United Republic of Tanzania
Ministry of Education, Science and Technology

A costed plan of action and investment case for implementation of school water, sanitation and hygiene (SWASH) services

MAINLAND TANZANIA

March 2022

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Foreword

Access to adequate safe water, proper sanitation, and the practice of appropriate hygiene in schools can make an enormous difference in the lives of schoolchildren by making the learning environment pleasant and healthy, boosting educational achievement, and promoting gender equity. A clean, safe, secure, and enabling environment in which pupils can learn and perform to their full potential is a vital part in any child's life and a basis for development. The impact of inadequate WASH facilities in schools is pronounced and can fundamentally undermine the ability of millions of children to gain a quality education. There is growing evidence that inadequate WASH facilities limit school enrolment and attendance, lead to early dropout, and affect performance and completion of education.

In recent years, Tanzania has made substantial progress in expanding access to education after the introduction of the Fee-Free Basic Education in 2015, which had a positive effect on increasing the number of pupils enrolled in schools across the country. Despite these gains, the increased number of pupils enrolled in schools means that the infrastructure in existing schools is overwhelmed and is supporting pupils that exceed the initial design loads. This means that even where facilities had been provided (including WASH facilities), they are now insufficient to meet the needs of all pupils enrolled. Added to this is the fact that high costs involved in the construction of WASH facilities in schools have been a major impediment for accelerating scale-up, given the enormous gap between supply and demand.

The 2018 data from the National Bureau of Statistics has shed some light on the state of WASH services in schools in Tanzania. The assessment has revealed some good progress in providing WASH services in schools, though with some notable gaps and challenges that need to be addressed. The findings indicated inadequate coverage in terms of quality and access to WASH services. Only 18 per cent of schools had access to basic hygiene services, 55 per cent to basic drinking water services and 30 per cent to basic sanitation. The data further indicate that, while handwashing facilities were present in more than 6 out of 10 schools (63.8 per cent), only 32.1 per cent of schools had water and soap for handwashing, 50.3 per cent had water only, 1.2 per cent had soap only and 16.4 per cent had neither water nor soap. Inadequate access to water and a lack of soap in schools limit children's ability to regularly practice handwashing with soap at critical times. In addition, 67 per cent of schools in Tanzania have menstrual health and hygiene services, though only 17 per cent had changing rooms in girl's toilet blocks with basic amenities (water, soap, and emergency supplies).

To address the established gaps, the Government called for the development of a national costed plan of action and investment case, which was developed in consultation with multiple stakeholders facilitated by the Oxford Policy Management (OPM). It serves two equally important purposes: to provide the government and sector partners with an evidence-based information about the economic case for increased investment in School WASH (SWASH) services; and to guide future decision making on SWASH investments and implementation at scale.

The economic analysis has helped to inform the cost of action and the cost of inaction on SWASH. It has further estimated SWASH needs and financing requirements across all rural and urban schools in Tanzania elaborating on three different packages to consider on decisions for investing in SWASH infrastructure (**the minimum package, intermediate package,** and **standard package**). This provides

the government and counterparts a broader perspective for making informed decisions on selecting the appropriate and affordable package to implement in five years.

I would like to take this opportunity to encourage policymakers, planners and other stakeholders in WASH, education, and health sectors to use this costed plan and investment case to mobilize increased funding for enhancing SWASH services across Tanzania. The analyses in this plan illustrate that increased investment in SWASH helps ensure that children enjoy a safe learning environment, which encourages greater school attendance and better learning, and which, in turn, result in significantly better educational and economic outcomes benefiting the country.

Prof. Carolyne I. Nombo
Permanent Secretary
Ministry of Education, Science and Technology

Acknowledgement

The development of a costed plan and investment case for School Water, Sanitation, and Hygiene (SWASH) was prepared through a series of consultations processes that brought together key stakeholders in education, health, and WASH sectors. The main objective is to provide the Government of Tanzania and their development partners with an evidence-based assessment of the economic case for increased investment in SWASH services to help guide future decision-making on equitable resource allocation. This will ensure inclusive and quality education for all, promote lifelong learning and availability and sustainable management of WASH services for all schoolchildren.

The development of the costed plan and investment case for SWASH was facilitated by coordinated by a team of experts from Oxford Policy Management (OPM). Their technical capabilities and analytical skills successfully enabled putting together this important work.

I would like to acknowledge the contributions from the task force team comprising key staff from the Ministry of Education, Science, and Technology (MoEST) and President's Office Regional Administration and Local Government (PO-RALG) for their invaluable efforts and dedication to ensure that this plan was timely developed to address the gaps that were established from the National school WASH assessment conducted in 2018.

I would further like to take this opportunity to thank all partners in this exercise: The National Bureau of Statistics (NBS), whose data and SWASH 2018 report were very useful for this exercise; the Education Management Information System (EMIS) staff from MoEST and Basic Education Management Information System (BEMIS) from PO-RALG for ensuring that key data were timely available to inform the analysis. Staff from the Ministry of Health (MoH) and Ministry of Water for their invaluable inputs in the execution of this document through focused group discussions.

Special thanks are due in particular to the United Nations Children's Fund (UNICEF) for financing this important undertaking, which made the costed plan and investment case for SWASH available that will help decision making. This will further ensure that children in schools learn in a healthy environment through access to improved water, sanitation, and hygiene services.

It is expected that all key players in education and WASH sectors will find this document useful in mobilizing and addressing issues related to financial resources required to close the existing gaps.

Dr. Lyabwene M. Mtahabwa
Commissioner for Education
Ministry of Education, Science and Technology

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List of abbreviations

CwD	Children with disability
EMIS	Education Management Information System
EPforR	Education Programme for Results
ESDP	Education Sector Development Plan
GoT	Government of Tanzania
GoZ	Revolutionary Government of Zanzibar
IC	Investment case
LGA	Local Government Authority
MHH	Menstrual Health and Hygiene
MoEST	Ministry of Education, Science and Technology
MoEVT	Ministry of Education and Vocational Training
MoH	Ministry of Health
MoHCDEC	Ministry of Health, Community Development, Gender, Elderly and Children
MoW	Ministry of Water
OCGS	Office of the Chief Government Statistician
OPM	Oxford Policy Management
PO-RALG	President's Office Regional Administration and Local Government
NBS	National Bureau of Statistics
NCP	National Costed Plan
PO-RALGSD	President's Office Regional Administration, Local Government and Special Departments
SCMS	School Construction and Maintenance Strategy
SEN	Special Educational Needs
TA	Technical Assistance
SWASH	School Water, Sanitation and Hygiene

Executive summary

Introduction

Globally, at least **800 million children** lack access to basic water, sanitation or hygiene services at school. In sub-Saharan Africa specifically, **over half of all children** do not have access to adequate School Water, Sanitation and Hygiene (SWASH) services.

Limited access to adequate SWASH services is known to increase **illness** and **absenteeism** among school children. Lack of access to sanitation and hygiene facilities **disproportionately affects adolescent girls**, particularly those that are menstruating.

A recent analysis by the National Bureau of Statistics (NBS) with UNICEF support indicates that SWASH access in Mainland Tanzania is a **major challenge**. Nationally, only 55 per cent of schools provide pupils with a 'basic' water service and only 30 per cent of schools provide pupils with 'basic' sanitation services, with most of the unserved living in rural areas and studying in government primary schools.

Studies suggest that **inadequate access to SWASH** is contributing to **higher pupil absenteeism** and high dropout rates. In Tanzania, dropout rates continue to be a challenge at all levels, but particularly at the end of primary school, such that 3 out of every 10 children that complete primary education are not transitioning to secondary schools.

