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Water Management Education in the East African Region: A Review of the Challenges to Be Addressed

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Abstract: Increased urbanisation coupled with inadequate awareness of the public on the issue of freshwater resource management has affected the use and the availability of freshwater resources in urban areas of Uganda, Kenya, and Tanzania. Lake Victoria has been the clearest example, with the water level decreasing 0.005 m/year from 1993 to 2016 causing an overall drop of 0.115 m. In order to develop sustainable methods for addressing these issues, this paper critically reviews the different legal frameworks used in each country (Uganda, Kenya, and Tanzania) adopted to manage the water resources and identifies the challenges faced by each legal framework applied. It also analyses the education systems implemented within these three nations to educate students at various levels about water resources and identifies the challenges involved in each system. Finally, suggestions are made for future research to be conducted to obtain specific benefits for better management of water resources in East Africa.

Keywords: urbanisation; education; water resource management; unified research ideas; water demand; variation of water in Lake Victoria

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1. Introduction

The rapid urbanisation in East African countries has posed a challenge to freshwater resource management in the region during the last decade [1]. In particular, cities such as Kampala, Kisumu, and Mwanza, chosen due to their proximity to Lake Victoria in Uganda, Kenya, and Tanzania, respectively, as shown in Figure 1, are prime examples.

They are experiencing rapid urbanisation, with their water supplies extracted directly from the lake, which is therefore under extreme water-use pressure.

Rural–urban migration is the major driving factor for urbanisation in East Africa [2]. For example, 20 percent of the Ugandans who live in rural areas are considering migrating to urban areas in the next five years [3]. Kampala, the capital city of Uganda, is on the list of fast-growing cities in Africa due to its recorded population growth of 5.26% per year [4] (2022, population: 3,651,919). Kisumu is located along Lake Victoria, and, after Nairobi and Mombasa, it is the third largest city in Kenya [5]. Mwanza is second largest city [6], after Dar es Salaam, in Tanzania [7]. The cities are experiencing a rapid urbanisation which has led to high water demand as shown in Table 1.

The high-water demand has affected the water level of existing freshwater resources. The water level in Lake Victoria decreased 0.005 m/year from 1993 to 2016 causing an overall drop of 0.115 m [10]. Due to this reduction, the area and the volume of the lake decreased by 100 km^2 and 5 km^3, respectively [10] (Figure 2).

Table 1. Water demand and supply in urban areas of Uganda, Kenya, and Tanzania.

Cities	Population	Daily Water Demand (m^3/day)	Daily Water Produced (m^3/day)
Kampala (Uganda)	3,451,919 [4] (2021)	300,000 [8]	240,000 [8]
Kisumu (Kenya)	1,155,574 [5]	60,000 [9]	81,000 [9]
Mwanza (Tanzania)	905,473 [6]	116,575 [6]	73,233 [6]

Figure 1. A map of East Africa showing Kampala, Kisumu, and Mwanza.

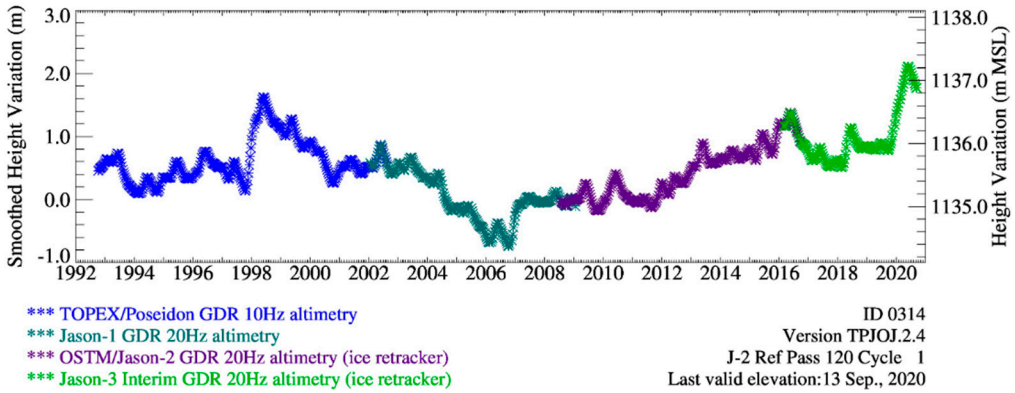

Figure 2. Variation of water level in Lake Victoria from 1992 to 2020 (Adapted from [11]).

Uganda, Kenya, and Tanzania have institutional frameworks used to set rules for water service provision in urban areas. An institutional framework for water management comprises various organisations that are responsible for managing and developing water resources at various levels of society [12]. Applying an institutional framework is an essential procedure for making a foundation for sustainable water management. This could be through water conservation policies such as water awareness programs [13] to influence the citizens to utilise less water in their everyday water practice. This would reduce the overall water demand and would be a cheaper solution than infrastructural projects [13] such as the Integrated Water Management and Development Project which is funded by the World Bank with a loan worth 313 million USD [14]. The root cause of several failures such as weak enforcement bodies [15] and inadequate human resources [16] in service delivery and water management is the lack of comprehensive institutional frameworks [12].

Data have shown that people with lower levels of education have less interest in environmental and natural resources [17]. Education can be a crucial tool to promote

environmental awareness and an example is provided by the United Nations which has proclaimed that it has to be incorporated within every national educational curriculum [18]. Environmental literacy is aimed to be taught in subjects such as freshwater resource management to learners via classroom instruction, web-based training, remote labs, e-learning courses, workshops, seminars, and webinars [19]. Within the school curriculum in Uganda, Kenya, and Tanzania, significant environmental themes have been already included [20] at various levels; primary, secondary, and tertiary. At primary level, six subjects (English, integrated science, social studies, agriculture, integrated production skills, and religious studies) have content on environmental education [21]; at secondary level, environmental education themes are covered in the geography syllabus [22]; and it is through the Department of Environmental Management at university level [23]. However, according to Mucunguzi, important themes such as social change are still not fully considered when tackling environmental features in schools [24]. To date, non-formal environmental education seems to have focused more on promoting environmental concerns via the adoption of multidisciplinary tasks. Therefore, there is a strong need for education to also embrace additional aspects; for example, programmes that are based on the diversity of environments (including the biophysical, social, and economic element) and that consider not only the current situation of things, but also target the development of the society in the future and the consequent changes in risks and needs [24].

To pursue the Sustainable Development Goals (SDGs) and Education for All (EFA), a rapid implementation of Universal Primary Education (UPE) and Universal Secondary Education (USE) policies has been driven forward across the three countries [25]. This has led to an increasing enrolment rate in both primary and secondary schools. For example, studies estimate that 90 percent of children aged from 6 to 12 years [26] in Uganda, Kenya, and Tanzania attend primary school [27]. Due to the increasing enrolment in the East African schools, it could be assumed that more residents should be receiving education about freshwater resource management through environmental education. According to Johnson-Pynn and Johnson, environmental awareness has grown across the public since it was launched in 1975 by UNESCO [20] and the United Environment Programme [28]. For example, on the 2nd of June 2021, the East African Community called for an increased regional coordination in ecosystem conservation and management [29]. However, the persistence of water degradation in the three East African countries raises questions about the environmental education that students have received to date and the methods adopted within curriculums in schools [21]. As claimed earlier, formal environmental education enables students to develop environmentally responsible behaviours. Given that freshwater resources are still stressed [30] by human activities which influence the pollution and unsustainable usage of the resource, this shows that not all people have developed environmentally responsible behaviours yet. Therefore, this prompts an examination into the nature of education relating to water resource management in East Africa [31].

To address this gap, this paper presents a review of the current frameworks used to manage water resources in the urban areas of Uganda, Kenya, and Tanzania adjacent to Lake Victoria. Furthermore, the education system used in each country is reviewed to identify challenges affecting each system and pinpoint areas that require further development. Subsequently, this should offer proposed changes that could benefit public awareness and knowledge of water management and inspire further research aimed at providing detailed solutions for the management of water resources in East Africa.

2. Water Management Frameworks in Uganda, Kenya, and Tanzania

This section will compare the different water management frameworks used in Uganda, Kenya, and Tanzania to manage the water resources. It will also provide an overview of the challenges affecting the frameworks in each country.

2.1. Water Management Framework in Uganda

A complete national policy framework for the management of water resources in Uganda was established with the Constitution and the Local Government Act (1997) [32] as presented in Figure 3.

