infrastructure and services, with a keen focus on enhancing social welfare. The fundamental objective is to deliver optimal services while minimizing costs. This approach underscores a nuanced synergy between the public and private sectors, strategically tailored to achieve socio-economic equilibrium most effectively. According to March and Purcell, (2014), PPP is a mechanism often adopted by advanced economies such as the United Kingdom to present a transit point for companies to enter emerging markets [49]. regard PPP "as financial models that enable the public sector to make use of private finance in a way that enhances the possibilities of both the elected government and the private company". They also posit its use as a tool for addressing social injustice, urban renewal and community regeneration. The importance this partnership is crucial in the debate on the adoption of a market-based strategy in addressing water accessibility in many emerging communities, especially the critical role played by informal enterprises in the water sector, where PPP contracts are minimal and in Africa with sparse and insufficient water networks [50,51].

While PPP may not consistently translate into the successful attainment of its objectives, particularly in the context of Sub-Saharan Africa, the intricacies of the region's socio-economic landscape and governance dynamics often introduce complexities that can challenge the anticipated outcomes of such partnerships. Further work by Ref. [52] indicates the success and failures of PPP in Africa

(Tanzania and Mozambique) and the lessons learnt. Entrepreneurs are risk-takers and private owners who source opportunities to make a profit. They venture into the water sector according to Ref. [50] due to three main reasons: one, due to gaps in the water market and withdrawal of public participation; secondly, their ability to innovate and think outside of the box quicker than the public and finally, the ability to compete and grow business concept with the right mindset and motivation.

Major companies in Europe such as Thames, Suez, Saur, Veolia and AGBAR entered the water production space with huge financial capacity, producing a global rise from 6 to 93 million in the population served by private water companies. It should be noted that water bills are homogenous irrespective of neighbourhoods such as the informal settlements and devoid of choice of suppliers; the customers are mandated to make a regular fixed payment, which provides private companies with a regular and secured revenue stream (Allen and Pryke, 2013). But financialisation reverses this stability and places the management of water in the capacity of financial actors who are mostly less risk averse and able to convert secured payment into derivatives, by packaging this revenue into a tradable financial product, assigning risk and marketing them to investors (securitisation) (March and Purcell, 2014; Allen and Pryke, 2013; [53,54].

In the late 1990s and early 2000s, privatisation swept through sectors like water utilities, aiming for efficiency. While it brought technology and efficiency gains, concerns emerged about equity and affordability, particularly for low-income communities facing higher tariffs. Around the early 2000s, "financialisation" gained traction, as financial institutions and equity funds viewed water as an investment opportunity. While financialisation could provide capital, worries arose about prioritizing profits over universal water access and commodifying water as an asset. This interaction between finance and water governance sparked debates on sustainability and social responsibility. Balancing financial interests with water accessibility remains a complex challenge in ongoing discussions about water management.

An illustrative instance of intricate transactions in private firms is the Suez Company's $56 million loan for capital investment in Jakarta, Indonesia. This loan incurred double the interest, ultimately burdening Jakarta's city councils and residents (Hall, 2006). While market volatility and speculation, especially during the financial crises in the 90s and early 2000s, impeded PPP progress, the availability of capital resources such as credit derivatives, accumulated debts, and accessible loans to private companies remains unaffected. This situation contributes to uncertainties in capital markets and fluctuations in exchange rates, carrying global implications. These dynamics significantly affect SSA countries due to their heavy dependence on foreign exchanges and international transactions, as highlighted by March and Purcell (2014).

Capitalism and neoliberalism, however, thrive on this turbulence and are shifting focus from capital investment in the water sector into management and research and development, through strategies like securitisation [37]. However, the emergence of powers such as China in global trade and the volume of economic transactions may spur a capital flight from established markets and encourage a reappraisal of resources and opportunities.

3. Methodology

The study employs primary and secondary data including literature reviews and surveys to explore the relationship between water entrepreneurship, financialisation and their implication for SDGs. Using a qualitative approach with a selective sampling sample size of fifty participants, the study focuses on practitioners with over five years of experience in the SSA water sector. The data was collected through Google Forms, with questions ranging from population, income, water access and poverty statistics. The participants were partly sourced online and through authors' networks. A thematic analysis approach was adopted to gain valuable insight into professional views, experience and values in the water sector. The data was cleansed and coded, themes were generated and reviewed. Data collected tested against research robustness, validity, reliability and ethical implications. The ethical approval was obtained from the National Institute for Policy and Strategic Studies in Jos, Plateau, Nigeria. Given the limited information on water financialisation in the global south, this research takes an exploratory approach, aiming to provide an in-depth understanding of SSA's exposure to water financialisation and its impact on citizens. The study also collected information about professionals' years of experience, roles, educational levels, and remuneration within the water sector. This data was specifically gathered to emphasize the level of expertise within the blue economy in SSA and to add validity and rigour to the data collected (see Table 7). To ensure anonymity and confidentiality, the data regarding location and workplaces were omitted. It is also important to note that the sampling method relies on years of experience, which could potentially introduce bias in the participants' perspectives, leading to a skewed portrayal of the water sector. Additionally, the objectivity of the research might be affected due to the relatively small sample size, potentially hindering the generalizability of the data.