Through an econometric analysis of secondary data, this study seeks to provide the Government of Tanzania and their partners with a robust evidence-based analysis exploring the important role SWASH can play in improving effective learning and in delivering returns to people as well as the wider economy.

Methods

The study findings are founded on two types of financial analysis (termed the cost of action and cost of inaction analyses), which have been used in conjunction with one another to develop a **five-year national costed plan** (2021–2026) and **investment case** for SWASH.

The cost of action analysis builds on the existing secondary data, namely the Ministry of Education, Science and Technology Costed Action Plan (2019–2024) and the Education Management Information System (EMIS) 2020 database, to estimate SWASH needs and financing requirements across **all the rural and urban schools in Mainland Tanzania.**

SWASH investment requirements have been modelled for three different packages of WASH services – the **standard package, intermediate package and minimum package** – on the basis that all schools in Mainland Tanzania would at a minimum have access infrastructure and facilities outlined in these packages by the end of the costed plan, that is, by the end of 2026.

The cost of inaction analysis combines data from the Tanzania Household Budget Survey (2018) with 2020 Education Management Information System data to estimate the impact of WASH infrastructure spending on effective years of pupil education and in turn to estimate the impact of improved education on lifetime earnings.

As a final stage, the cost of action and inaction are calculated and compared for all three SWASH packages in order to derive an overall return on investment for each package.

It is important to note that this study is entirely desk-based and relies exclusively on the analysis of secondary data drawn from national surveys and existing sector documentation. This data is used to assess complex and multifaceted relationships between SWASH access, effective schooling and lifetime earnings and is therefore subject to numerous confounding factors. The findings of this study should therefore be treated as indicative and illustrative in nature, indicating the sign of the relation (positive/negative) and providing orders of magnitude rather than exact estimates.

Findings: cost of action

The costs required to achieve full SWASH infrastructure coverage by 2026 are substantial and will require dedicated public finance support, irrespective of the infrastructure package being considered. Nevertheless, it is also important to emphasize that the cost differences between packages are also significant, as are the expected level of service these packages of infrastructure would provide. As such, any eventual investment decision-making will need to reckon with trade-offs between affordability and quality of access.

The standard package of SWASH infrastructure is the costliest to implement. It would require an estimated investment of between TSh 330 billion and 370 billion per year over the next five years to achieve full coverage by 2026. This compares with an investment between TSh 180 billion and TSh 220 billion per year to achieve full coverage of the intermediate package and between TSh 66 billion and TSh 78 billion for the minimum package.

Generally speaking, the primary driver of current SWASH infrastructure costs is the provision of toilets for pupils and for teachers. In part, this is driven by prevailing low levels of sanitation coverage across most schools in Mainland Tanzania but also the close links between the number of pupils and required toilets.

SWASH investment needs vary substantially between regions, reflecting both different levels of SWASH coverage and population size.

Findings: cost of inaction

An economic analysis of the EMIS and HBS data indicates that access to SWASH infrastructure plays a significant role in keeping children in school for a longer period. **That is, on average access to SWASH is shown to significantly impact the effective number of years that a child stays in school.**

The size of this effect is driven by the package of SWASH infrastructure that is accessed. For example, it is estimated that if a standard package is implemented in all the schools, rural school children **might stay in school for 1.1 years** longer whereas urban children might stay in **school for 1.4 years longer**. These impacts decrease, but remain significant, for the other packages of SWASH infrastructure modelled.

When aggregated across all school children in Mainland Tanzania, this analysis indicates that access to SWASH would lead to tens of millions of additional years of schooling for the Tanzanian children.

The analysis clearly shows that amount of time a child stays in **school has a significant impact on their future earning potential.** At the margin, an additional year of schooling at secondary school has a bigger impact on earnings than an additional year of schooling at primary school, but both remain important drivers of future earnings.

As a result of the relationship between SWASH access and effective schooling, this analysis suggests that, on average, access to the standard package of SWASH infrastructure could lead to a **2.5 per cent increase in average lifetime earnings in rural areas and over a 4 per cent increase in urban areas.**

Conclusion: The economics of return on investments in SWASH

There is a compelling economic case to prioritize investments in SWASH infrastructure and services. This analysis shows that under all scenarios, providing universal access to SWASH services provides a staggeringly high return on investment over the medium and long term. Specifically, across all investment scenarios – including the most high-cost approach – the future economic benefits to the economy are well over **100-fold higher than the initial investment requirements.**

The key drivers of this extremely high returns on investment (RoI) include (i) the **strong quantitative relationship** this study has established between SWASH provision, years of schooling and future earnings, (ii) the fact that under the full-coverage investment scenario these benefits are realized across **all school-aged children** in Mainland Tanzania and (iii) these benefits continue to be realized throughout the child's entire working life.

Improving the **effective years of education for urban girls is a critical driver** of the economic returns on SWASH investments.

As all SWASH infrastructure packages show a positive return on investment, the Government of Tanzania and their partners have an important decision to make about which package of services is appropriate and affordable. Overall, this study recommends that **full SWASH coverage** should become a key investment priority for the

Government of Tanzania and this should be formally adopted as a medium-term strategic goal, with intermediate package standards as a benchmark. Where difficult investment choices need to be made, as an interim measure, decision makers may choose to prioritize the achievement of the intermediate package in urban secondary schools in the first instance, while at the same time ensuring that **all other schools in all areas** have access to the minimum package of infrastructure.

This study has **broken new ground** in the sector by using secondary data and econometric techniques to quantitively assess the relationships between SWASH provision and years of schooling. The apparent strength of this relationship is extremely significant to WASH and education practitioners and policymakers alike. Nevertheless, it is important to note that this analysis is subject to several limitations and should be considered indicative of the order of magnitude of the economic returns of SWASH.

CHAPTER 1

Introduction

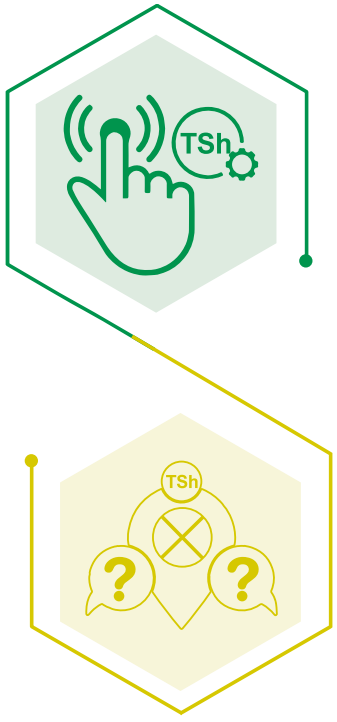
1.1 Project overview

Oxford Policy Management (OPM) was contracted by UNICEF to work with the Government of Tanzania (GoT) to develop a *National Costed Plan of Action and Investment Case for the Implementation of School Water, Sanitation and Hygiene (SWASH) Services in Tanzania.*

The overarching aim of the project is to provide the Government and their development partners with an **evidence-based assessment** of the economic case for **increased investment in school WASH (SWASH) services** to help guide future decision-making on SWASH investments.

TWO INTER-LINKED COMPONENTS OF THE ASSESSMENT

A **cost of action** analysis exploring the investments required to deliver different standards of SWASH services to primary and secondary schools in Mainland Tanzania. This analysis forms the basis of the National Costed Action Plan.



A **cost of inaction** analysis, which provides models estimates of losses to labour productivity and income resulting from lost education due to lack of WASH infrastructure in schools.

The combination of the cost of action analysis and the cost of inaction analysis informs the overall **investment case** for increasing funding for SWASH services.

The scope of the assignment covers SWASH services and needs in all the **primary and secondary** schools in **Mainland Tanzania**.