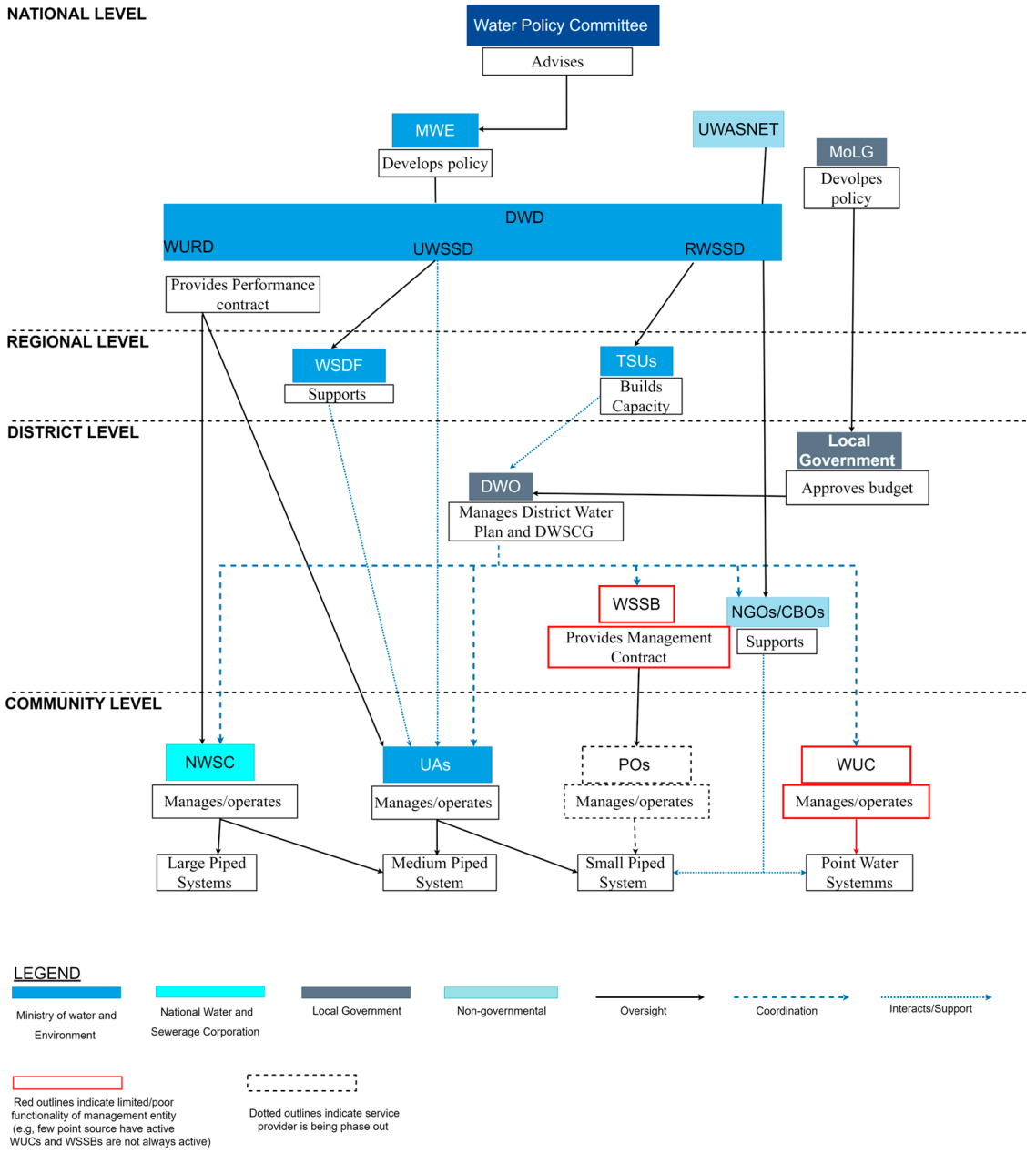

Figure 3. Institutional framework for water service provision in Uganda (Adapted from [33]).

There are existing policies such as the National Water Policy (1999) [32] which encourage the integration of principles linked with water resources management. More in detail, this policy also stresses that utilisation of Uganda's water resources is a key factor to be understood and that a sustainable water management should be the final goal to be achieved [34]. The National Water and Sewerage Corporation (NWSC) Act (2000) and Land Act (1998) are also significant for water resources management [32]. Most of the functions associated with wetlands, the environment, and water sanitation have been implemented by institutions in a decentralised manner to district level.

The Ministry of Water and Environment (MoWE) is the main body in charge of shaping standards and national policies, and this role also requires the management and the regulation of water resources and continuously setting priorities, and needs to make water management sustainable and innovative [35]. The MoWE receives advice from the Water Policy Committee and the committee is made up of district-level decision makers, non-government organisations (NGOs), and private sector actors [35]. The MoWE sector comprises the Water Supply and Sanitation (WSS) sub-sector and the Environment and Natural Resource (ENR) sub-sector [36]. The first one deals with the water management, water production, water supply, and sanitation in urban and rural areas, while the second one concentrates on forests and trees, wetlands, and other aquatic resources [36]. MoWE has three directorates, as shown in Table 2, through which the programmes of water sector development are delivered.

Table 2. The three directorates and their duties.

Acronym	Organisation	Duties
DWD	Directorate of Water Development	Responsible for the regulation, supervision, and implementation of water services in urban and rural areas in Uganda. DWD is formed by three departments: Urban Water Supply and Sanitation Department (UWSSD), Rural Water Supply and Sanitation Department (RWSSD), Water Utility and Regulation Department (WURD) [37].
DWRM	Directorate of Water Resources Management	In charge of water use allocation, water service, regulation compliance monitoring, and enforcement of laws [38].
DEA	Directorate of Environmental Affairs	Enforces legal and institutional regulations related to the environment in Uganda [32].

Links to the organisations, **DWD**: Directorate of Water Development | Ministry of Water and Environment (mwe.go.ug); **DWRM**: Directorate of Water Resource Management | Ministry of Water and Environment (mwe.go.ug); **DEA**: Directorate of Environment Affairs | Ministry of Water and Environment (mwe.go.ug).

The ministry has institutions fully owned by the government: for example, in large urban centres across Uganda, NWSC is authorised to supply water and sewerage services, while forests are managed by the National Forestry Authority. The National Environmental Management Authority (NEMA) is in charge of securing and seeking sustainable environmental practices to be implemented. Finally, the Uganda Meteorological Authority (UNMA) deals with weather monitoring, keeping databases with all variables linked to the climate and imparting regular updates on national weather and climate to the government [36]. Since 1993, it was possible to notice a decentralisation of responsibilities in Uganda within the water supply and sanitation sector: more in detail, there has been a transfer of commitments from central government level to district local government level [39].

To guarantee that resources are allocated more efficiently and policies planned more accurately, there is a need to develop a structure which incorporates clarity and collaboration between the institutions involved [32].

Unfortunately, recent studies [40] have shown that the existing legal and institutional frameworks and the strategies that are being adopted to manage water resources are insufficient. Thus, there is scope for improvement, and changes are required at many institutional levels in order to improve the situation, for example, to ensure that new policies can secure more sustainable water management as well as adequate quantity and good water quality for future generations in Eastern African regions [40].

2.2. Water Management Framework in Kenya

The Ministry of Water and Irrigation (MWI) is responsible in Kenya for generating institutions that have the duties to manage water resources and furnish water services [41], as shown in Figure 4.

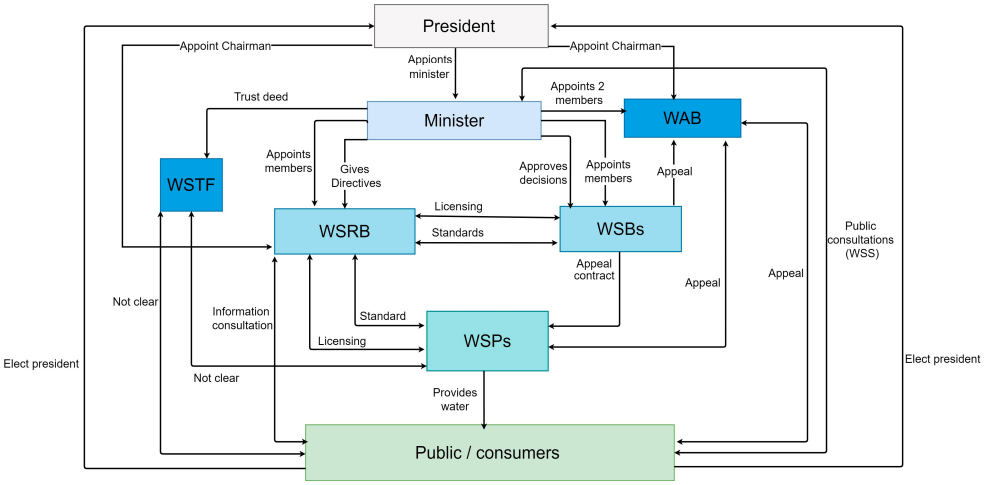

Figure 4. The water sector institutional framework in Kenya (Adapted from [42]).

Kenya was able to make reforms in the institutional water management framework under the Water Act 2002 [43]. The Water Resources Authority Management (WRA) serves as an agent of the national government and controls the administration and operation of water resources. The Authority has a variety of duties, such as to map out and impose directives necessary for the management and use of water resources, as well as the mitigation of flooding, and the abstraction of water (e.g., permit applications) [41]. The Water Services Regulatory Board (WSRB) has a mandate of regulating and controlling water services boards, issuing licenses to water service boards, and assembling standards and developing guidelines for water tariffs [43]. Water Services Boards (WSBs) are in charge of securing water (and sanitation) services in their areas of jurisdiction [44].

Water Services Providers (WSPs) are responsible for day-to-day operations and maintenance of water production and distribution [45].

Water Resource Users Associations (WRUAs) are accountable for the decision process used to identify and register water users in Kenya and they also collaborate in processes associated with catchment management and water allocation. The Water Services Trust Fund (WSTF) oversees the provision of water and sanitation to disadvantaged groups. The Water Appeals Board (WAB) supervises the arbitration of water-related disputes and conflicts in the country [43]. The National Water Conservation and Pipeline Corporation (NWCPC) has the role of constructing dams and drilling of boreholes [45]. The Kenya Water Institute (KEWI) provides training and research. It is the responsibility of the National Irrigation Board to develop the irrigation infrastructure [43].

Recent reforms made within the water sector have enabled a lot of improvements in terms of providing sustainable water and basic sanitation; however, these results are mainly limited to a minority of Kenyans who live in urban areas [46], though urban dwellers who live in slums areas are unable to connect to piped water infrastructure [47]. The issues that still require further development are associated with the inadequate management of existing infrastructure [44].

Optimal standards set by the MWI are yet to be achieved by Kenya's water sector regulators and the main reason is to be linked with inappropriate water and sanitation coverage [48]. On a positive note, a strong effort such as improving the sustainable management of freshwater resources has been noted from WSPs, WSRB, and the MWI, and they are all trying to optimise and improve their performances [44].

2.3. Water Management in Tanzania

Nine river basins divide Tanzania, and these do not follow managerial boundaries [49]. Water management and planning are distributed within national, basin, district, and community levels [49], as shown in Figure 5.