4. Result and discussion

4.1. Discussion

Fifty (50) experts were contacted within the water sector, out of which 30 responses were obtained. The demographic data reveal that 37.9 % of the age range falls between 36 and 45 years old while 27.6 % were 18–35 years of age. Many of the respondents are from Nigeria and Zambia, with 53.3 % of respondents holding a postgraduate degree and 50 % earning between $400–1000 income per month. The level of experience also varies with 70% of the respondents having worked in the water sector for more than 10 years and 16.7% for over 5 years. Many occupied roles such as geologist, hydrologist, researcher, engineer, and water expert among others. Over 96% of male experts also participated in the study with a low turnout of females raising concerns on gender and water resource management. The key objectives explored in this study are to examine the current state of WFE and its impacts on SDG in sub-Saharan

Table 1
State of water provision and sanitation in Sub-Saharan Africa.

City and Country	Water Scarcity	Water Provision	Responsibility for Water Supply
Lusaka, Zambia	**Medium**	**Medium**	**Public utility company**
Jos, Nigeria	**High**	**Low**	**Private companies, individuals**
Lagos, Nigeria	**Medium**	**Low**	**Private citizens**
Ilorin, Nigeria	**Medium**	**Low**	**Private companies**
Ibadan, Nigeria	**Various**	**Low/Medium**	**Government, private companies, individuals**
Sango Otta, Nigeria	**High**	**Low**	**Private citizens, Government**
Abeokuta, Nigeria	**High**	**Low**	**Private citizens**
Kaduna, Nigeria	**Medium**	**Medium**	**Private citizens, Government**
Maiduguri, Nigeria	**Medium/Low**	**Medium**	**Government, private companies, individuals**
Damaturu, Nigeria	**Medium/Low**	**Medium**	**Government**
Abuja, Nigeria	**Low**	**Medium**	**Government**
Gombe, Nigeria	**High**	**Medium**	**Private companies, public utility companies, individuals, Government**

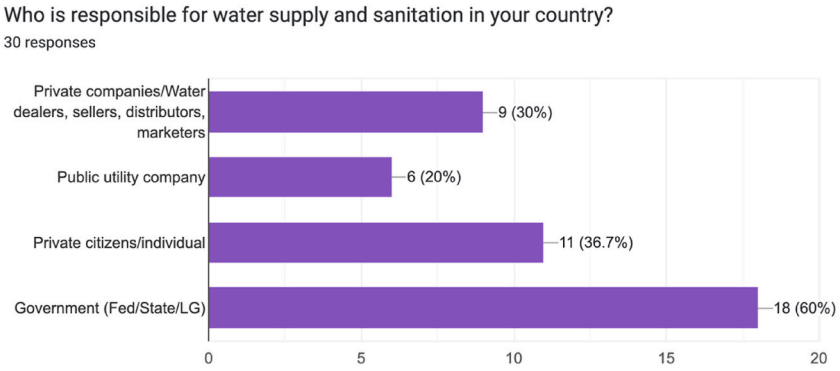

Fig. 1. Those responsible for water supply and sanitation in SSA.

Africa.

Based on the result, most respondents understand water financialisation but may not be aware of the impact of this links to water wars, food insecurity, energy and climate change. They viewed financialisation as a tool for commodification, marketisation and privatisation of water with 13.3 % and 10 % strictly linking water financialisation to mainly privatisation and marketisation respectively. While the study revealed that water scarcity (63.3 %) and water provision (56.7 %) are at a medium level, many worry about water shortages and the quality of water supply including the cost of water. Close to 40 % of respondents spent $20 and above on water and 50 % observed an increase in water tariff in the last 2–3 years, impacting disposable income and some citizens may have to prioritise water usage or continual home infrastructure and investment. Although water availability might exist, the concern lies in affordability, especially in addressing problems related to unsafe water and sanitation, which are vital for health and well-being. Moreover, this affordability issue can contribute to violations of equitable water access, particularly affecting girls and women. Over 60 % of the respondents placed the responsibilities of water supply, sanitation and infrastructural finance in the hands of the government and maintained that 20 % of the infrastructure is financed by private companies. The government figure is likely to reduce with interest from private citizens, donor agencies and public-private partnerships. Many of the infrastructures in the hands of the government have also fallen into disuse and require modernisation, resources of which are in the hands of the private sector. The government strategy of benign neglect is also an indication while water did not have a substitute the government's priority and hold on water management is fading. Competing demands for water resources prioritise domestic use according to the study with the industry consuming 10 % and Agriculture 30 %. This shows that contrary to a common understanding that industries consume more water, the government are more conscious of the populace's needs and equally finances water infrastructure. This is partly because political interest (62.1 %) is one of the biggest drivers of water provision in Africa. Many politicians in SSA are often elected on the promise of water provision, energy and road construction. This suggests the current state of the water sector and management in most SSA countries. However, the government need to meet the demands of multiple parties, and the need to seek capital from financial institutions becomes pertinent with an interest rate which could be affected by inflation or combining forces with the private sectors which are liable to financial actors, with their share in the water company as collaterals. Therefore, the financial companies often sell these shares to willing buyers and they eventually acquire multiple ETFs to command major shareholding stakes within the water company.