In accordance with the terms of reference, the analysis undertaken as part of this project has been primarily **desk-based** and relies on the **authors' treatment and analysis** of the existing secondary data drawn from routine government monitoring data; household survey data files; and other government policy and costing documents. A full overview of the methodological approach, the data sources used and the limitations of the analysis are elaborated in section 3.

REMAINING SECTIONS OF THE REPORT

SECTION 2 Provides the background on the importance and status of SWASH services globally and in Tanzania

SECTION 3 Outlines the methodology and limitations of the analysis

SECTION 4 Present the findings of cost of action analysis organized into a national costed plan

SECTION 5 Presents the findings of cost of inaction analysis

SECTION 6 Discusses the overall investment case for SWASH investments

CHAPTER 2

Understanding SWASH

KEY MESSAGES

- Globally, at least **800 million children** lack access to basic water, sanitation or hygiene services at school. In sub-Saharan Africa specifically, **over half of all children** do not have access to adequate SWASH services.
- Limited access to SWASH services, including infrastructure, is known to increase **illness** and **absenteeism** among school children. Lack of access to sanitation and hygiene facilities **disproportionately affects adolescent girls**, particularly those that are menstruating.
- A 2018 survey by the National Bureau of Statistics (NBS) indicates that access to SWASH services in Mainland Tanzania is a **major challenge**. Nationally, only 55 per cent of schools provide pupils with a 'basic' water service and only 30 per cent of schools provide pupils with 'basic' sanitation services, with most of the unserved living in rural areas and studying in government primary schools.
- Studies show that **inadequate SWASH access** is contributing to **higher pupil absenteeism** and high dropout rates. In Tanzania, dropout rates continue to be a challenge at all levels, but particularly at the end of primary school, such that 3 out of every 10 children that complete primary education are not transitioning to secondary schools.
- Through an econometric analysis of secondary data, this study seeks to provide the Government of Tanzania and their partners with a robust **evidence-based analysis** exploring the important role SWASH can play in improving effective learning and in delivering returns to people and the overall economy.

2.1 Why invest in SWASH?

Around the world, improving access to SWASH services is a critical priority if the WASH-related Sustainable Development Goals (SDGs) are to be achieved. The Joint Monitoring Programme (JMP), a collaboration between the World Health Organization (WHO) and UNICEF mandated for monitoring WASH SDG 6 targets 6.1 and 6.2 on drinking water and sanitation globally, estimates that globally 31 per cent of schools lack basic water services, 37 per cent of schools lack basic sanitation and 43 per cent of schools do not provide basic hygiene facilities. Overall, this means that at least 800 million children globally are not able to access basic water, sanitation or hygiene facilities at school. The situation is even more critical across sub-Saharan Africa, where over half of children in schools are unable to access basic water and sanitation (56 per cent and 53 per cent respectively), and nearly three-quarters of school children in the region do not have access to basic hygiene (see Table 1).

The impact of inadequate WASH facilities is even more pronounced in schools and can fundamentally undermine the ability of millions of children to gain quality education. Lack of access to improved water supply, sanitary toilets and handwashing facilities is known to increase exposure to pathogens, leading to various diseases in pupils, including diarrhoea, soil-transmitted helminth and trachoma, among others. Furthermore, the lack of access to SWASH disproportionately

TABLE 1: ACCESS TO SWASH SERVICES GLOBALLY AND SUB-SAHARAN AFRICA

WASH service	Globally		Sub-Saharan Africa	
	% school children without access	Number of school children without access (million)	% school children without access	Number of school children without access (million)
Basic water	31%	584	56%	225
Basic sanitation	37%	698	53%	213
Basic hygiene	43%	818	74%	295

affects adolescent girls, particularly those that are menstruating, discouraging them from attending schools. Several studies and particularly Kaur et al. (2018) and Chinyama et al. (2019) indicate that poor management of menstrual hygiene health (MHH) contributes to poor health, education and psychosocial outcomes. In Tanzania, the 2021 Annual Education Sector Performance Report (AESPR) highlights the case of the Kiluvya ward primary school where improvements in SWASH infrastructure and increased support to girls on menstrual hygiene management issues was directly linked to increased girls' attendance rate in schools. The AESPR also reports that girls' in Kisarawe had improved learning in schools when they are menstruating following the installation of modern toilets with running water.

Taken together, the lack of access to adequate WASH and MHH in school is likely to contribute to high level of absenteeism, drop-outs and also affect enrolment and ultimately result in poor learning outcomes and social development among girls. However, in the literature globally, and also in Tanzania, the aggregate economic costs of not investing in SWASH has not been adequately measured. This limits the ability of decision makers in terms of policy and financial impact to make informed decisions around SWASH investments in the short, medium and long term. This study uses econometric modelling[1] of secondary data to quantitatively estimate the economic cost of inadequate access to SWASH services in Mainland Tanzania. The costs of not investing in SWASH are then compared with the estimated costs to improve infrastructure to determine an overall investment case for these services.

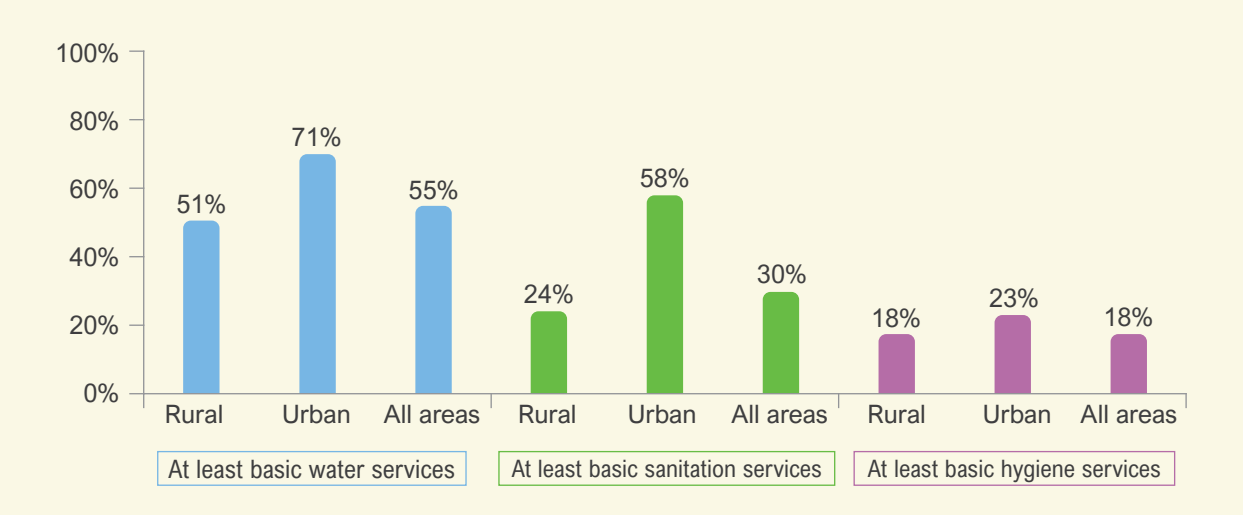
2.2 SWASH access in Mainland Tanzania

In 2018 UNICEF supported the National Bureau of Statistics in collaboration with the Ministry of Education and PORALG to undertake a National School WASH assessment on WASH coverage and service delivery across the various regions of the Tanzania mainland and Zanzibar. This assessment was based on large scale primary data collection from schools sampled for all regions of the country. The results show that around half (55%) of all schools surveyed in Mainland Tanzania had access to a "basic" water service; about a third (30%) had access to a "basic" sanitation service, and around a fifth (18%) had access to a "basic"[2] hygiene service (Figure 1).

[1] Econometric modelling uses statistical techniques to identify multivariate correlations between variables.