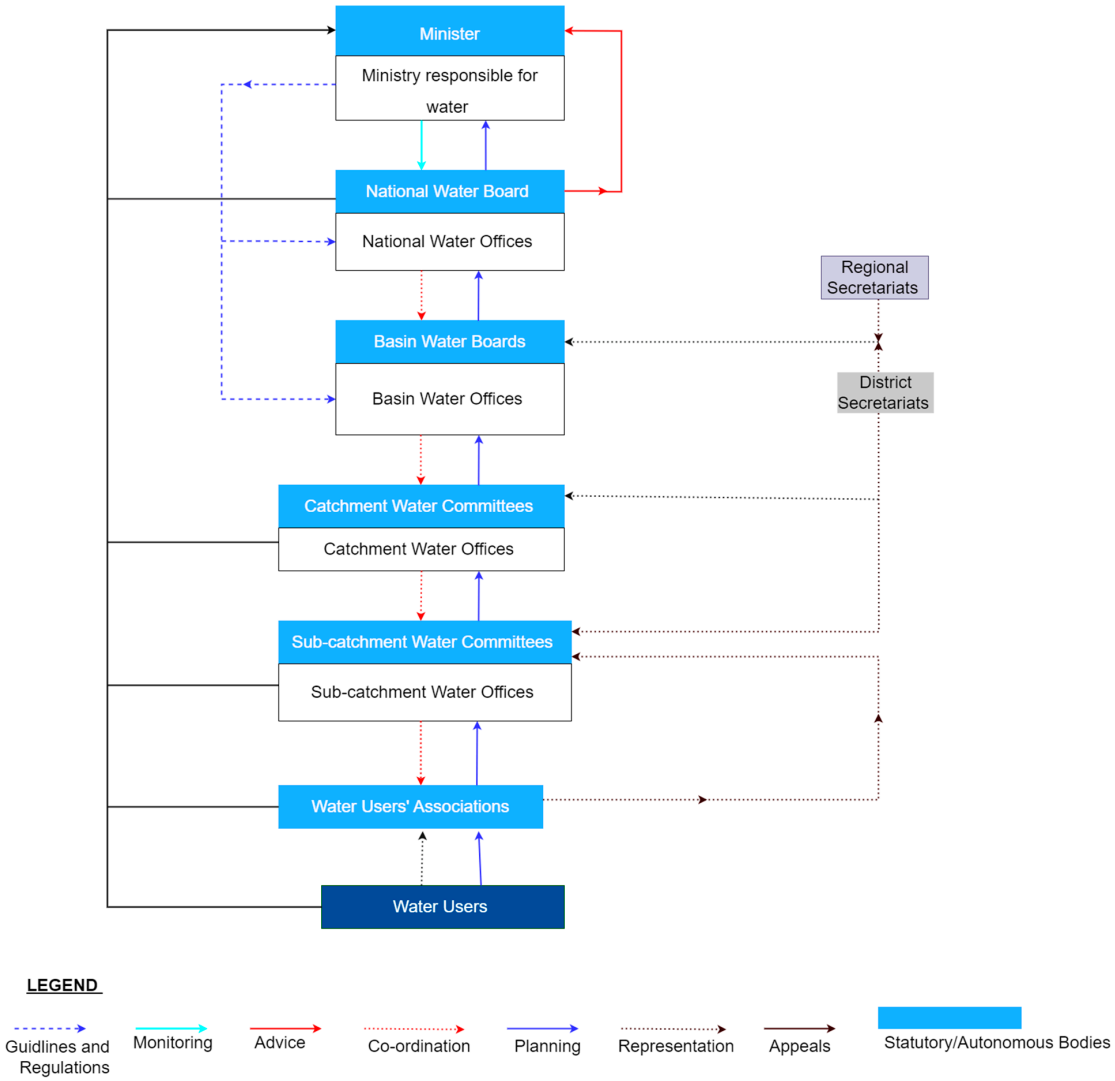

Figure 5. Kisumu institutional structure of water resource management in Tanzania. (Adapted from [49]).

The Ministry of Water and Irrigation oversees water resource governance at the national level: its main duties are associated with the development, dissemination, monitoring, and evaluation of the National Water Policy of 2002. The Basin Water Office (BWO) is responsible for water administration at the basin scale, covering catchments and sub-catchment units [50]. BWO is authorised to establish lower-level water management organisations which commonly gather stakeholders and users of the same resources, and it is also mandated to collect the various water use fees, and is responsible for resolving conflicts in water allocation, water connection, water use, and implementing bylaws for preventing pollution [50].

The National Environment Management Council (NEMC) is the legal regulatory body for environment [51] and is authorised to enforce, review, comply, and monitor the environmental impact. Furthermore, this Council eases public participation when environmental decisions must be made and supervises and coordinates all matters concerning the environment. The Council works through the regional secretariat and the local governmental authorities. It is a responsibility for the village environmental management committees to ensure the proper management of the environment. However, to date, the action of NEMC has been more clearly noticeable when dealing with industrial pollution by large companies at national level [51].

In Tanzania, the situation is more challenging: the institutions that are in charge of dealing with water management are unfortunately very disconnected and there is a lack of coordination between them; moreover, they are not often involved when new water management programs are stipulated [50]. The method for water resource development [52] is sector-oriented and does not fully recognise the multi-sectoral linkages in planning the use of water resources [52]. According to [50], institutional linkages need to evolve following the needs of inter-sectoral water management.

2.4. Challenges Faced by Water Management Frameworks in Uganda, Kenya, and Tanzania

The three East African countries have a constitutional obligation to provide water as a fundamental right for citizens [53]; however, there have been issues in implementing this objective. Institutional structures for water resource management in East Africa experience technical and social challenges which are summarised in Table 3.

Table 3. Technical and social challenges affecting water management framework in East African countries.

Challenges	Uganda	Kenya	Tanzania
Technical	• Data and information related to water resources are not sufficient or reliable. Furthermore, there are several issues linked with negotiations required on trans-boundary agreements, proper management of the resources, and participation of members of the communities [32]. • The main challenge of the Ministry of Water is related to the implementation of mandates through the various departments. This should be conducted by interacting, consulting, and agreeing with the directorates or the departments, especially in terms of finances, in order to operate and develop efficient water schemes [32]. • Funding available is not sufficient [34]. • Incapacity of the sector institutions (e.g., the MWE) to shape its role of planning, supporting, and supervising water and sanitation programs via improving the monitoring of existing systems and composing sustainable procedures [34]. • Increasing costs (3 million USD annually between 2014–2019) of water treatment due to pollutant loads in water resources [54]. • Alleged corruption in the sector [55]. • Uganda suffers from uneven distribution of water resources resulting from severe drought and floods [54]. • The increasing demand of water due to rural–urban migration [39]. • Weak implementation of regulations and laws on water abstraction and waste discharge.	• Inadequate communication and information management systems within the sector [56]. • Inadequate management and maintenance of existing infrastructure [56]. • Corruption is active and ethics in the water management framework are missing [42]. • Financial accountability which would lead to non-sustainability of water services is not available yet [42]. • The water sector is not properly funded because it is given ~2.8% of the national budget, which is expected to cover around 44% of the needed investment costs [45]. • A rapid growing demand for water for multi-sectoral uses mainly in urban areas [57]. • Inadequate institutional sectors and human capacity [58]. • Weak implementation of laws and regulations of water resources [56].	• The overlapping responsibilities and roles among various organisations leading to unproductive use of human and financial resources, repetition of effort, and a gap in effective management [59]. • Insufficient cross-sectoral management within various government institutions [49]. • Failure to implement laws and regulations governing water resources [60]. • Financial sustainability in water resources management has not reached yet [61]. • Water treatment costs are too high; for example, the cost of delivering centralised water is about 221 USD per family [62].

Table 3. *Cont.*

Challenges	Uganda	Kenya	Tanzania
Social	• Inadequate involvement of local communities [34]. • Illegal connection of water by the customers has affected service provision to other parts of the country [63].	• Risks and issues associated with social acceptance are very present within rural water supplies because the communities are required to take over operation and maintenance of facilities once construction is complete [45]. However, there is limited funding for maintaining the facilities [45]. • Conflicts are quite frequent amongst various water users; for example, Tana River Basin conflicts between the upstream and downstream users [45]. • Direct or indirect release of waste into the water without adequate treatment to remove harmful compounds [64].	• Water conflicts upstream, downstream, and transboundary which is due to the scarcity of water [61].

Based on the insights identified when analysing existing frameworks, the major challenges that are required to be dealt with in the near future as a matter of urgency can be listed as follows:

- Inefficient funding from the government is a major issue faced by the three-water management framework.
- Increased water demand, predominantly in urban areas.
- Institutional and human capacity require further improvements because existing skills (e.g., negotiating transboundary issues, regulating the use of water resources, and tackling pollution) are not fully developed or efficient.
- Weak implementation of legislation to better manage water abstraction and waste discharge.
- Absence of enough communication and awareness building within the institutions and local organisations and the community.

3. Comparison of the Education Systems in Uganda, Kenya, and Tanzania

As with the provision of water, Uganda, Kenya, and Tanzania have actively acknowledged education as a fundamental right to citizens and hence a constitutional obligation for each nation. Section 3 offers an introduction and comparative review of the education systems within Uganda, Kenya, and Tanzania with the aim of ascertaining how water resource management education can be integrated successfully into the curriculum.

3.1. Education System in Uganda

The education system in Uganda has a structure of seven years of primary education, six years of secondary education (divided into four years of ordinary/lower level and two years of advanced level), and three to five years of post-secondary education. Uganda's education system framework as shown in Figure 6 has been in place since the early 1960s [65].

The school system consists of private and government (public)-run schools. Evidence has shown that there are notable differences in quality between public and private schools, exacerbated by the urban/rural divide [65].

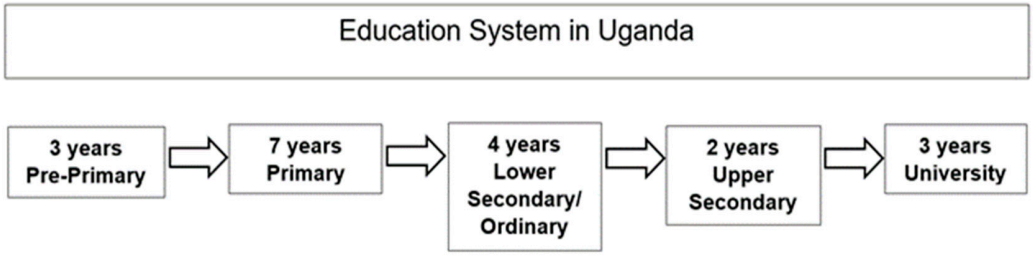

Figure 6. Uganda education system structure (Adapted from [66]).

Uganda's education system has experienced important developments following a commitment to Universal Primary Education (UPE) and the abolition of school fees in mid-1996 [67]. This increased primary enrolment rates from a low of 2.5 million in 1996 to 5.2 million learners in 1998 [68]. Due to the increased enrolment in primary schools, Uganda introduced Universal Secondary Education programmes (USE) in 2007 [69] and it became the first country in sub-Saharan Africa to introduce USE, which led to an immediate increase in the number of lower secondary enrolment by nearly 25 percent between 2007 and 2012 [70]. Whilst a continued increase in the enrolment rates has offered significant economic, social, and potentially environmental opportunities in Uganda, one of the major challenges the country and many other sub-Saharan nations continue to face is educational attainment. Few studies, with the exception of [71], have explored the impact of UPE on educational attainment at USE and tertiary level in Uganda. Their research concluded that the Free Primary Education (FPE) reforms had little impact on educational attainment overall, due to the additional costs of uniform and lack of quality teaching staff and facilities able to cope with the expansion in students [71].