4.2. Current state of water financialisation and entrepreneurship in the provision of water and sanitation in sub-Saharan Africa

The current state of water provision in Sub-Saharan Africa, as revealed in Table 1 and Fig. 1, depicts a scenario where water

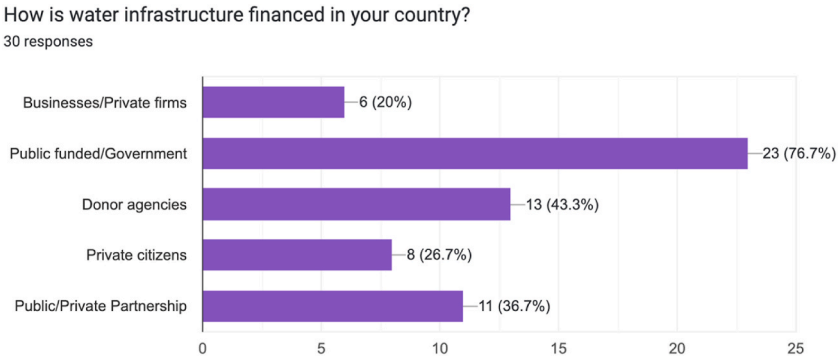

Fig. 2. Water infrastructure financier in SSA.

Table 2
State of public and private sector partnership in sub-Saharan Africa.

Issues		Responses	
		Yes	No
i.	Working with the Public/Private sector	33.3 %	66.7 %

availability remains partial. Despite 63.3 % of respondents identifying medium levels of water scarcity, water provision in SSA remains limited. This situation reflects the intricate challenges faced by the region in ensuring access, affordability, and sustainability of water resources [15]. It is important to note that the water provision being emphasized is more from urban areas, as most of the respondents are from the city and not rural areas. Notwithstanding this, the medium level of water provision to satisfy water scarcity was provided mostly by the Federal, State, and Local government (60 %), private individuals (36.7 %), private companies (30 %), and public utility companies (20 %) as expressed in Fig. 1. However, these water infrastructures were financed largely by the government, donor agencies, public and private partnerships, private citizens, and a few private firms in the form of corporate social responsibility (Fig. 2).

The United Nations Sustainable Development Goals (UNSDG) advocate for safe and clean water availability, particularly crucial during the 2020 COVID-19 pandemic, which highlighted the importance of water for sanitation and overall well-being. This crisis prompted a re-evaluation of water entrepreneurship and financialisation models, especially in developing nations, as potential avenues to address water-related challenges (UN, 2020c; Pandey, 2020). The notion of water financialisation gained traction in low-income countries to expand water access and reduce vulnerability. While water is a valuable and essential resource, the question arises whether financialisation could serve social needs effectively, especially in impoverished communities. Entrepreneurs have played an increasing role in water provision, with examples such as small-scale operators and formal water operators. These entrepreneurs often leverage innovation and local capital sources to meet water demand [2]. The involvement of private companies, particularly through Public-Private Partnerships (PPP), introduces complex dynamics. Major players like Suez and Veolia have been influential in the water sector, reflecting a global trend towards financialisation. However, the challenges of affordability and access persist, with questions regarding the extent to which these interventions narrow the gap between desired SDG outcomes and reality in developing nations [8, 9]. Fagundes and Malheiros (2023) further added that the growing issue of water affordability adds complexity to water supply and sanitation services. Affordability barriers, including costs for connections and bill payments, hinder access for vulnerable families. While aligned with SDG target 6.1, the lack of standardized measurement methods hampers progress assessment, necessitating solutions for equitable access.

Furthermore, the concept of green and circular economies underscores the multifaceted role of water in sustainable development. Water is critical for agriculture, energy, and industrial processes. The scarcity of water resources poses a threat to food and energy security, exacerbating existing challenges in SSA [27]. Despite the potential benefits of financialisation, concerns arise about the influence of global financial motives over water resources, particularly in vulnerable regions like SSA. The dominance of financial markets in the water sector may lead to uncertainties and power dynamics, raising questions about the governance and equitable distribution of water resources [39,41]. In light of these complexities, the paper explores the impact of water financialisation on SSA communities, analysing water management practices and international interests. The study emphasizes the need for effective government policies to mitigate negative consequences and ensure equitable water availability. The role of water entrepreneurship and financialisation, while potentially valuable in the short term, necessitates careful consideration of long-term strategies and their implications for water governance, sustainability, and poverty alleviation.

Furthermore, this study found that water provision to take care of water shortage and scarcity is facing the challenge of non-adoption of public and private sector partnerships (Table 2). This could be a result of the loss of trust of the private sector in the public water provision occasioned by the attitude of those in government, especially in complying with the standard sets or achievement of anticipated goals. It could also be a result of a change in the business plan of the private sector which could be pointing to a change of interest and involvement in the sector.