[2] The definition of 'basic' water, sanitation and hygiene services used in this analysis accord with the WHO/UNICEF Joint Monitoring Programme (JMP) service ladders for monitoring WASH in schools. A basic water service is defined as "drinking water from an improved source is available at the school". A basic sanitation service is defined as "improved facilities, which are single-sex and usable at the school". A basic hygiene service is defined as "handwashing facilities, which have water and soap available".

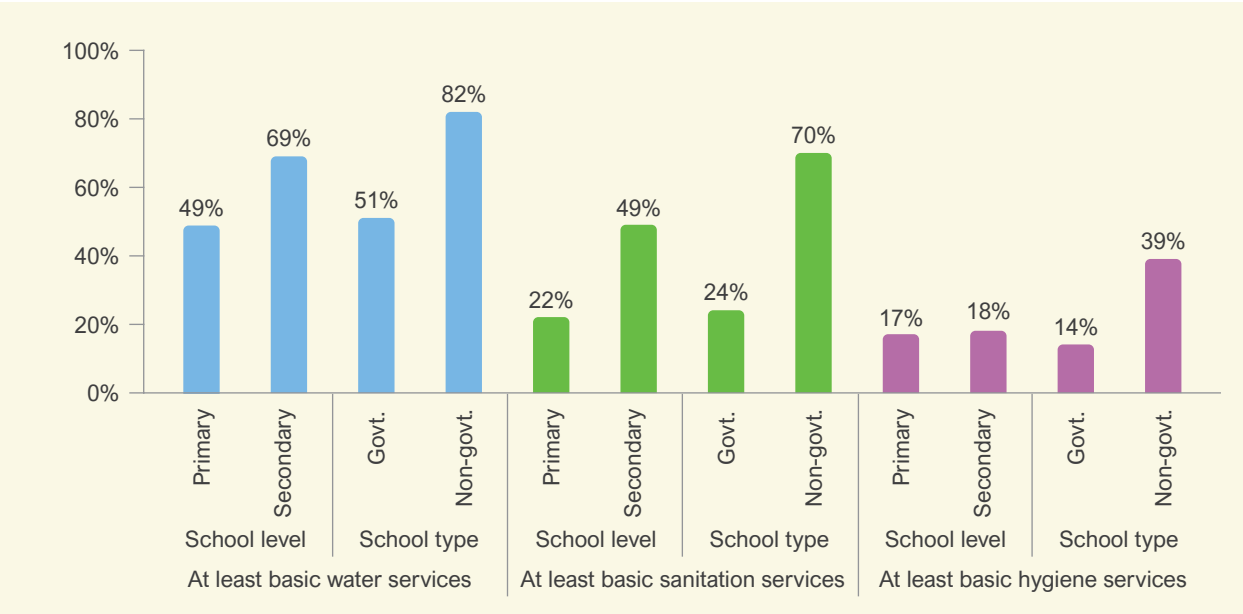
FIGURE 1: ACCESS TO WATER, SANITATION AND HYGIENE SERVICES IN RURAL AND URBAN SCHOOLS



Source: Authors calculations of the 2018 School Water, Sanitation and Hygiene Assessment

Schools in urban areas were found to have significantly better access to WASH facilities than those in rural areas. Moreover, the provision of SWASH (with the exception of basic hygiene services) was shown to be substantially better in secondary schools compared to primary and in non-government schools (largely fee-paying private schools or a school run by a religious institution)[3] compared to government schools (see Figure 2). Finally, the assessment found stark variations in coverage and service quality across regions on Mainland Tanzania. For example, the SWASH assessment found that schools in Rukwa, Songwe and Simiyu regions were much more likely to have inadequate access to water and sanitation services than anywhere else in the country.

FIGURE 2: ACCESS TO WATER, SANITATION AND HYGIENE SERVICES BY SCHOOL LEVEL AND TYPE



Source: Authors' calculations of the 2018 School Water, Sanitation and Hygiene Assessment.

[3] Non-government schools represent approximately 12 per cent of all schools across the Tanzanian mainland and Zanzibar (2018 Schools WASH Assessment).

Some of the reasons underlying the disparity and slow progress on SWASH service provision are unpacked by Antwi-Agyei et al. (2017) as part of a broader evaluation of National Sanitation Campaign in Tanzania. This report highlights fund availability and irregular disbursement as key factors underpinning the issues of lack of infrastructure, but also the lack of service quality evidenced by unacceptably high ratios of students to facilities and a lack of facility maintenance. For example, fund disbursement to Local Government Authorities (LGAs) were shown to be late and irregular in most cases meaning planned SWASH investments were not implemented. These issues were also exacerbated by the limited capacity at the regional and LGA level to execute the planned budgets.

The level of planned funding is also inadequate. To a large degree, SWASH investments remain largely subsidized by external investments and support from development partners. Changing this picture requires political commitment founded on the evidence of implementation effectiveness and impact.

Another key issue identified by Antwi-Agyei and others relates to the operation and maintenance of existing SWASH facilities. Existing plans and strategies to mobilize the systematic use and maintenance of facilities do not in many cases lead to the successful practice, eroding the benefits of SWASH facilities.

2.3 SWASH and education in Tanzania

2.3.1 Education performance

Over recent years, Tanzania has made substantial progress in expanding access to education after the introduction of the Fee-Free Basic Education Circular no.6 of 2015.

According to the Joint Annual Review (JAR) of the Tanzania Education Programme for Results (EPforR), 2020, since the introduction of fee-free basic education in December 2015, enrolment in government primary and secondary schools has increased by 3.2 million and significant increases in net enrolment rates have also been recorded. However, although dropout rates in basic education have come down, it remains a key concern that 28 per cent of boys and 20 per cent of girls drop out of school without completing primary school. There is another key bottleneck for education in the transition between primary and secondary schooling. According to the 2021 *education sector analysis for Mainland Tanzania,* 3 out of every 10 children that complete primary education does not proceed to secondary schools. Similarly, in secondary education, the loss of students remains a challenge as one in three students who begin the O-level do not complete their studies.

The majority of the students that dropout between primary and secondary education are girls. The reasons for girls not transitioning to lower secondary need further investigation and analysis, but factors may include the increased distance to secondary schools, schools not being girl-friendly in terms of WASH facilities, a requirement to work more-or-less full-time on domestic chores at home and early marriage (ESDP 2016/17-2020/21, p. 27).

2.3.2 Strategic priorities for SWASH in Tanzania

The 2017–2022 Education Sector Development Plan (ESDP) logical framework includes strategic targets related to the provision of SWASH services.

STRATEGIC TARGETS RELATED TO PROVISION OF SWASH SERVICES UNDER ESDP LOGICAL FRAMEWORK

The **'School Environment'** strategy component 3 speaks of the need to strengthen SWASH facilities such that *"all male and female children in school are able to access sanitary toilet facilities (including segregated, girl-friendly facilities)"* and *"all schools have drinking water on their premises accessible by all staff and students".*

Under the **'Infrastructure'** strategy component 3, there is a specific commitment to ensure that separate latrines are *"available for adolescent girls in sufficient number and adhering to WASH standards and that this will results to girls' enrolment and retention improvement."*

To ensure that these WASH strategic objectives are met, the government has developed the school construction and maintenance costed plan 2020–2024. This plan outlines costs and financing requirements for implementing the School Construction and Maintenance Strategy (SCMS) 2019–2028. The SCMS outlines minimum agreed standards for the provision and maintenance of school infrastructure, including WASH facilities, and it has been an important resource to help ensure that the design of cost of action and inaction analysis are aligned with national norms and standards.

The economic and financial implications of the strategic choices and plans set out in the costed plan were examined using a simulation model,[4] resulting in a set of policy directions, targets and the estimated available resources envelope.