Current Reforms in Ugandan Education

The Ministry of Education and Sports (MoES) oversees education and a focus on quality education is now the key target for the sector [67], further encouraged by the Sustainable Development Goals (SDGs), particularly Goal 4 'Quality Education'. MoES ensures that the teachers are deployed and well trained in the teaching colleges. Uganda currently has 46 primary teachers' colleges [72]. Uganda Polytechnic Kyambogo (UPK) is a tertiary technical institution responsible for the training of teachers and the coordination of technical education in the country in connection with other relevant governmental bodies and stakeholders.

Environmental Education (EE) is among the mandatory programmes of UPK's curriculum [73]. Emphasis in this program is concentrated on the theme of Environment and Sustainable Development. Students are exposed to the sub-themes of Total Environment (land, water, climate etc.) and Environmental Education (its philosophy, goals, objectives, and main guiding principles) [73]. The approaches employed when teaching and learning include lectures, class discussions and presentations, and action research for local and community environmental problem solving. EE is mandatory in the national education curriculum at all levels, being taught to students from the primary grades to the university level and in other national education agencies. A lack of a conceptual framework within the EE curriculum, however, has led to setbacks in its implementation and understanding. School subjects are regularly taken seriously but only if they are examinable at the end of the course. EE is mandatory and examinable for all students at UPK, though this is not the same situation in most tertiary educational institutions in Uganda [73].

The Uganda National Examination Board (UNEB) administers all the final examinations in Uganda which include the Primary Leaving Examination (PLE) national examination for primary candidates, Uganda Advanced Certificate of Education (UCE) national examination for lower secondary, and Uganda Advanced Certificate of Education (UACE) national examination for upper secondary [74]. On successful completion, students can continue to university. Currently, Uganda has 53 universities including Makerere University

and Kyambogo University with approximately 40,000 students graduating annually [75]. In 2016, 86 percent of the 102,858 students who sat UACE exams passed with the majority attaining three principal passes [69]. Subsequently, approximately 35,000 students will join university education [74] with others deciding to join institution schools, failing their exams, or joining the labour market.

3.2. Education System in Kenya

From 1985, the Kenya Institute of Curriculum Development (KICD) proposed that a 2-6-3-3-3 education system as shown in Figure 7 should replace the 8-4-4 system of the time [76].

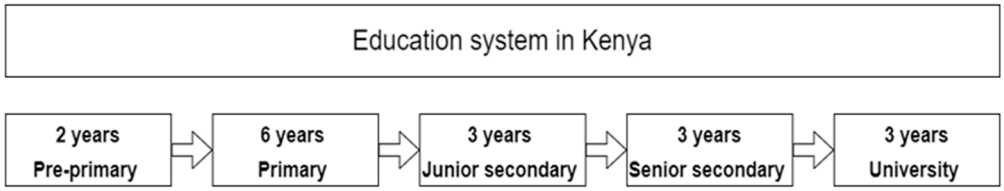

Figure 7. Kenyan education curriculum framework (Adapted from [76]).

The new system was characterised into three stages, which include: (i) Early year education covering kindergarten (pre-primary) education up to Grade 3; (ii) middle school education, covering Grade 4 to Grade 9; and (iii) senior school education, covering Grades 10 and 12. Under the new system, Early Childhood Education (ECD) would also be recognised, learners are required to spend two years in ECD centres before joining primary schools [76].

All children are expected to enrol for pre-primary education at the age of 4 and at this stage, they would be introduced to subject areas that target many core skills such as literacy and mathematics alongside an early appreciation for the environment [77]. Learners would then move from a class system referred to as Standard level to the Grade level which is from Grades 1 to 3 [76], further expanding to incorporate environmental studies, indigenous languages and knowledges, and nutrition and hygiene from Grade 4 [77].

The structural shift in the education system followed over twenty years of what many argued to be a heavily loaded curriculum focused on establishing and sustaining a future blue-collar workforce in the country. Comparatively, the 2-6-3-3 system offers a more holistic and child-centred approach to learning for students where student's own personal interests and preferences can be embedded into the curriculum [76].

Limited research has been discussed in relation to the implementation of EE in the current education system in Kenya, given how recent the structural changes have been. The themes on EE, however, have been integrated into various subjects within the school curriculum in Kenya since 1985 [22] in an attempt to reduce the pressure of human activities on the environment. In the primary school curriculum, themes on EE were mainstreamed in social studies subjects and through the geography syllabus at secondary level [78]. In addition, EE is covered in non-formal and extra-curricular education such as debating or conservation societies [22]. In regions sustained by tourism such as the Diani-Ukunda area, environmental sustainability initiatives are regularly driven by and funded by tourism especially in private education [79]. The mainstreaming of environmental education in Kenya has witnessed a positive impact on environmental sustainability; however, challenges continue to exist for relating to a lack of trained personnel [80].

The education system in Kenya is dominated by examination-oriented teaching, whereby passing examinations is the only benchmark for performance since there is no internal system of monitoring learning achievements at other levels within an education cycle [76]. The Kenya Certificate of Primary Education (KCPE) examination is an entry examination that enables candidates (standard 8) to progress to secondary education or training in tertiary institutions [81]. The Kenya Certificate of Secondary Education (KCSE)

examination is an examination that comes at the end of the four years in secondary education [82] and administered by the Kenya National Examinations Council (KNEC) [83].

3.3. Education System in Tanzania

As with other countries in East Africa, Tanzania has made tangible efforts and commitments to education, including the development of the Education and Training Policy (ETP) 2014 which replaced the former Education and Training Policy of 1995 [84]. The 2014 ETP provided significant changes in primary and secondary education from the previous formal educational. The old system was characterised by a 2-7-4-2-3 (with the potential for more) [84], whereas the new system includes 1-6-4-2-3 (with the potential for more) [85] as shown in Figure 8.

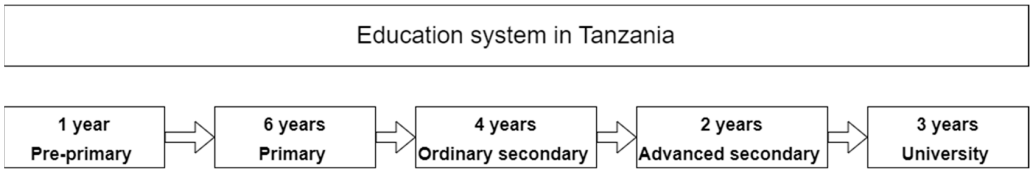

Figure 8. Tanzanian education framework (Adapted from [85]).

After the introduction of ETP, it was decided that EE should be integrated in all subjects at all levels of schooling [86]. Similar to many neighbouring nations, Tanzania has been facing environmental and hazard-related problems including drought, floods, poor sanitation, lack of clean and safe water, land degradation, and deforestation among others. Therefore, these serious problems require urgent attention through quality education, in particular EE.

Students are engaged in critical inquiry into real issues concerning the environment and development, as well as promoting actions that will address EE issues. Tanzania's primary education curriculum emphasises teaching and learning methods which make students active participants in the learning process [86]. Such approaches provide learners with high critical thinking skills and stimulate learning, which is important for the learning of EE [87].

Despite the inclusion of EE in the Tanzanian school curriculum in since the 1960s and further emphasis in the ETP since 1995, the condition of the environment has seen little improvement. Studies have found that the implementation of EE has been unsuccessful [88]. Evidence of environmental degradation in the form of water pollution, poor waste management, and many other problems can still be observed in many schools and in the communities of Tanzania [89]. In addition, research [90] about environmental management around Lake Victoria discovered that people's awareness of environmental problems is generally low in Tanzania even though many have attended school [89]. Therefore, this suggests a critical issue as far as the teaching and learning of EE is concerned.

The Ministry of Education and Vocational Training (METV) has a legal mandate for formulating policy, coordinating, monitoring, setting standards, quality assurance, and quality control of the entire education system in Tanzania [85]. METV is responsible for supervising higher education, training teachers, developing the curriculum, managing the examination, and inspecting schools. The management of pre-primary, primary, secondary, and out-of-school education is discussed under the control of the President's Office-Regional Administration and Local Government (PO-RALG) [85]. PO-RALG supervises the work of the local authorities. They are responsible for the daily operations of primary and secondary schools, for example, the management of teachers and payment of school supplies [85].

3.4. Challenges Faced by the Education System in Uganda, Kenya, and Tanzania

Access to education is not just a fundamental right but it is also a key to increasing employment and income opportunities [91]. Education is a sustainable means to reduce poverty and bring lasting change [92]. Therefore, education must be involved in one

way or the other to effect permanent change and in the effort to bring lasting change. Unfortunately, gaining sufficient education tailored to the needs of locals is challenging for underprivileged families in East Africa. As with any national education system, Kenya, Tanzania, and Uganda are continuously monitoring their own education and assessment structures considering current environmental, political, and social issues in their respective countries. Some of the challenges affecting their incorporation of EE into the system are outlined in Table 4.

Table 4. Challenges affecting the education system in the East African countries.

	Uganda	Kenya	Tanzania
Technical challenges	• The language of instruction policy was the most controversial issue during curriculum development process. There are more than 60 local languages including Luganda, Ateso, and Luo (among others) which are used in Uganda and therefore instructions need to be written many different languages [93]. Selecting a local language as the language of instruction at school has financial, staffing, and training, as well as political, implications [94]. • The relevance of the curriculum has not been adopted to suit contemporary needs. The teaching in Uganda promotes rote learning rather than application, problem-solving, and entrepreneurial skills. [95]. • Inadequate infrastructure and learning materials such as classrooms, laboratories, libraries, textbooks, and desks in some government schools [96].	• Cheating in both KCPE and KCSE has been of great concern not only to the government but also to the Kenyan public [97]. • Lack of adequate physical materials such as desks, textbooks, and a shortage of permanent classrooms in primary schools [98]. • Lack of clear legal guidelines on the implementation of inclusive education and non-formal education programs [99]. Inclusive education is education that includes students with special needs [100]. The legal guidelines for education programs for students with special needs are unclear in Kenya.	• The controversy of Kiswahili versus English. Students in Tanzania admit that they understand their teachers better when teaching is carried out in Kiswahili; however, a majority of students still believe that English should be maintained as the medium of instruction in secondary schools [101]. • Lack of qualified teachers, mainly in pre-primary schools of Tanzania causing pupils to be taught by unqualified teachers [102]. • Accessibility of teaching and learning materials are issues in the majority of schools in Tanzania. Some 70 percent have limited access to teaching and learning materials [102].
Economic challenges	• Poverty stands out as the main reason which limits children in Uganda from enrolling in schools [103].	• Poverty levels and inequalities across the country. Though enrollment in Kenyan schools is high, completion rate has consistently been low due to lack of school fees [104].	• Due to the high poverty in the country, many parents cannot afford the schooling costs, especially the school fees, and this is the central reason for early dropout from schools [105].