Table 3
Amount spent on water every month in Sub-Saharan Africa.

City and Country	Monthly Water Spending Range
Lusaka, Zambia	$20+
Jos, Nigeria	$10 - $15
Lagos, Nigeria	$20+
Ilorin, Nigeria	$5 - $10
Ibadan, Nigeria	$5 - $20+
Sango Otta, Nigeria	$10 - $15
Abeokuta, Nigeria	$20+
Kaduna, Nigeria	$15 - $20
Maiduguri, Nigeria	$0 - $15
Damaturu, Nigeria	$5 - $20
Abuja, Nigeria	$15 - 20
Gombe, Nigeria	$20+

Table 4
Increase in water tariff in the last 2–3 years in Sub-Saharan Africa.

City and Country	Have you observed any increase in water tariffs in the last 2–3 years? (Mixed – Yes and No)
Lusaka, Zambia	Mixed
Jos and Nigeria	Yes
Lagos/Nigeria	Yes
Ilorin Nigeria	No
Ibadan, Nigeria	Mixed; Unsure
Sango Ota, Nigeria	Unsure
Abeokuta, Nigeria	Yes; Unsure
Kaduna and Nigeria	Yes; Unsure
Maiduguri, Nigeria	No
Damaturu Nigeria	Yes; Unsure
Maiduguri, Nigeria	No
Abuja, Nigeria	No
Gombe Nigeria	Yes

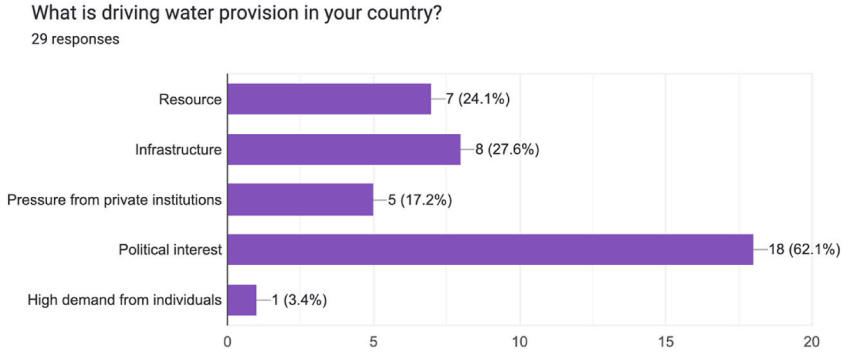

Fig. 3. Drivers of water provision in SSA countries.

However, the private sector is beginning to see that the monthly spending in SSA countries is growing to twenty dollars from five dollars, symbolising readiness and willingness to pay (Table 3). Thus, a withdrawal or decline in PPP arrangement can and may lead to bigger and better business decisions for involvement in more water entrepreneurship and investment for better profit.

This assertion is buttressed by the recent increase in water tariffs in these countries as attested to in Table 4. This provides a reputable opportunity for water entrepreneurs to make more investment decisions in the public water sector. This result agrees with the opinion of [46] and Orobello and Cirrela, (2021) that a conducive environment for change in water governance and increasing participation and investment from global financial players (capitalist, neoliberalist) for financial gains are ripe in SSA [46]; Orobello and Cirrela, 2021).

Furthermore, this decision for more water investment is strengthened by increasing the country's competing demands for more water resources to satisfy domestic needs. This finding aligned with the United Nations assertion on the increase in population in Sub-Saharan African countries and its implication on the population requiring more water to satisfy domestic water needs, food, and industrial needs. Not only this, the increased population and request for more water have made water provision a subject of political discussion and decision-making, as more people are demanding more water during election times (Fig. 3). Politicians too are willing to

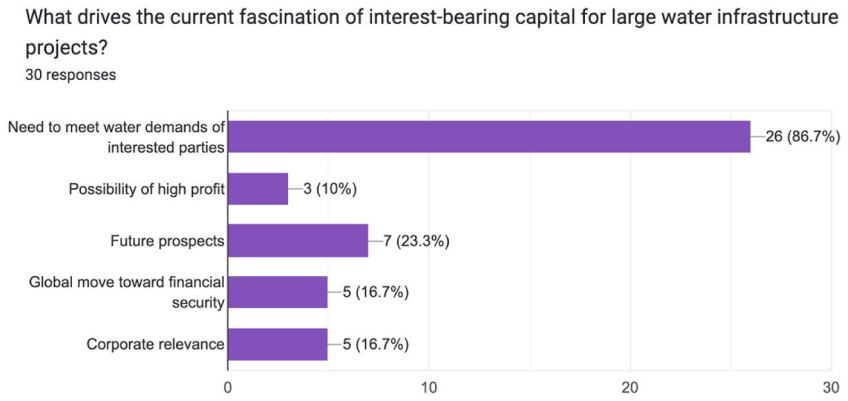

Fig. 4. Drivers of the current fascination of interest-bearing capital for large water infrastructure.