2.4 WASH financing

The current status of WASH sector financing in Mainland Tanzania have been captured in a recent (2020) sector *budget brief* developed by UNICEF. This brief illustrates the declining sector spend on WASH sector activities across the board in the last financial year and highlights key cross-cutting issues, such as poor budget execution. The analysis does not isolate SWASH spending, but it is assumed that this spending on SWASH facilities has also been somewhat constrained during the COVID-19 period. The key finding from UNICEF budget brief are presented below:

- In the 2019/20 financial year, the WASH sector was allocated TSh 669 billion, which amounts to a 10.5 per cent decline in nominal spending, and 16.6 per cent in real terms spending, as compared to TSh 748 billion allocated in FY 2017/18.
- The allocation accounts for 2 per cent of the total national budget and 0.5 per cent of gross domestic product (GDP), a decline from 2.4 per cent and 0.6 per cent, respectively, from the previous year.
- Most WASH resources are directed at water supply – approximately 81 per cent of the Ministry of Water (MoW) budget in FY 2019/20 – compared to 6.4 per cent allocated to sanitation programming.
- Budget execution remains a matter of significant concern. It stood at an overall 58.2 per cent in FY 2018/19, a slight improvement from 57.2 per cent in FY 2017/18. The budget execution rate for locally funded development projects was 57 per cent in 2018/19.

[4] Simulation models use estimated statistical correlations to predict what would happen to given variables, if explanatory or causal factors were affected.

- Significant variations exist in the allocation of WASH budgets across the regions. For instance, in FY 2018/19, the per capita water budget allocation to Kagera region (which at 39.8 per cent has the lowest proportion of households with improved drinking water source during the dry season) was TSh 2,758, which was below the average of TSh 3,657. This suggests the need to alter the formula for intergovernmental fiscal transfers on recurrent and development budgets to address potential inequity issues.

In Mainland Tanzania, responsibilities for financing SWASH infrastructure and service delivery are split across government ministries and education stakeholders. In 2016, the Ministry of Science, Education and Technology (MoEST) published a common set of *National Guidelines for Water, Sanitation and Hygiene for Tanzania Schools.* These guidelines formalized key roles and responsibilities for SWASH service delivery, summarized below.

For the most part, public investments earmarked for the construction and rehabilitation of SWASH infrastructure are channelled through LGAs. In turn, LGAs oversee private contractors building the facilities.[5] Parents and communities are often engaged to provide in-kind support to help reduce the financial cost of the facilities. The regularized operation and maintenance of SWASH facilities are the responsibility of the schools themselves in theory financed through the capitation grant (if a public school) or through parental fee if a private school.

Public investment in SWASH is also supplemented by development partner support, the most prominent of which is the World Bank's *Sustainable Rural Water Supply and Sanitation Programme.* This programme aims to increase access to rural water supply and sanitation services in participating districts and strengthen the capacity of select sector institutions to sustain service delivery and it is implemented over a period of six years from 2019 to 2024 covering 17 regions of Tanzania that

KEY ROLES AND RESPONSIBILITIES FOR SWASH SERVICE DELIVERY

Education: The Ministry of Science, Education and Technology's (MoEST) key responsibilities are to lead in the formulation and enforcement of SWASH policies, standards and guidelines in collaboration with other stakeholders.

Health / community development: The Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) acts as the technical lead on issues related to sanitation and hygiene policy formulation, monitoring and enforcement as part of its mandate to safeguard public health. They also provide technical assistance (TA) to local government agencies on sanitation and hygiene issues.

Local government: The President's Office – Regional Administration and Local Government (PO-RALG) is responsible for the coordination, planning and implementation of LGA SWASH projects and for the development of guidelines for SWASH budgeting to support investments at the LGA level.

Water: The Ministry of Water (MoW) facilitates the provision of adequate water in schools.

[5] **Note:** Development partners including UNICEF and the World Bank also provide financial support for SWASH programming, including through the various phases of the water sector development programme.

have a low access to improved water supply and sanitation and high rates of poverty and stunting. This programme works through the results-based financing approach to incentivize the achievement of the programme objective through payments, which are triggered by a set of disbursement-linked indicators (DLIs) that measure and reward the districts for achieving annually verified results. DLI number 4 incentivizes districts that improve the number of public primary schools with access to improved sanitation and hygiene facilities for up to USD 20,000 per school.

CHAPTER 3

Methodology and assumptions

KEY MESSAGES

- The study findings are based on two types of financial analysis (termed the cost of action and cost of inaction analyses), which have been used in conjunction with one another to develop a **five-year national costed plan** (2021–2026) and **investment case** for SWASH.
- The cost of action analysis builds on the existing secondary data, namely the MoEST Costed Action Plan (2019–2024) and the Education Management Information System (EMIS) 2020 database, to estimate SWASH needs and financing requirements across all the rural and urban schools in Mainland Tanzania.
- SWASH investment requirements have been modelled for three different packages of WASH services – the standard package, intermediate package and minimum package – on the basis that all schools in Mainland Tanzania would at a minimum have access infrastructure and facilities outlined in these packages by the end of the costed plan, that is, by the end of 2026.
- The cost of inaction analysis combines data from the Tanzania Household Budget Survey (2018) with 2020 EMIS data to estimate the impact of WASH infrastructure spending on effective years of pupil education and in turn to estimate the impact of improved education on lifetime earnings.
- As a final stage, the cost of action and inaction are calculated and compared for all three SWASH packages in order to derive an overall return on investment for each package.
- It is important to note that this study is entirely desk-based and relies exclusively on the analysis of secondary data drawn from national surveys and existing sector documentation. This data is used to assess complex and multifaceted relationships between SWASH access, effective schooling and lifetime earnings and is therefore subject to numerous confounding factors. The findings of this study should therefore be treated as indicative and illustrative in nature, indicating the sign of the relation (positive/negative) and providing orders of magnitude rather than exact estimates.

3.1 Overview

The objective of this study was to provide estimates of the cost of action (to inform the national costed plan) and the cost of inaction (to inform the investment) on SWASH using administrative data provided by the MoEST and Household Budget Survey (HBS) data. Econometric modelling was used to estimate the effects of SWASH on educational outcomes and earnings, controlling for relevant personal and school characteristics. The time frame of the projection was 2021–2026.

3.2 Cost of action

The cost of action was estimated based on the projections of school enrolment. The baseline was drawn from the 2020 school enrolment figures reported in the MoEST Costed Action Plan (2019–2024). The total school enrolment figures are broken down by sex and region/school using the information available in the EMIS 2020 database. For schools with missing or incomplete enrolment data (24 schools out of 18,152 with fewer than 10 pupils reported), imputations were made based

on the average school size, so as to fill the gap between the total enrolment reported by the MoEST and the one available in EMIS 2020.

The EMIS for Mainland Tanzania does not contain information on sanitation or enrolment in secondary schools. Consequently, that information was imputed based on the MoEST action plan and the information on secondary school enrolment by region contained in the HBS 2017/18. The total number of students enrolled in secondary school in Mainland Tanzania in 2020 was obtained from the MoEST, whereas the distribution of female and male secondary students across regions was estimated from the HBS.

For the end line figures (2026), we did not use the projected enrolment reported in the MoEST Costed Action Plan, as these are thought to be insufficiently ambitious in that they assume that only a small proportion of pupils would transition to secondary education and even fewer would complete secondary school. Consequently, the projected school-age population at end line is used as a basis for SWASH planning, assuming that 3 per cent dropout or delays would occur in each year. These are admittedly aspirational assumptions, but that should be what the national policy aims for in the medium term in order to be compliant with the internal development objectives and human rights commitments.