Table 4. *Cont.*

	Uganda	Kenya	Tanzania
Social challenges	• Early marriage in Uganda has increased school dropouts in the country. It leads to pregnancy which disrupts education. Early marriage is estimated at 49 percent and is one of the highest in the region [106]. • Many children dropout of school because they have experienced physical, sexual, and emotional violence from their teachers or their peers [107].	• Influence of peers and involvement of early sex which leads to teenage pregnancy, hence early marriage, are the main causes of school dropout in Kenya [108]. • Gender disparity. Girls have been denied their right to education in Kenya [109]. • High number of HIV/AIDS orphans. Over 660 thousand Kenyan children are orphaned as a result of HIV/AIDS [110]. Often, orphans are unable to attend school due to financial difficulties which affect their education. In addition, some children have contracted the virus from their parents, and their poor health can affect their education.	• Increased HIV/AIDS infections among learners, teachers, and administrators at various levels of the education hierarchy has affected efficiency in education. This is through increased illness and death of teachers and students with HIV infection withdrawing from school [111]. New HIV/AIDS infections reduced in number from 82,000 new infections in 2018 to 77,000 new infections in 2019 [112]. • Incidences of violence in school settings have revealed numerous setbacks to the progress of children's education. Corporal punishments and sexual violence within school settings have increased school dropouts in Tanzania [113].

Having analysed the existing education systems across the three countries selected, the major challenges that need to be dealt with as a matter of urgency can be listed as follows:

- Poverty has created disparities in the education system in East Africa which has denied a considerable proportion of students from accessing school. Students are left out of the education system in East Africa since their parents are poor and cannot afford the school fees. Consequently, students affected by poverty are not able engage with environmental education programs taught in the East African schools.
- Students in East Africa may drop out of school due to factors such as physical, sexual, and emotional violence they might experience from their teachers or their peers at school. Due to the dropout from schools, this sector of students does not get an opportunity to engage with the environmental education programs taught in schools which could help them build their capacities to conserve natural resources such as water.
- Lack of adequate infrastructure and learning materials such as textbooks about the environment and water management, and a shortage of permanent classrooms in the East African schools where environmental education programs could be taught.

Usually, states try to achieve the best they can with the resources available. It could happen, however, that there may be cases of badly managed funds or inefficiency or outright corruption which could limit resources from reaching schools. If substantial funding is linked with good management, then high-quality education regarding the major worldwide issues can be achieved. To achieve this, schools must be renovated, facilities must be developed, and grants should be displayed for both research purposes as well as for paying teachers what they deserve and implementing programs to support students that unfortunately had to experience physical, sexual, and emotional violence in their life. Although trying to correct these deficiencies is definitely a major priority, it will take time.

Poverty is a major issue in these countries and governments should think of providing books to low-income families, exposing individuals to free resources, and facilitating the access of students to literacy resources and tutors. In an era where technology is continually developing, the Internet could play a crucial role in facilitating awareness and the accessibility of information, and unfortunately only a minor part of the populations can use the Internet (e.g., 10.34% in 2021 in Uganda) and the performance is also not elevated (Uganda ranks 146th in an international comparison, with the upload rate of 11.99 Mbit/s which corresponds to the 119th place worldwide).

4. Way Forward: Unified Research Ideas

4.1. Need to Design and Deliver Workshops about Water Resource Management in Schools

The public should be sensitised about managing water resource as early as primary level in each country. For example, during the academic year 2005/06, students from the hydro technical engineering study programme at the University of Rijeka, Croatia organised a workshop in one of the pre-school institutions such as Seagull schools [114]. The mission of Seagull schools is to develop early learning by providing quality programmes of high value that provide information to multiple generations in relation to a healthy environment. The purpose is to develop a greater awareness amongst children of the need to sustainably manage water resources for multiple uses, including water supply and sewage and waste-water treatment [114]. In addition, in the academic year 2007/08, the programmes also organised workshops covering issues including the properties of water, the hydrological cycle, and water protection [114]. The workshops enabled students to investigate challenges in water management, and mitigation approaches [114]. For example, the farmer training program which lasted two years (2015–2017) was implemented in Uganda's Busoga region [115]. The program aimed at lifting smallholder dairy farmers in Uganda, Kenya, and Tanzania from poverty through increasing the amount of milk they produce. At the end of the programme, the trained farmers were able to adapt to new technologies, resulting in increased milk production and as well transferring some knowledge to other farmers in the region [115].

Therefore, the Ministry of Water and Environment needs to work in conjunction with the Ministry of Education to conduct workshops about water resource management in both primary and secondary schools, and universities should support the design and preparation of the material to be delivered. Through the Ministry of Education, all schools should be mandated to include the workshops in their school calendar and should be overseen by the Ministry of Water and Environment; all water companies and organisations in charge of managing the environment should be mandated to organise these workshops in schools in the regions that they operate from. Ideally, water companies in each region could send water experts to different schools to organise the workshops and teach students the importance of water, the principles and ethos of water management, and the potential risks of poor water management. Teachers should also be expected to attend these workshops to also acquire relevant knowledge and help empower students for best practices, both at school and when they return to their homes. The Ministry of Water could find it costly to fund the workshops; for example, the Uganda youth sustainable skills and empowerment programme was estimated to cost 18,000 USD for a period of one year, 2012–2013 [116]. Therefore, to reduce on the costs that Ministry of Water may face, the workshops could be organised once or twice a year, dependent on the school capacity. In schools with high numbers of pupils (1000 pupils plus), students could be grouped according to their class levels; for example, all lower primary classes (primary one to primary four could form a group and then all the upper primary classes (primary five to primary seven) could form another one. Then, each group could receive a different workshop every year. Educating children about the importance of managing water at an early age will enable the current and the future generation to understand the need for sustainable water management, and the potential negative impacts of increased water demand from the freshwater resources.

4.2. Performance Benchmarking in the Activities Delivered by Water Companies

Decentralisation is a process which allows devolvement of powers (e.g., decision making, financial control, delivery etc.) to lower levels of a company or organisational hierarchy [117]. A decentralised approach of providing water services should be adopted in East Africa, away from centralised systems of supplying water to serve millions of households [118]. There are various countries around the world, for example Mali and Bolivia [119], which use such devolved water governance, and they could serve as examples for a framework in East Africa [118]. Centralised water distribution systems are often insufficient in serving the needs of poor and remote populations; the needs of infrastructure maintenance or water quality monitoring may be insufficient due to a lack of local training or staff, for example. Often, in developing regions, such centralised distribution systems only operate well for wealthier urban populations, often in relation to political, institutional, and economic advantages or pressures [120]. In contrast, a decentralised system of water supply monitoring and financial management should offer the potential to increase management of water resources at a local level [118]. For instance, every major city in Kenya has its own water distribution and sewerage body [121]. In addition, there has been a devolution of water services in Kenya with organisational control at the county level. Nairobi County, for example, is serviced by the Nairobi city Water and Sewerage Company [122]. Therefore, private companies should be given contracts by the central government to provide water services in various parts of the country, and then central government should benchmark the performance of a specific company with the other companies in the country.

4.3. Developing Regional Water Policies in Common between Bordering Nations

Since Uganda, Kenya, and Tanzania share Lake Victoria, the three countries need to combine the best options to create guidelines that will limit the discharging of untreated water into water resources and the inappropriate disposal of waste in and around the water resources. This will reduce pollutant loads to the lake, which will in turn reduce the high treatment costs faced by the water supply companies. This will require a strong collaboration among the national governments and local authorities to monitor and implement the laws to achieve a common goal. It is necessary for both national and local leaders to inform the public of the dangers of polluting the water resources and what could be the result if an individual or an organisation is found to not be following the guidelines provided. The levels of protection of Lake Victoria against the pollutants, especially in the urban areas of Uganda, Kenya, and Tanzania, will be to a similar standard since all the countries will be following the same policies, implemented at the same level. For example, Southern Africa Development Community (SADC) region has 15 major river basins which are transboundary for two or more countries, highlighting and enabling the need for regional cooperation [123]. The SADC Regional Water Policy and Strategy (RWPS) supports implementation of the SADC Protocol on Shared Watercourses as the primary legal instrument enabling water-related issues to be understood and managed, with cooperation at a regional level [124].

5. Summary and Recommendation

This paper has presented how increasing urbanisation due to rural–urban migration and inadequate awareness of the public on water resources management are impacting the freshwater resource management in urban areas of East Africa. The paper also summarised the different frameworks used to manage water resources in East Africa and the existing education system adopted in Uganda, Kenya, and Tanzania to inform pupils about risks, challenges, and issues with managing existing freshwater resources. Amongst the major factors challenging the water management frameworks and the system used for educating students, there are issues including inadequate funding, increased water demand, inadequate institutional and human capacity, weak implementation of laws and regulations, poverty, and lack of adequate infrastructure and learning materials. The following as-

pects are considered essential to improve the water management system being used in Uganda, Kenya, and Tanzania, and if implemented they would create a stronger and wider awareness within pupils and their families.