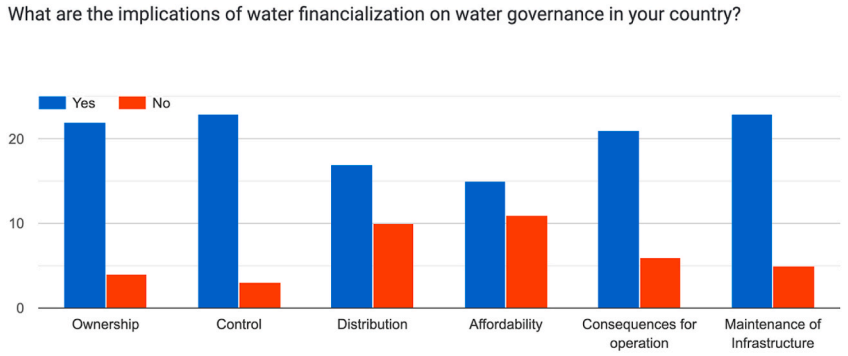

Fig. 5. Implications of water Financialisaton on water governance in SSA

satisfy this need to enjoy winning the elections. This, therefore, open the politician and those in power to explore all opportunities for water provision, especially when there is existing water infrastructure which may require revamping and availability of water resources both in terms of the amount of rainfall in the countries as well as dams that is holding water for possible use for irrigation and domestic purposes.

Furthermore, pressure from private institutions on the government for further engagement in water provision is paving the way for more robust discussion with the decision-makers especially as there are dwindling finances from the government to take the headlong provision of water for the public. This point is further strengthened by the government exposure to water provision is low. Thus, the present water provision is coming more from individual and corporate investment, pointing to broad investment opportunities for private investment in the water sector in SSA. It can be therefore agreed that the indices for water entrepreneurship and financialisation is present in SSA various testing of public and private partnership has been done, and it's now in decline. The possibility for water financialisation in SSA as it has presently been done in some Western countries is getting high in these countries.

4.3. Impact of water financialisation and entrepreneurship in reducing the gap between the desired state of attainment of SDG on water and sanitation in sub-Saharan Africa

To examine the impact of water financialisation and entrepreneurship in the attainment of SDG on water and sanitation in Sub-Saharan Africa, Fig. 4 explains the drivers of interest-bearing capital for large water infrastructure projects in SSA. The drivers vary from the need to meet the water demands of interested parties, the possibility of high-profile, prospects, the global move toward financial security, and corporate relevance.

In all these, the need to meet the water demands of the interested parties (86.7 %) remains the major driver of investment in water infrastructure. This is followed by the prospects of investment in the water infrastructure in line with the Sub-Saharan Africa increase in population with implications on water demand. This has established the propensity towards an increase in financial drive, including water entrepreneurship and financialisation options, to meet the water demands of the people, in line with the idea of Coy and LaCorte, (2013). Thus, the background for water financialisation investment options wherein global companies would be involved in water utilities, water treatment companies, retail and distribution has been laid. Already, Coca-Cola has secured contracts for the use of Asejire Dam for its production and maintenance in Oyo State, Nigeria while Lagos State utilising public and private partnerships with Oyan Dam in Abeokuta, Ogun State is accessing raw water to meet both domestic and industrial water need in one of the populous

Table 5
Water entrepreneur activities in SSA countries.

	Strongly agreed	Agreed	Neutral	Disagree	Strongly Disagree
Improved water access	27 %	40 %	20 %	7 %	0 %
Enhance water Affordability	20 %	33 %	30 %	10 %	0 %
Provide water infrastructure	27 %	30 %	27 %	7 %	3 %
Improve water utilisation	27 %	30 %	23 %	10 %	3 %
Ensure water safety	20 %	37 %	17 %	13 %	3 %
Reduce water time violation	17 %	40 %	17 %	13 %	7 %
Reduce water inequality	27 %	30 %	13 %	17 %	3 %
Minimise gender poverty	27 %	23 %	20 %	13 %	7 %

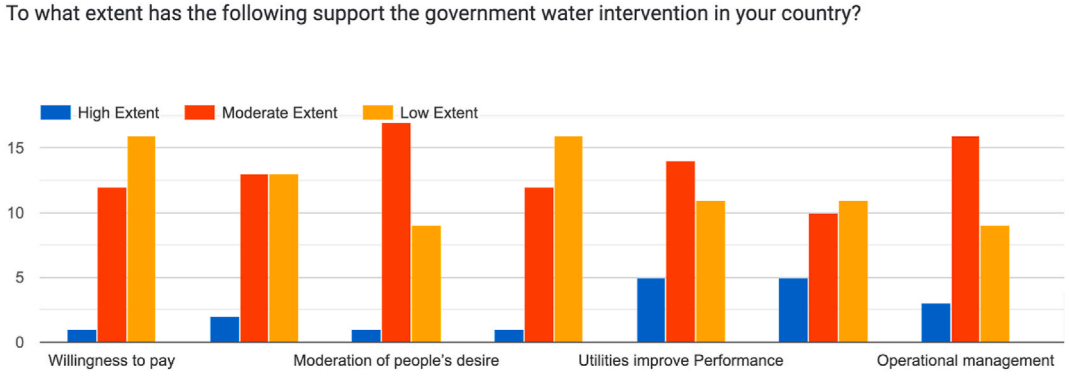

Fig. 6. Extent of the following support government water intervention.