The MoEST Costed Action Plan extends to 2024, whereas the costing used in this analysis stretches to 2026. For the final two years, linear extrapolations were made based on the 2019–2024 trend reported in the Costed Action Plan. For the years in between 2020 and 2026, the growth in school enrolment and required infrastructure is assumed to be linear.

The projected WASH financing needs for 2026 are modelled for three scenarios related to three different packages of WASH services: standard package, intermediate package and minimum package. These key characteristics of these packages are outlined below (see Table 2).

According to these scenarios, under the standard package, there should be a female toilet for every 20 girls and a male toilet for every 25 boys as well as two toilets for persons with disabilities and two toilets for teachers. The MoEST action plan also includes a provision to connect the schools to the water network under the standard package. The characteristics of the intermediate package are similar to the standard package except that the target ratio of toilets to pupils has been relaxed to one female toilet per 40 female pupils and one male toilet per 50 male pupils. Finally, under the minimum package, only four girls' and four boys' toilets would be built in each school, regardless of school size. The authors note that the minimum coverage rate would clearly be inadequate to guarantee appropriate hygiene to children and should therefore be seen as an absolute lower bound estimate of the minimum investment needed to ensure that no school is left with any access to water or sanitation.

TABLE 2: MODELLING PARAMETERS

Aspect of WASH facility	Minimum package	Intermediate package	Standard package	Unit cost (TSh in 2020)
Girls' toilets	4 per school	40 girls per toilet	20 girls per toilet	2,138,919*
Boys' toilets	4 per school	50 boys per toilet	25 boys per toilet	2,138,919*
Toilets for persons with disability	2 per school	2 per school	2 per school	2,138,919*
Teachers' toilets	2 per school	2 per school	2 per school	2,138,919*
Water tank	–	1 per school	1 per school	8,346,496
Water connection	Clean water	Tap water	Tap water	7,500,000
Maintenance				8%

Source: MoEST Costed Action Plan 2019.
*Includes 5 per cent transport cost on materials and 3 per cent for supervision.

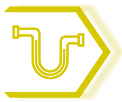
The following unit costs are used, also from the MoEST Costed Action Plan (TSh):

MoEST COSTED ACTION PLAN

Cubicle: 2,304,329 (unit cost+ 5 per cent transport and 3 per cent supervision cost)

Teacher toilet: 2,304,329 (unit cost+ 5 per cent transport and 3 per cent supervision cost)

Water tank: 8,346,496



Water connection: 7,500,000 (half of the reported water + electricity connection cost)

Across all the packages, a standardized maintenance provision of 8 per cent has been applied to all capital investments to indicate the requirement to (a) cover routine operation and maintenance costs of new infrastructure, including the provision of soap, and (b) to make a provision for eventual capital maintenance/replacement costs.

The cost information reported in the MoEST action plan has not been broken down by region. If regionally disaggregated data were made available, unit costs could be adjusted to reflect regional price differences.

The following variations on the costing will be compared for cost-effectiveness:

- Using the standard, intermediate and minimum package of investment mentioned in the MoEST Costed Action Plan;
- Investing only in WASH for girls or boys; and
- Investing only in WASH at primary level or secondary level.

3.3 Cost of inaction

The cost of inaction estimation focuses primarily on the loss of labour productivity and income resulting from lost education due to lack of WASH infrastructure in schools. This was done in two steps:

STEP 1 Estimate the impact of WASH infrastructure on effective years of education

STEP 2 Estimate the impact of effective years of education on earnings

STEP 1: Effective years of education correspond to actual years of education completed by the respondent, adjusted for days of schooling missed by those who are still in school. If, for instance, a girl misses two days of school each month during her periods, that reduces the actual education she receives by 10 per cent compared to someone who attended the school all days in the month. Effective years of education also takes into account literacy, so that a person who is illiterate is considered to have zero effective years of education, regardless of how many years he/she had spent in school.

The estimation of the impact of WASH on education takes into account all the WASH infrastructure items listed in section 3.2 above. It also controls for a number of additional factors that affect schooling, including gender, age, household income, parents' education, distance to school, area of residence, disability and region. A projection is made of the expected effective years of education that the child will achieve by age 20, based on his/her characteristics and the characteristics of the school, under the following scenarios:

The HBS does not contain information on the school last attended by children who are currently out of school, so it is not possible to directly assess the school characteristics associated with school dropout. For these children (3,336 out of 14,449

SCENARIOS UNDER WHICH A CHILD IS EXPECTED TO ACHIEVE EFFECTIVE YEARS OF EDUCATION BY AGE 20

No WASH infrastructure

Current WASH infrastructure

Full WASH infrastructure based on the minimum package described in the costing

Full WASH infrastructure based on the intermediate package described in the costing

Full WASH infrastructure based on the standard package described in the costing

children aged 6–17 years in the HBS), imputations have to be made based on the school reported by those who are in school using the following hierarchy:

- School attended by siblings in the same age group (± 2.5 years)
- School attended by other household members of school age
- Most common characteristics of schools attended by children in the ward who are in the same age group
- Most common characteristics of schools attended by children in the district who are in the same age group
- Most common characteristics of schools attended by children in the region who are in the same age group.

The information on child and household characteristics were taken from the HBS 2017/18 data set. The information on school characteristics were drawn from the EMIS 2020 data set. As the HBS does not contain unique school identifiers, the HBS and EMIS data have to be matched based on the ward, school level and school ownership. At the secondary level, there is often only one private and/or public school per ward, meaning that a one-to-one matching between the HBS and EMIS data sets is possible. At the primary level, however, a one-to-one matching cannot be performed in most cases, as there is typically more than one public/private primary school per ward. In these cases, a weighted average of the school characteristics per ward/ownership was performed based on the number of children attending each school.

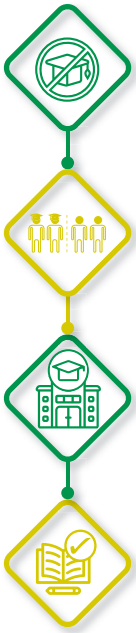
STEP 2: The impact of effective years of schooling on income was then estimated based on information available in the HBS 2017/18. The publicly available data set does not contain the labour module (section 9) of the survey. For this reason, it has not been possible to directly estimate the impact on labour earnings, as had been initially envisaged. In the absence of access to the labour module, individual earnings will have to be deduced based on total household consumption, age and reported activities as follows:

- Only persons aged 15–65 years are assumed to work by default unless the available information says otherwise.
- Persons who report being in school are assumed not to work even if they are of working age.
- Persons who declared spending all day looking after children or elderly are assumed not to work unless they declare this to be exceptional. Persons who spent part of the day are assumed to work part-time.
- Persons who declare being on leave from work are assumed to work.
- Children who declare having an unemployed, retired or inactive parent, or a parent doing unpaid household work, are matched to the appropriate adult to establish the parent's working status.

The relationship between earnings and education for persons aged 21–65 years was then estimated using an ordinary least squares (OLS) regression, controlling for age, sex and area of residence. Future earnings of children currently aged 0–20 years is projected for each year from age 21–65 years based on their individual characteristics under the following scenarios:

The implicit assumption is that children currently of school age will earn similar amounts at each age of their future working life as adults who were aged between 21 and 65 years in 2018. As such, the model does not take into account future economic growth, technological change or cultural changes in gender relations, among other factors. The information in steps 1 and 2 was then combined

SCENARIOS UNDER WHICH A CHILD (CURRENTLY AGED 0–20 YEARS) IS EXPECTED TO EARN EACH YEAR FROM AGE 21–65 YEARS



No children attend any school

All children currently in school dropout at the end of the current school year

All children currently in school complete their schooling until the end of secondary schooling

All children, including those not currently in school, complete a full course until the end of secondary schooling

to project the expected future lifetime earnings of children currently aged 0–20 years under the various modelled schooling outcomes projected for different levels of SWASH investment. Future earnings are discounted with a discount rate of 5 per cent per year.