- The East African governments should set water prices that will enable long-term vision of a better maintenance of existing water infrastructure. Furthermore, they should encourage a more efficient use of water resources. It is essential to remember water for efficient use in East Africa where household income levels might be extremely low. Therefore, access to funding and support from developed countries such as the United Kingdom and the United States of America; for example, the United Kingdom Minister for Africa, Vicky Ford, announced a 17 million GBP support package to East African countries affected by extreme drought and flooding [125].
- Investing into human resources through increasing the number of recruits in the Ministry of Water and training them on how to monitor freshwater resources.
- Revision of laws, policies, standards, and regulations, and adoption of modern updates; for example, implementing the 6th SDG goal (Clean Water and Sanitation) which targets improving water quality by 2030 through reducing pollution, eliminating dumping, and minimising the discharge of hazardous materials and chemicals into freshwater resources [126]. In addition, it increases the efficiency of water use across all sectors and ensuring sustainable withdrawals and supply of freshwater to reduce the number of people suffering from water scarcity [126].
- Instilling water sustainability practices as a core in poverty reduction strategies and mainstream water management as a developmental resource vital for economic growth.

The authors recommend a survey be conducted in Ugandan, Kenyan, and Tanzanian schools in order to investigate the kind of lessons taught in schools about freshwater resources. This would help to examine how the awareness of managing the freshwater resources in the three East African countries can be increased within schools and propose innovative approaches such as workshops and training courses about freshwater resource management.

A survey should be conducted in water companies and other stakeholders such as NEMA, households, and business sectors to identify the sources of pollutants in urban freshwater resources. This would help in identifying areas that require further improvement, for example, monitoring.

Government institutes, such as the ministries in charge of water resources in Uganda, Kenya, and Tanzania should benefit from the outputs of this study as it would allow them to set up a financial and technical structural framework to address the areas that require support in order to better manage water resources in urban areas. For example, facilitating workshops and training courses of water management in schools will enable the public to understand the importance of managing water resources and highlight what problems they could face if water resources are misused.

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References

1. Chitonge, H. Urbanisation and the water challenge in Africa: Mapping out orders of water scarcity. *Afr. Stud.* **2020**, *79*, 192–211. [CrossRef]
2. *Urbanization in Sub-Saharan Africa*; CSIS: Washington, DC, USA; Available online: https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/180411_Saghir_UrbanizationAfrica_Web.pdf (accessed on 17 November 2022).
3. 8 Million Rural Dwellers Planning to Migrate to Urban Areas—Study. Monitor, 16 December. Available online: https://www.monitor.co.ug/uganda/business/prosper/8-million-rural-dwellers-planning-to-migrate-to-urban-areas-study-3654676#:~:text=KAMPALA.%20One%20in%20five%20Ugandans%20or%2020%20percent,to%20migrate%20to%20urban%20areas%2C%20citing%20varying%20reasons (accessed on 19 November 2021).
4. Kampala Population 2021 and 2022. Available online: https://worldpopulationreview.com/world-cities/kampala-population (accessed on 10 May 2022).
5. Waruru, A.; Onyango, D.; Nyagah, L.; Sila, A.; Waruiru, W.; Sava, S.; Oele, E.; Nyakeriga, E.; Muuo, W.S.; Kiboye, J.; et al. Leading causes of death and high mortality rates in an HIV endemic setting (Kisumu county, Kenya, 2019). *PLoS ONE* **2022**, *17*, e0261162. [CrossRef]
6. Shushu, P.U.; Komkach, C.H.; Dodoo-Arhin, D.; Ferras, D.; Kansal, L.M. Managing non-revenue water in Mwanza, Tanzania: A fast-growing sub-Saharan African city. *Sci. Afr.* **2021**, *12*, e00830. [CrossRef]
7. Sarah, L.S. Explaining improvements and continuing challenges in water access in Dar es Salaam, Tanzania. *Int. J. Water Resour. Dev.* **2018**, *35*, 959–976. [CrossRef]
8. Kampala Water Demand Outstrips Supply—NWSC. Monitor, 12 May. Available online: https://www.monitor.co.ug/uganda/business/markets/kampala-water-demand-outstrips-supply-nwsc-1889426 (accessed on 27 May 2021).
9. Kisumu Surpasses Its Daily Water Requirement by 20 Million Litres. The Standard. Available online: https://www.standardmedia.co.ke/nyanza/article/2001429610/kisumu-surpasses-its-daily-water-requirement-by-20-million-litres (accessed on 10 May 2022).
10. Sichangi, A.; Makokha, G. Monitoring water depth, surface area and volume changes in Lake Victoria: Integrating the bathymetry map and remote sensing data during 1993–2016. *Model. Earth Syst. Environ.* **2017**, *3*, 533–538. [CrossRef]
11. Story Maps (2020) Lake Victoria Rising Water Levels. Available online: https://storymaps.arcgis.com/stories/bd820937c06845faa86f7f8944d56f47 (accessed on 7 May 2022).
12. Building an Institutional Framework (WD). Available online: https://sswm.info/water-nutrient-cycle/water-distribution/softwares/creating-and-enabling-environment/building-an-institutional-framework-(wd)#:~:text=The%20term%20%E2%80%9Cinstitutional%20framework%E2%80%9D%20refers%20to%20a%20set,and%20therefore%20needs%20to%20be%20considered%20in%20particular (accessed on 25 July 2022).
13. Benedict, S.; Hussein, H. An Analysis of Water Awareness Campaign Messaging in the Case of Jordan: Water Conservation for State Security. *Water* **2019**, *11*, 1156. [CrossRef]
14. Uganda—Integrated Water Management and Development Project. Uganda: The World Bank. Available online: https://mwe.go.ug/sites/default/files/IWMDP%20PAD%20IDA.pdf (accessed on 27 September 2022).
15. Strengthening Enforcement Bodies (WS). Available online: https://sswm.info/water-nutrient-cycle/water-sources/softwares/creating-and-enabling-environment/strengthening-enforcement-bodies-(ws) (accessed on 23 October 2022).
16. Developing Human Resources (WS). Available online: https://sswm.info/water-nutrient-cycle/water-sources/softwares/creating-and-enabling-environment/developing-human-resources-(ws) (accessed on 23 October 2022).
17. Coban, U.G.; Akpinar, E.; Kucukcankurtaran, E.; Yildiz, E.; Ergin, O. Elementary school students' water awareness. *Int. Res. Geogr. Environ. Educ.* **2011**, *20*, 65–83. [CrossRef]
18. The Need for Environmental Education in East Africa. Available online: https://www.keainc.org/keas-commitment-to-environmental-education-in-east-africa.html (accessed on 25 January 2022).
19. Srbinovski, M.; Erdogan, M.; Ismaili, M. Environmental literacy in the science education curriculum in Macedonia and Turkey. *Procedia-Soc. Behav. Sci.* **2010**, *2*, 4528–4532. [CrossRef]
20. Johnson-Pynn, J.S.; Johnson, R.L. Successes and Challenges in East African Conservation Education. *J. Environ. Educ.* **2010**, *36*, 25–39. [CrossRef]
21. Implementation of Formal Environmental Education in Primary Schools near the Rwenzori Mountains National Park, Uganda. Available online: https://www.researchgate.net/publication/304676635_Implementation_of_formal_environmental_education_in_primary_schools_near_the_Rwenzori_Mountains_National_Park_Uganda (accessed on 18 January 2022).
22. Kimiti, R.P.; Kipkoech, L.C. The Need to Integrate Themes of Environmental education in school curriculum in Kenya. *IJARPED* **2013**, *2*, 51–57.
23. School of Forestry, Environmental & Geographical Sciences. Available online: http://caes.mak.ac.ug/schools-3/forestry-environmental-geographical-sciences-2/ (accessed on 8 August 2022).