Table 6
Government strategy on water management in sub-Saharan Africa.

Issues		Responses		
		High	Moderate	Low
i.	Robustness of government strategy	4.3 %	50 %	46.7 %
ii.	Extent of government strategy on Water provision implementation	–	53.3 %	46.7 %
iii.	Regulatory support	4.4 %	43.3 %	53.3 %
iv.	Managing consumer complaints	4.3 %	36.7 %	59 %

state, Lagos, Nigeria.

At the moment, therefore, water infrastructural ownership is changing from government to public and private ownership on the one hand and private sector on the other hand. As further presented in Fig. 5, control of water in water holding structures like dams, which was hitherto in the hand of Ogun Oshun River Basins Authority, for instance, by investment, is now in the hand of investors, Coca-Cola Company. One of the challenges that led to this was the inability to distribute water to the public to satisfy domestic needs.

The majority of water infrastructure is currently underutilized due to ageing and deteriorating distribution systems that require substantial funding for maintenance. Consequently, the focus has shifted towards investing in distribution networks for private buildings and businesses, which are more willing to invest. This shift is reflected in Fig. 5, depicting improved affordability, willingness, and preparedness to cover costs, thereby fostering water financialisation and effective governance. Both public-private partnerships and the private sector have promptly responded by revitalizing stagnant water projects to meet the surging demand for water. This rejuvenation is further supported by the availability of financial resources and viable tariffs from a willing public, ensuring a consistent water supply. This shift towards involving large corporations and multinational industries in water infrastructure acquisition has yielded multiple benefits (Table 5). These include enhanced accessibility to clean water, increased water availability, optimized utilisation and maintenance of water pipelines, heightened water safety, decreased violations of water distribution, mitigated water disparities, and a reduction in gender-based poverty.

Their strategies led to a remarkable global increase in the population served by private water companies, from 6 to 93 million. In the context of SSA, however, a critical challenge arises: the ability of often impoverished informal settlers, residing in neighborhoods with standardized water bills, to make regular fixed payments. These payments are essential to guarantee a steady and secure revenue stream for private companies, as highlighted by Allen and Pryke (2013). This presents a unique hurdle, given the socio-economic disparities and financial constraints faced by these marginalized communities. As multinational involvement grows, navigating these challenges and ensuring equitable access to water becomes a pressing concern in the pursuit of sustainable water management in Sub-Saharan Africa.

Table 7
Most successful government water intervention in Sub-Saharan Africa.

Issues		Perceptions' Responses (%)
i.	Borehole provision	36.7 %
ii.	Rural water supply	3.3 %
ii. i	Community water supply	6.7 %
iv.	Urban water supply	10 %
v.	Government/Donor provided water	36.7 %

Table 8
Key themes on water financialisation and entrepreneurship.

Key Themes	Categories	Sub-categories	Representative Text
Theme 1: Water Scarcity and Challenges	Global Water Scarcity and Challenges	Overestimation of Water Surplus and Over-exploitation; Impact on Population and Water Stress; Water Shocks and Impact on Sub-Saharan Africa; Water Scarcity and Sanitation in SSA; Water-Related Child Mortality	"Water is an abundant natural resource vital to life, but this surplus is often overestimated … "
Theme 2: Water and Sustainable Development	Water's Role in Green and Circular Economies	Water's Impact on Food and Energy Consumption; Water's Role in Achieving Sustainable Development Goals; Economic Impacts of Unsafe Water; Water as a Driver of a Sustainable Ecosystem; Challenges and Considerations in Implementing Circular Economy; Water Management in Different Countries; Economic Consequences of COVID-19 in SSA	"The critical role of water in the green economy cannot be overemphasised … "
Theme 3: Climate Variability and Vulnerability	Impacts of Climate Variability on Water Resources	Periodical and Irregular Rainfall Patterns; Water Challenges due to Floods and Droughts; Impact on Waterborne Diseases; Overcrowding and Health Issues in Urban Poor Areas	"Although Africa experiences a high level of rainfall, rains are often periodical and irregular … "
Theme 4: Water Financialisation and Governance	Concept of Financialisation and Its Domination	Emerging Trends of Water Financialisaton; Public-Private Partnership and Water Governance; Role of Private Entrepreneurs in the Water Sector; Impact of Financialisation on Water Policies and Ownership; Challenges and Opportunities of Water Financialisaton; Capitalism, Neoliberalism, and Water Management	"The concept of financialisation and its implications have gained prominence in recent years … "

4.4. Prospect and challenges of social intervention programmes in the attainment of SDG on water and sanitation

The credibility of the aforementioned narrative can be challenged when examining the prevailing government approach to water provision in both rural and urban contexts. Notably, the strategies employed by governments in Sub-Saharan Africa (SSA) countries lean towards relatively minimal and moderate water management measures, as depicted in Fig. 6. This perspective gains further clarity from the moderately implemented water provision strategies outlined in Table 6. Specifically, the data highlights that the predominant methods employed involve borehole provision and government/donor water schemes, as evidenced in the responses and strategies indicated in Table 7. These findings collectively underscore the cautious and restrained approach taken by governments in SSA towards water management and provisioning.