3.4 Overall limitations

Apart from the limitations listed in section 3.3 above (missing labour data, lack of school identifier in the HBS, no information on school last attended by out-of-school children), the main limitation of the study relates to its scope. The potential ramifications of lack of SWASH are vast and only partly known. There may be qualitative and second-order effects on issues ranging from child protection to learning outcomes and health and nutrition. Each of these would require a dedicated study for adequate understanding and quantification. Due to data and budget limitations, this study only focuses on the most prominent of these effects, namely the loss of labour productivity and earnings resulting from poor schooling outcomes. Modelling exercises always require simplification in order to distil the most salient explanatory factors. To estimate these relations, we are using second-order data that was not designed specifically for the purpose of determining these relations.

The estimation is even more difficult, as the relationship between WASH and school dropout is complex and indirect. WASH is but one of many factors affecting educational outcomes. Consequently, the estimated relationships between SWASH and education outcomes are likely to be fairly weak and with large confidence intervals. For these reasons, the study will necessarily be indicative and illustrative in nature, indicating the sign of the relationship (positive/negative) and providing orders of magnitude rather than exact estimates of the cost of inaction. Different specifications of the model and different treatment of the data could yield different results. The ones reported will be those that seem most robust and plausible based on the various robustness tests carried out, rather than the ones that support a pre-selected narrative. The proposed methodology was selected based on a careful analysis of the data and an assessment of the constraints described in section 3.3 above.

CHAPTER 4

Cost of action

KEY MESSAGES

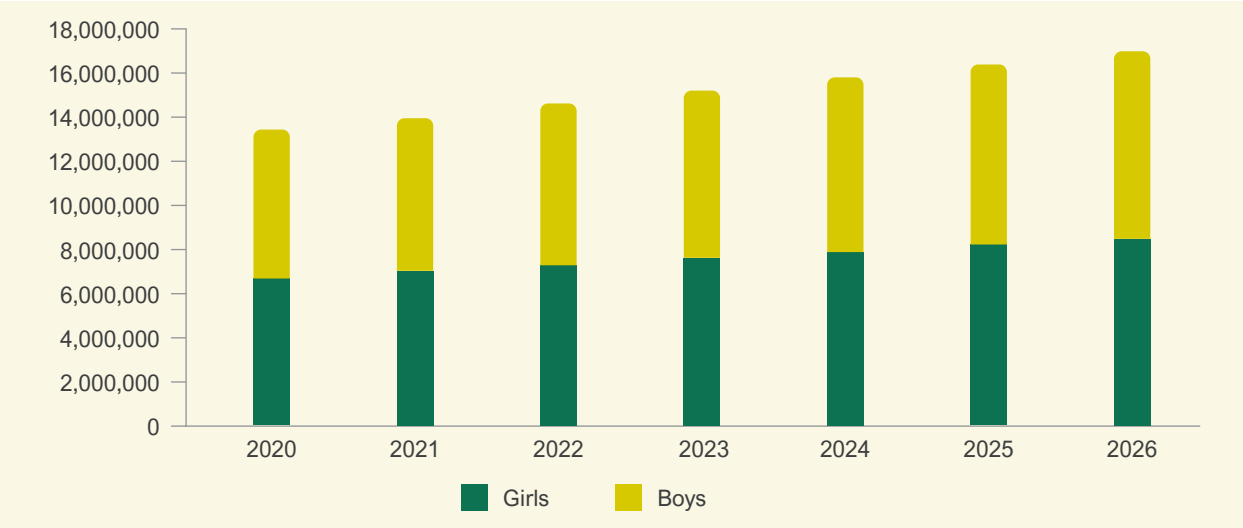
- The costs required to achieve full SWASH infrastructure coverage by 2026 are substantial and will require dedicated public finance support, irrespective of the infrastructure package being considered. Nevertheless, it is also important to emphasize that the cost differences between packages are also significant, as are the expected level of service these packages of infrastructure would provide. As such, any eventual investment decision-making will need to reckon with trade-offs between affordability and quality of access.
- The standard package of SWASH infrastructure is the costliest to implement. It would require an estimated investment of between TSh 330 billion and 370 billion per year over the next five years to achieve full coverage by 2026. This compares with an investment between TSh 180 billion and TSh 220 billion per year to achieve full coverage of the intermediate package and between TSh 66 billion and TSh billion 78 for the minimum package.
- Generally speaking, the primary driver of current SWASH infrastructure costs are the provision of toilets for pupils and for teachers. In part, this is driven by prevailing low levels of sanitation coverage across most schools in Mainland Tanzania but also the close links between the number of pupils and toilets required.
- SWASH investment needs vary substantially between regions, reflecting both different levels of SWASH coverage and population size.

This section presents the results of the costing that was carried out using the EMIS 2020 data and MoEST projections.

4.1 Number of primary and secondary pupils to be served

In 2020, there were 11.1 million children in primary schools in Mainland Tanzania and 2.5 million in secondary schools, according to the projections made by MoEST. By 2026, the number of primary school children is expected to decrease to 9.8 million as a large proportion of children currently repeating years graduate to secondary school, while the number of secondary school children would need to almost triple to 7.2 million in order to achieve near-universal primary and secondary education (see Figure 3). These figures assume that all eligible children would be enrolled at the right level by 2026, although we allow for a yearly dropout rate of 3 per cent. These figures are admittedly aspirational, but useful to provide an upper bound estimate of what would be required to ensure that all capable children complete secondary school.

FIGURE 3: PROJECTED NUMBER OF PRIMARY AND SECONDARY PUPILS 2020–2026, BY SEX



Source: EMIS 2020 and MoEST Costed Action Plan 2019.

4.2 Projected needs and costs – standard package

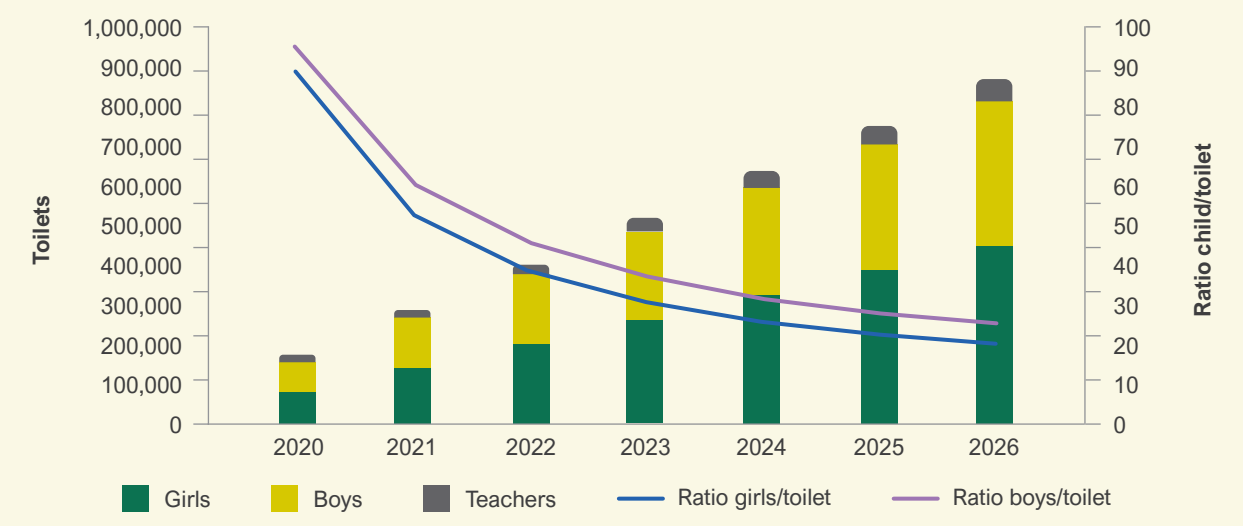
Aspect of WASH facility	Standard package
Girls' toilets	20 girls per toilet
Boys' toilets	25 boys per toilet
Toilets for persons with disability	2 per school
Teachers' toilet	2 per school
Water tank	1 per school
Water connection	Tap water

The projected increase in the number of girls/boys and teachers' toilets required to meet the projected school enrolment numbers in Mainland Tanzania by 2026 is shown below (see Figure 4).