24. Mucunguzi, P. A review of Non-formal environmental education in Uganda. *Environ. Educ. Res.* **1995**, *1*, 337–344. [CrossRef]
25. Sasaoka, Y.; Nishimura, M. Does universal primary education policy weaken decentralisation? Participation and accountability frameworks in East Africa. *Compare* **2010**, *40*, 79–95. [CrossRef]
26. International Schools in Uganda. Available online: https://www.internationalschoolsearch.com/international-schools-in-uganda (accessed on 27 September 2022).
27. Jones, S.; Schipper, Y.; Ruto, S.; Rajani, R. Can your child read and count? Measuring learning outcomes in East Africa. *J. Afr. Econ.* **2014**, *23*, 643–672. [CrossRef]
28. Activities of the Unesco-UNEP International Environmental Education Programme (1975–1983). Available online: https://unesdoc.unesco.org/ark:/48223/pf0000059759 (accessed on 28 September 2022).
29. Environment & Natural Resources. Available online: https://www.eac.int/press-releases/144-environment-natural-resources (accessed on 12 May 2022).
30. Mutiga, K.S.; Mushogi, A.A.; Kangethe, E. Enhancing Food Safety through Adoption of Long-Term Technical Advisory, Financial, and Storage Support Services in Maize Growing Areas of East Africa. *Sustainability* **2019**, *11*, 2827. [CrossRef]
31. Gender Sensitive Educational Policy and Practice: A Uganda Case Study; International Bureau of Education: Kampala, Uganda. Available online: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.474.3231&rep=rep1&type=pdf (accessed on 12 January 2022).
32. Songa, P.; Rumohr, J.; Musota, R. Policy and institutional framework considerations in the implementation of catchment-based water resources management in Uganda: Highlights from the River Rwizi catchment. *WIT Trans. Ecol. Environ.* **2015**, *196*, 15–26. [CrossRef]
33. Uganda Institution Framework for Water Provision. Available online: https://www.google.com.hk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjq6MHTvKmAAxWPc94KHULYAVUQFnoECAwQAQ&url=https%3A%2F%2Fwww.aquaya.org%2Fwp-content%2Fuploads%2F2020_Ugandan-Institutional-Framework-for-Water-Provision_EN.pdf&usg=AOvVaw1VYAiNd3OFYjXONROS6skO&opi=89978449 (accessed on 26 October 2021).
34. Mabasi, T. Review of the Policy, Legal and Institutional Framework for Water Management in Uganda. 2010. Available online: https://ugandanwaterproject.com/?gclid=EAIaIQobChMI3Yiz-rypgAMVGT5gCh28PQhDEAAYASAAEgKo6_D_BwE (accessed on 26 October 2021).
35. Comparative Assessment of Sanitation and Hygiene Policies and Institutional Frameworks in Rwanda, Uganda and Tanzania. Stockholm Environment Institute. Available online: https://mediamanager.sei.org/documents/Publications/SEI-2016-WorkingPaper-Ekane-Sanitation.pdf (accessed on 27 October 2021).
36. Environment and Social Safeguards Policy. Kampala. Available online: https://www.mwe.go.ug/sites/default/files/library/MWE-ESS-Policy.pdf#:~:text=The%20Ministry%20of%20Water%20and%20Environment%20%28MWE%29%20prepared,safeguards%20should%20always%20be%20incorporated%20in%20their%20programmes (accessed on 6 October 2021).
37. Directorate of Water Development. Available online: https://mwe.go.ug/library/directorate-water-development (accessed on 28 October 2021).
38. Directorate of Water Resources Management. Available online: https://mwe.go.ug/directorates/directorate-water-resources-management (accessed on 28 October 2021).
39. Nsubuga, F.; Namutebi, E.; Ssenfuma, M. Water Resources of Uganda: An Assessment and Review. *JWRP* **2014**, *6*, 1297–1315. [CrossRef]
40. Need for Reform of Water Resources Management in Uganda. Available online: https://wedc-knowledge.lboro.ac.uk/resources/conference/29/Tindimugaya.pdf#:~:text=Water%20of%20adequate%20quantity%20and%20good%20quality%20is,its%20equitable%20share%20of%20this%20resourcesfor%20socio-economic%20development (accessed on 9 February 2022).
41. Streamlining Water Governance in Kenya for Sustainable Development. Available online: http://kmco.co.ke/wp-content/uploads/2018/08/Streamlining-Water-Governance-in-Kenya-17TH-FEBRUARY-2017.pdf (accessed on 7 February 2022).
42. K'Akumu, A.O. Toward effective governance of water services in Kenya. *Water Policy* **2007**, *9*, 529–543. [CrossRef]
43. The National Water Resources Management Strategy (NWRMS). Available online: http://waterfund.go.ke/watersource/Downloads/006.%20Water%20Resources%20Management%20Strategy.pdf (accessed on 3 October 2021).
44. Ndirangu, N.; Ng'ang'a, J.; Chege, A.; Blois, R.J.; Mels, A. Local solutions in Non-Revenue Water management through North-South Water Operator Partnerships: The case of Nakuru. *Water Policy* **2013**, *15*, 137–164. [CrossRef]
45. Chepyegon, C.; Kamiya, D. Challenges Faced by the Kenya Water Sector Management in Improving Water Supply Coverage. *J. Water Resour. Prot.* **2018**, *10*, 85–105. [CrossRef]
46. Kenya Water Institute Strategic Plan 2021–2026. Kenya. Available online: https://kewi.or.ke/wp-content/uploads/2021/11/KEWI-Strategic-Plan-2021-2026.pdf (accessed on 10 February 2022).
47. Improve Governance and Investment to Tackle Water Crisis. STAR, 4 September. Available online: https://www.the-star.co.ke/business/2022-09-04-improve-governance-and-investment-to-tackle-water-crisis/ (accessed on 28 September 2022).
48. Impact a Performance Review of Kenya's Water Services Sector—2010/11. WSRB: Nairobi, Kenya. Available online: https://wasreb.go.ke/downloads/WASREB_Impact_Report5.pdf (accessed on 8 February 2022).
49. MWI. *National Water Sector Development Strategy*; MWI: Arusha Region, Tanzania, 2008.
50. Sokile, S.C.; Kashaigili, J.J.; Kadigi, M.J.R. Towards an integrated water resource management in Tanzania: The role of appropriate institutional framework in Rufiji Basin. *Phys. Chem. Earth Parts A/B/C* **2003**, *28*, 1015–1023. [CrossRef]

51. National Environment Management Council. Available online: https://eia.nemc.or.tz/#:~:text=National%20Environment%20Management%20Council%20%28NEMC%29%20-%20is%20a,monitor%20environmental%20impact%20statements%2C%20research%20and%20awareness%20raising (accessed on 9 February 2022).
52. Mahoo, H.; Simukanga, L.; Kashaga, R.A.L. Water resources management in Tanzania: Identifying research gaps and needs and recommendations for a research agenda. *Tanzan. J. Agric. Sci.* **2015**, *14*, 57–77.
53. Rombo, O.D.; Lutomia, N.A.; Malinga, T. Water and Sanitation in East Africa: Perspectives from Africana Feminism. *J. Pan Afr. Stud.* **2017**, *10*, 190–203.
54. High Costs of Water Blamed on Pollution. Available online: https://ugandaradionetwork.net/story/high-costs-of-water-blamed-on-pollution- (accessed on 19 February 2022).
55. Nansubuga, J.; Smith, H.; Jeffrey, P. A de jure study of social accountability for water and sanitation services in Uganda. *J. Water Sanit. Hyg. Dev.* **2022**, *12*, 463–474. [CrossRef]
56. Mbaka, M.R.; Mugambi, F. Factors affecting successful strategy implementation in the Water Sector in Kenya. *J. Bus. Manag.* **2014**, *16*, 61–68. [CrossRef]
57. Mulwa, F.; Li, Z.; Fangninou, F.F. Water Scarcity in Kenya: Current Status, Challenges and Future Solutions. *Open Access Libr. J.* **2021**, *8*, 1–15. [CrossRef]
58. Directorate of Environment Affairs. Available online: https://mwe.go.ug/library/directorate-environment-affairs (accessed on 28 September 2022).
59. Magawa, Y. Legal, regulatory, and institutional framework of water and sanitation services in the Eastern and Southern Africa Region. *Oxf. Res. Encycl. Glob. Public Health* **2021**. [CrossRef]
60. Nathalie, R.; Mkenda, A.; Bjornlund, H. Addressing water security through catchment water stewardship partnerships: Experiences from the Pangani Basin, Tanzania. *Water Int.* **2022**, *47*, 540–564. [CrossRef]
61. UNESCO. *Water Resources Management: Planning Meeting of the National Committee for the UNESCO Intergovernmental Hydrological Programme (IHP)*; UNESCO: Dar es Salaam, Tanzania, 2010.
62. Komba, E.F.; Fabian, C.; Elimbinzi, E.; Shao, N.G. Efficiency of common filters for water treatment in Tanzania. *Bull. Natl. Res. Cent.* **2022**, *46*, 208. [CrossRef]
63. NWSC Issues Amnesty to Water Thieves. Available online: https://www.independent.co.ug/nwsc-issues-amnesty-to-water-thieves/ (accessed on 13 January 2022).
64. Water, Sanitation and Hygiene. Available online: https://www.unicef.org/kenya/water-sanitation-and-hygiene (accessed on 28 September 2022).
65. Education in Uganda. Available online: https://nuhafoundation.org/crps/education-in-uganda/#.YfqFtJrP3IW (accessed on 2 February 2022).
66. Atuhaire, S.; Zhicheng, H. Influence of Teacher Quality on Literacy Achievement in Primary Schools in Uganda: A Cross-sectional Study of Gomba District. *IJSBAR* **2018**, *39*, 148–161.
67. Hardman, F.; Ackers, J.; Abrishamian, N.; O'Sullivan, M. Developing a systemic approach to teacher education in sub-Saharan Africa: Emerging lessons from Kenya, Tanzania and Uganda. *Comp. J. Comp. Int. Educ.* **2011**, *41*, 669–683. [CrossRef]
68. Improving Learning in Uganda, Volume 3: School-Based Management: Policy and Functionality. World Bank Publications. Available online: https://ebookcentral.proquest.com/lib/coventry/reader.action?docID=1152874&query= (accessed on 2 June 2021).
69. National Population and Housing Census 2014. Kampala. Available online: https://uganda.unfpa.org/sites/default/files/pub-pdf/CENSUS%202014%20Final%20Results_0.pdf (accessed on 4 July 2021).
70. A Review of Uganda's Universal Secondary Education Public Private Partnership Programme. Uganda: Epg. Available online: https://epg.org.uk/wp-content/uploads/2019/05/Uganda-PPP-Review_2018_Final.pdf (accessed on 3 June 2021).
71. Lincove, A.J. The influence of price on school enrollment under Uganda's policy of free primary education. *Econ. Educ. Rev.* **2012**, *31*, 799–811. [CrossRef]
72. 23 Teacher Training Colleges to Close as Gov't Phases out Grade III, V Qualifications. Available online: https://observer.ug/education/71628-23-teacher-training-colleges-to-close-as-gov-t-phases-out-grade-iii-v-qualifications (accessed on 5 November 2021).
73. Okaka, W. An Environmental Education Program: Uganda Polytechnic Kyambogo. *Appl. Environ. Educ. Commun. Int. J.* **2010**, *1*, 45–52. [CrossRef]
74. Education System in Uganda. Available online: https://www.ugandainvest.go.ug/uia/images/Download_Center/SECTOR_PROFILE/Education_Sector_profile.pdf (accessed on 20 October 2021).
75. Higher Education: From One to 53 Universities, Vision Group. Available online: https://visiongroup.co.ug/supplements/2020/01/23/higher-education-from-one-to-53-universities/ (accessed on 20 October 2021).
76. Kaviti, L. The new curriculum of education in Kenya: A linguistic and education paradigm shift. *IJNREL* **2018**, *5*, 15–27.
77. New Education System in Kenya: An Excerpt from Basic Education Curriculum Framework. Available online: https://schoolsnetkenya.com/downloads/new-education-system-in-kenya-an-excerpt-from-basic-education-curriculum-framework.pdf (accessed on 3 November 2021).
78. Connell, S. Empirical-Analytical Methodological Research in Environmental Education: Response to a negative trend in methodological and ideological discussions. *Environ. Educ. Res.* **1997**, *3*, 117–132. [CrossRef]