The limitations of government interventions are further compounded by inadequate regulatory support for water entrepreneurs across many SSA countries. Particularly concerning is the government's inability to effectively address customer complaints, as highlighted in Table 6. Interestingly, this governmental shortcoming is juxtaposed with a willingness among the populace to contribute financially to water provision, as indicated by the moderate levels of desire for utility and improved performance depicted in Fig. 6. Despite these positive inclinations, operational inefficiencies persist, posing additional challenges.

5. Analysis of Water Financialisation and entrepreneurship in SSA

Thematic analysis, guided by inductive reasoning, identified key themes as shown below through data classification, iterative coding, and review. The resultant primary themes informed the development of a conceptual framework in line with research questions and literature (Tables 8 and 9). Data validity was ensured through participant selection from various water institutions and assessment against research quality criteria.

Overall, these themes collectively provide a comprehensive analysis of the intricate challenges surrounding water resources in the context of Sub-Saharan Africa. They highlight the interconnections between water scarcity, sustainable development, climate variability, economic considerations, and governance issues. The analysis underscores the urgency of adopting holistic and collaborative approaches to ensure the availability, accessibility, and responsible management of water resources for the well-being of both current and future generations.

Table 9
Sub-categories and descriptions of Key themes on water entrepreneurship and financialisation.

Themes	Sub-categories	Description
Water Scarcity and Challenges	1.1 Socio-Economic Impact	Socio-economic consequences of water scarcity in Sub-Saharan African (SSA) communities are explored. Also examines how inadequate access to clean water affects livelihoods, income distribution, and overall well-being, particularly in vulnerable populations.
	1.2 Health Risks and Exploitation	The focus is on the health risks posed by water exploitation. Theme examines the impact of water scarcity on public health, including the prevalence of waterborne diseases and the challenges of maintaining sanitation and hygiene practices.
Water Management and International	2.1 Governance and Policy	Water management practices and governance structures in SSA were explored. The theme analyses government policies and strategies related to water supply, distribution, and conservation. Additionally, it considers international influences on water management decisions and their implications for local communities.
	2.2 International Investment	The focus is on international interests in SSA's water sector. The team examines foreign investments, partnerships, and initiatives aimed at water-related projects. The sub-category assesses the potential benefits and challenges associated with international involvement in addressing water scarcity and improving water infrastructure in the region.
Multi-Faceted Roles of Water	3.1 Health and Sanitation	Highlights the various roles of water in health and sanitation. The theme explores the importance of clean water for disease prevention, proper hygiene, and overall public health. The sub-category also addresses the challenges of providing safe water and sanitation facilities to SSA communities, particularly those facing economic constraints and inadequate infrastructure.
	3.2 Food and Agriculture	The focus is on the role of water in agriculture and food production. Theme examines the significance of water for irrigation, crop cultivation, and livestock rearing in SSA. The sub-category explores how water scarcity impacts food security, agricultural productivity, and the livelihoods of farming communities.
Water Financialisation and its Impact	4.1 Socio-Economic Effects	Socio-economic implications of water financialisation in SSA explored. The team examines how the introduction of financial motives and market dynamics to the water sector affects communities, economies, and access to water resources. The sub-category also addresses the potential benefits and risks of water financialisation in the context of SSA's vulnerable populations.
	4.2 Western-Driven Concepts	Western-driven concept of water financialisation examined. The theme analyses how external influences shape the perception and implementation of water financialisation in SSA. The sub-category also considers the implications of adopting financial approaches to water management, including potential power dynamics, equity concerns, and the role of international actors.

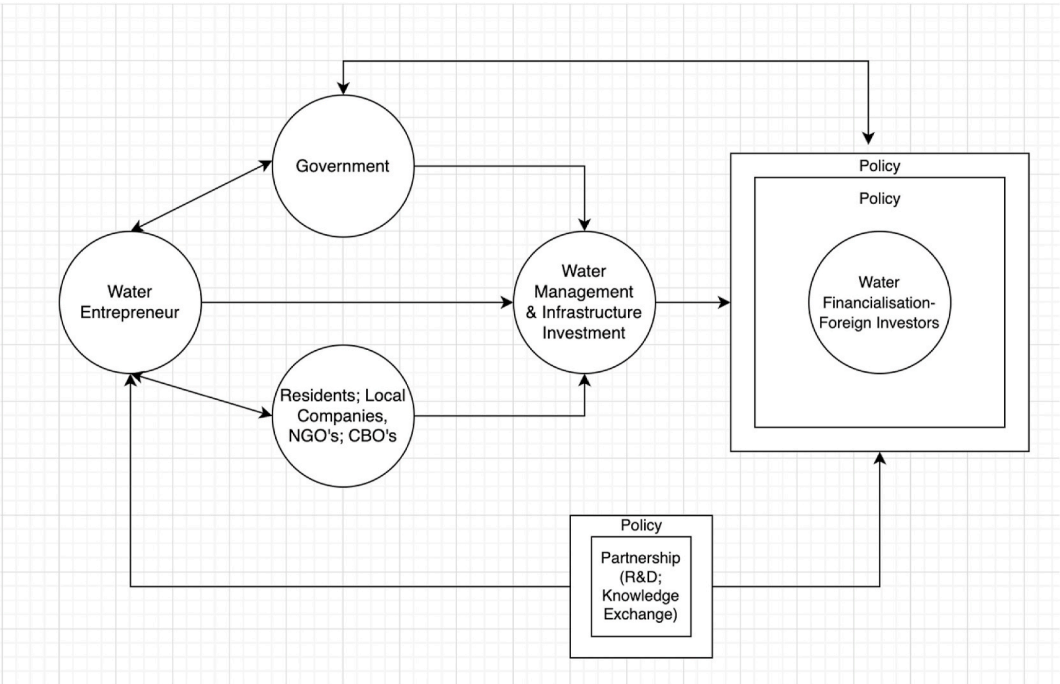

Fig. 7. Proposed framework towards achieving SDG Goals on water sustainability for all.

Table 10
Level of Expertise in the SSA water sector.

What is your level of education?	Select your level of income per month	Years of experience working in the water sector?	What is your role?
Diploma - Post-graduate (PhD)	$100–1000	0–5	Researchers, Engineers and Geologists
Diploma - PhD	$100 – above	5–10	Coordinator, Senior Hydrologist (District manager), Geologist, Hydrologist
Diploma - PhD	$100 – above	10 - above	Community Engagement and empowerment coordinator, Scientists, Consultants, Lecturer, Protecting and managing the Water Resources of the State, Hydrologist, Managing Director, Hydro-Consultant, Engineering, Groundwater expert, Geologist, Expert, Facility Manager, Training and research, General Manager, Geologist and Monitoring and evaluation officer, Teaching, Planning Officer (research), Water and Environmental Expert, Supervision.

5.1. Proposed SSA water sustainability framework

Considering the current ineffective and exposure to financial leakages in the water sector across SSA countries, there is a need for a new framework to better manage and address infrastructural gaps. The below-proposed framework in Fig. 7 highlights the role of Non-Governmental Organisations (NGOs) and Community-Based Organisations (CBOs) both local and international, government, residents and local water entrepreneurs as core stakeholders in water management, infrastructural investment and drivers of policy.

While the government and other water players in the framework are open to engagement and partnership with foreign investors, these relationships are only limited to research and development (R&D) and knowledge exchange. Future uncertainties are also likely to increase due to the impact of climate change, with sub-Saharan Africa likely to be mostly impacted. A substantial number of respondents (as indicated in Table 10) possess advanced qualifications, implying a potential facilitation of collaborative efforts among stakeholders to expedite the development of a concrete framework for attaining SDG on water sustainability for all.

6. Conclusion

This comprehensive analysis addresses the intricate challenges posed by water scarcity, sustainability, climate variability, and financialisation within the global water context. The study highlights the paradox of water scarcity, where abundant resources are often overused, leading to critical shortages that disproportionately impact vulnerable populations, particularly in Sub-Saharan Africa. Water's central role in sustainable development is emphasized as it intersects with the goals of green and circular economies. The escalating demand for water, driven by factors like agriculture and industry, underscores the need for innovative policies to ensure equitable distribution and efficient use. The concept of circular economies presents a potential solution, though implementation challenges must be carefully navigated. The unpredictable nature of climate variability, characterized by irregular rainfall patterns, exposes communities to both floods and droughts, amplifying waterborne diseases and health risks—especially in densely populated urban areas. The analysis explores the evolving landscape of water financialisation and governance, where financial motives and institutions play a significant role. The potential advantages of Public-Private Partnerships are weighed against the risks of profit-driven priorities, highlighting the complex interplay between financial interests, global dynamics, and water accessibility. Collectively, these findings underscore the urgent requirement for sustainable water management, equitable distribution, and effective governance to tackle the multifaceted challenges arising from water scarcity, sustainability, climate variability, and financialisation. These intricate issues demand innovative and collaborative approaches to ensure the availability, accessibility, and responsible stewardship of this invaluable resource.

Data availability statement

In line with the Heliyon Journal Data availability standard, to increase trust in our article. We, the authors state that the data associated with our study is publicly available in the following repository; https://docs.google.com/forms/d/14C2Zl0nl4E3buMuNH9f8FdTwk0n5Qp3K-d_9NLvsN4o/edit?usp=forms_home&ths=true.

CRediT authorship contribution statement

O.L. Sanusi: Conceptualization, Data curation, Investigation, Methodology, Project administration, Writing – review & editing. **M. O. Oke:** Conceptualization, Investigation, Project administration, Writing – original draft, Writing – review & editing. **M.A. Bello:** Conceptualization, Formal analysis, Investigation, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e20859.

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