79. Berman, N. Environmental Education Catalysed by Tourism Ecoliteracy Initiative on the Coast of Kenya. *Sustainability* **2021**, *13*, 8501. [CrossRef]
80. Álvarez-García, O.; Sureda-Negre, J.; Comas-Forgas, R. Environmental Education in Pre-Service Teacher Training: A Literature Review of Existing Evidence. *J. Teach. Educ. Sustain.* **2015**, *17*, 72–85. [CrossRef]
81. George, N.; Riungu, J.N.; Mbugua, K.Z.; Bundi, T.K. Factors Contributing to Poor Performance in Kenya Certificate of Primary Education in Public Day Primary Schools in Mwimbi Division, Maara District, Kenya. *IJHSS* **2012**, *2*. Available online: https://www.ijhssnet.com/journals/Vol_2_No_5_March_2012/14.pdf (accessed on 3 November 2021).
82. Jagero, N. How performance of students in Kenya certificate of primary education can predict their performance in Kenya certificate of secondary education. *Educ. Res. Int.* **2013**, *1*, 11–19.
83. KNEC Reveals Number of Registered Candidates for 2021 KCPE and KCSE Examinations. Jambonews. Available online: https://www.jambonews.co.ke/knec-reveals-number-of-registered-candidates-for-2021-kcpe-and-kcse-examinations/ (accessed on 3 November 2021).
84. Kapilima, C.V. Participatory challenges faced the formulation process of Tanzania's education and training policy (2014). *IJRRSSH* **2020**, *7*, 23–29.
85. Mashala, L.Y. The Impact of the Implementation of Free Education Policy on Secondary Education in Tanzania. *Int. J. Acad. Multidiscip. Res.* **2019**, *3*, 6–14.
86. Ndeskoi, T. The Status of Tanzania's Primary School Curriculum on Environmental Education from 1980s–2010s. *Pap. Educ. Dev.* **2016**, *36*. Available online: http://www.journals.udsm.ac.tz/index.php/ped/article/view/2523 (accessed on 3 November 2021).
87. Higgins, S.; Baumfield, V.; Lin, M.; Moseley, D.; Butterworth, M.; Downey, G.; Gregson, M.; Oberski, I.; Rockett, M.; Thacker, D. *Thinking Skills Approaches to Effective Teaching and Learning: What Is the Evidence for Impact on Learners*; EPPI-Centre, Social Science Research Unit, Institute of Education, University of London: London, UK, 2004; pp. 1–100.
88. Mtaita, U. Participation in school-based environmental education in Tanzania. In *Environmental Education in Context*; Brill: Leiden, The Netherlands, 2009; pp. 169–177. [CrossRef]
89. Kimaryo, L. Integrating Environmental Education in Primary School Education in Tanzania: Teachers' Perceptions and Teaching Practices. 2011. Available online: https://www.doria.fi/handle/10024/67481 (accessed on 3 February 2022).
90. Kongela, M.S. Sustainability potential awareness among built environment stakeholders: Experience from Tanzania. *Int. J. Build. Pathol. Adapt.* **2023**, *41*, 301–319. [CrossRef]
91. Providing Comprehensive Educational Support in Africa. Available online: https://www.developafrica.org/education-Africa (accessed on 3 February 2022).
92. Tilak, B.G.J. Education and Poverty. *JHD* **2010**, *3*, 191–207. [CrossRef]
93. Penny, A.; Ward, M.; Read, T.; Bines, H. Education sector reform: The Ugandan experience. *Int. J. Educ. Dev.* **2008**, *28*, 268–285. [CrossRef]
94. Altinyelken, H. Curriculum change in Uganda: Teacher perspectives on the new thematic curriculum. *Int. J. Educ. Dev.* **2010**, *30*, 151–161. [CrossRef]
95. Basaza, N.G.; Milman, B.N.; Wright, R.C. The Challenges of Implementing Distance Education in Uganda: A Case Study. *Int. Rev. Res. Open Distrib. Learn.* **2010**, *11*, 85–91. [CrossRef]
96. Kagoda, M.A. *Access to Quality Primary Education in Rural Societies of Uganda*; UNCIEF Publication: New York, NY, USA, 2012.
97. Barus, J.J.; Marigat, K.S.; Njathi, N.S. Enhancing security control in sustaining thegains made in addressing kcpe and kcse examination irregularities in Kenya. *J. Educ. Pract.* **2017**, *2*, 28–37. [CrossRef]
98. Cheruto, L.K.; Kyalo, W.B. Management challenges facing implementation of free primary education in Kenya: A case of Keiyo District. *J. Educ. Adm. Policy Stud.* **2010**, *2*, 71–76.
99. Ireri, R.B.; King'endo, M.; Thuranira, S. Policy strategies for effective implementation of inclusive education in Kenya. *Int. J. Educ. Adm. Policy Stud.* **2020**, *12*, 28–42. [CrossRef]
100. Lindsay, G. Inclusive education: A critical perspective. *BJSE* **2003**, *30*, 3–12. [CrossRef]
101. Tibategeza, R.E. The prospects of Kiswahili as a medium of instruction in the Tanzanian Education and Training Policy. *J. Lang. Educ.* **2018**, *4*, 88–98. [CrossRef]
102. Mghasse, N.E.; William, F. Practices and Challenges in the Provision of Pre-Primary Education in Tanzania. *Afr. Res. Rev.* **2016**, *10*, 1–6. [CrossRef]
103. Nankinga, O.; Kakuba, C.; Golaz, V.; Mushomi, J. Out-of-School Children in Uganda over the Past Decades: A Reflection on Available National Demographic Data and Indicators. Uganda and It's Demography. Available online: https://www.researchgate.net/publication/340861816_Out-of-school_children_in_Uganda_over_the_past_decades_A_reflection_on_available_national_demographic_data_and_indicators (accessed on 26 October 2021).
104. School Fees and Poverty—Barriers to Education in Kenya. Available online: https://nehemia-team.org/en/kenya-en/school-fees-and-poverty-barriers-to-education-in-kenya/ (accessed on 17 February 2022).
105. Shahidul, S.M.; Karim, H.M.Z.A. Factors contributing to school dropout among the girls: A review of literature. *Eur. J. Res. Reflect. Educ. Sci.* **2015**, *3*, 25–36.
106. Otim, J. Early Marriages in Uganda: A Comparative Assessment Of Determinants Across Regions. *RS* **2019**, 1–7. [CrossRef]
107. UNICEF Statement at the National Symposium on Violence against Children in Schools. Available online: https://www.unicef.org/uganda/press-releases/unicef-statement-national-symposium-violence-against-children-schools (accessed on 13 July 2021).

108. Morara, N.A.; Chemwei, B. Drop out among Pupils in Rural Primary Schools in Kenya: TheCase of Nandi North District, Kenya. *JEP* **2013**, *4*, 1–12.
109. Gender Inequality in Education Is Still an Issue in Kenya and South Africa. Available online: https://www.globalcitizen.org/en/content/gender-inequality-education-south-africa-kenya/ (accessed on 21 February 2022).
110. 3 Faith Organizations Helping HIV Orphans in Kenya. Available online: https://borgenproject.org/hiv-orphans-in-kenya/ (accessed on 27 September 2021).
111. Education in a Global Era: Challenges to Equity, Opportunity for Diversity. Available online: https://www.tanzania.go.tz/egov_uploads/documents/EDUCATION_IN_GLOBAL_ERA_sw.pdf#:~:text=The%20economic%20and%20social%20challenges%20facing%20our%20nation,-%20largely%20frame%20the%20education%20challenge%20within%20Tanzania (accessed on 17 February 2022).
112. The Current State of HIV/AIDS in Tanzania. Available online: https://volunteer-africa-blog.org/2021/02/18/the-current-state-of-hiv-aids-in-tanzania/ (accessed on 27 September 2022).
113. Violence against Children in Tanzania—Does It Affect Child Education? Available online: https://www.dmeforpeace.org/resource/violence-against-children-in-tanzania-does-it-affect-child-education/ (accessed on 17 February 2022).
114. The Role of Higher Education in Developing Awareness about Water Management. Available online: https://www.researchgate.net/profile/Barbara-Karleusa-2/publication/237759950_The_Role_of_Higher_Education_in_Developing_Awareness_about_Water_Management/links/0deec5293c56a4fe3b000000/The-Role-of-Higher-Education-in-Developing-Awareness-about-Water-Management.pdf (accessed on 20 January 2022).
115. The Impact of Farmer-to-Farmer Training on Agricultural Productivity in Uganda. Available online: https://www.povertyactionlab.org/evaluation/impact-farmer-farmer-training-agricultural-productivity-uganda#:~:text=The%20farmer%20training%20program%20was%20implemented%20in%20Uganda%E2%80%99s,engage%20in%20dairy%20farming%20as%20a%20side%20activity (accessed on 28 September 2022).
116. Uganda Youth Skills Training Project. Available online: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.globalhand.org%2Fsystem%2Fassets%2Fdfcd26c0f4d960cae482e081d20c8df75794486f%2Foriginal%2FProposal%2520to%2520home%2520Global.doc%3F1340964767&wdOrigin=BROWSELINK (accessed on 29 September 2022).
117. Laryea-Adjei, G.; Van Dijk, M. Changing water governance in Ghana through decentralization. *Int. J. Water* **2012**, *6*, 215–231. [CrossRef]
118. Decentralised Supply. SSWM. Available online: https://sswm.info/water-nutrient-cycle/water-distribution/hardwares/water-network-distribution/decentralised-supply (accessed on 3 February 2022).
119. The Benefits of Combining Centralised and Decentralised Drinking Water Systems. Available online: https://bosaq.com/the-benefits-of-combining-centralized-decentralized-drinking-water-systems/#:~:text=Communities%20in%20several%20developing%20countries%20have%20made%20successful,alternative.%20Advantages%20of%20using%20a%20decentralized%20water%20system (accessed on 21 October 2022).
120. Varbanets, P.M.; Zurbrügg, C.; Swartz, C.; Pronk, W. Decentralized systems for potable water and the potential of membrane technology. *Water Res.* **2009**, *43*, 245–265. [CrossRef]
121. List of Water and Sewerage Companies in Kenya. Available online: https://victormatara.com/list-of-water-and-sewerage-companies-in-kenya/#:~:text=List%20Of%20Water%20and%20Sewerage%20Companies%20In%20Kenya,%E2%80%8B%E2%80%8B%20Taita%20Taveta%20%2023%20more%20rows%20 (accessed on 5 February 2022).
122. Mwihaki, J.N. Decentralisation as a tool in improving water governance in Kenya. *Water Policy* **2018**, *20*, 252–265. [CrossRef]
123. Regional Water Policy. Available online: https://www.sadc.int/files/1913/5292/8376/Regional_Water_Policy.pdf (accessed on 5 February 2022).
124. Msangi, P.J. Managing Water Scarcity in Southern Africa: Policy and Strategies. In *Combating Water Scarcity in Southern Africa. Case Studies from Namibia*; Springer: Berlin/Heidelberg, Germany, 2013.
125. New UK Support to Tackle Impact of Droughts and Flooding in East Africa. Available online: https://www.gov.uk/government/news/new-uk-support-to-tackle-impact-of-droughts-and-flooding-in-east-africa (accessed on 19 October 2022).
126. Clean Water and Sanitation. Available online: https://unric.org/en/sdg-6/ (accessed on 20 October 2022).