The projections show that 449,021 girl toilets and 362,876 boy toilets would be required by 2026 to meet the standards set out in the MoEST action plan (up from 81,701 and 76,908, respectively, in 2020).

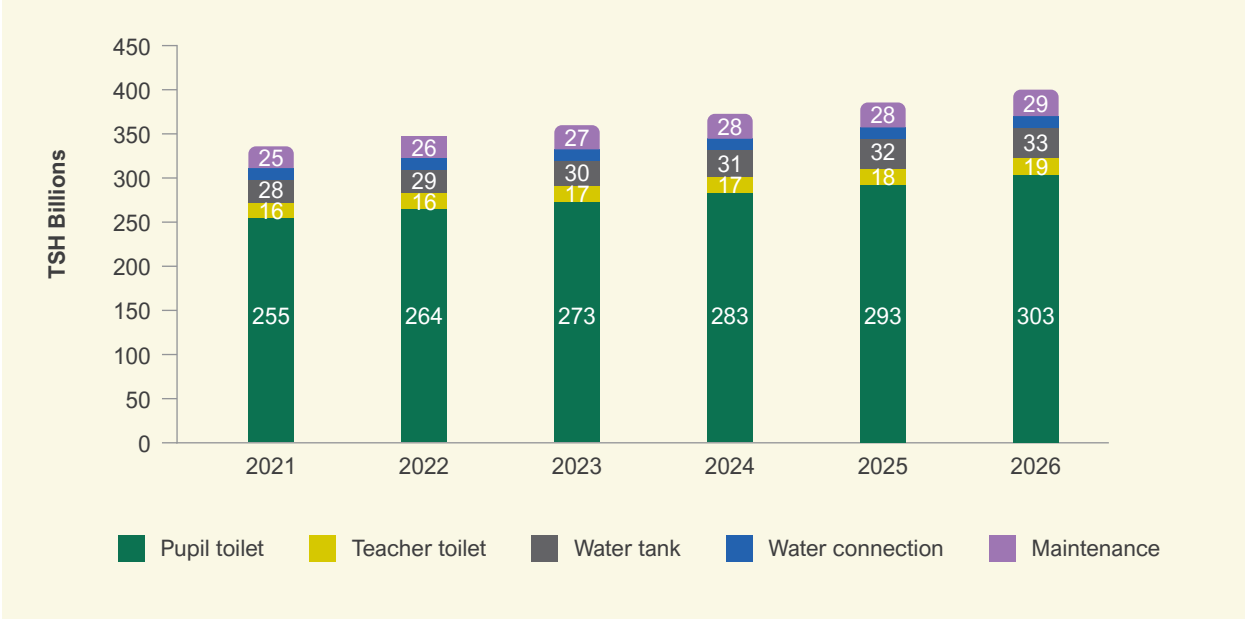
The number of teachers' toilets would need to increase from 13,650 to 54,230 over the same period. The numbers projected here are larger

FIGURE 4: PROJECTED NUMBER OF TOILETS NEEDED 2020–2026 – STANDARD PACKAGE, BY SEX



Source: EMIS 2020 and MoEST Costed Action Plan 2019.

FIGURE 5: PROJECTED INVESTMENTS REQUIRED 2021–2026 – STANDARD PACKAGE, BY ITEM



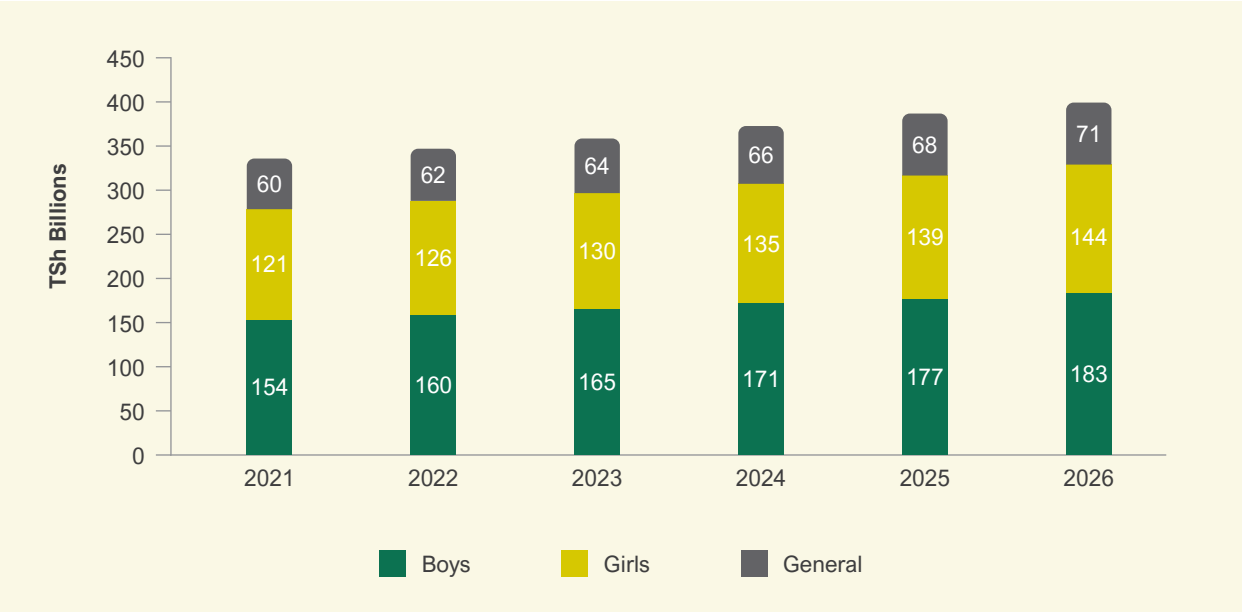
Source: EMIS 2020 and MoEST Costed Action Plan 2019.

than the ones in the MoEST action plan due to the fact that we plan for near-universal primary and secondary enrolment.

Based on the projected infrastructure requirement described above, and given the unit costs provided (see Table 2), the projected total investment required in SWASH for Mainland Tanzania between 2021 and 2026 is TSh 2.2 trillion, taking into account a projected 3.5 per cent inflation rate between 2021 and 2026 (in line with the MoEST projections). The overwhelming majority of the investment cost (76 per cent) would be for children's toilets, with the rest going to water tanks (TSh 182 billion), teachers' toilets (TSh 102 billion) and connection to the piped water network (TSh 77 billion). The comparatively higher investment requirements for pupil toilets as compared to other WASH infrastructure is driven by necessity to expand the toilet provision in direct proportion to pupil enrolment, whereas other capital requirements (such as water connection) are not so closely linked to absolute levels of enrolment.

It is shown below that 46 per cent of the required investment on the Mainland would go to girls' toilets, whereas 36 per cent would go to boys' toilets (see Figure 6). The rest (18 per cent) goes to teachers' toilets, water tanks and water connection. The imbalance in investment needs between girls and boys is due to the lower ratio of number of girls per toilet, as well as the fact that fewer girls than boys are currently enrolled in secondary school.

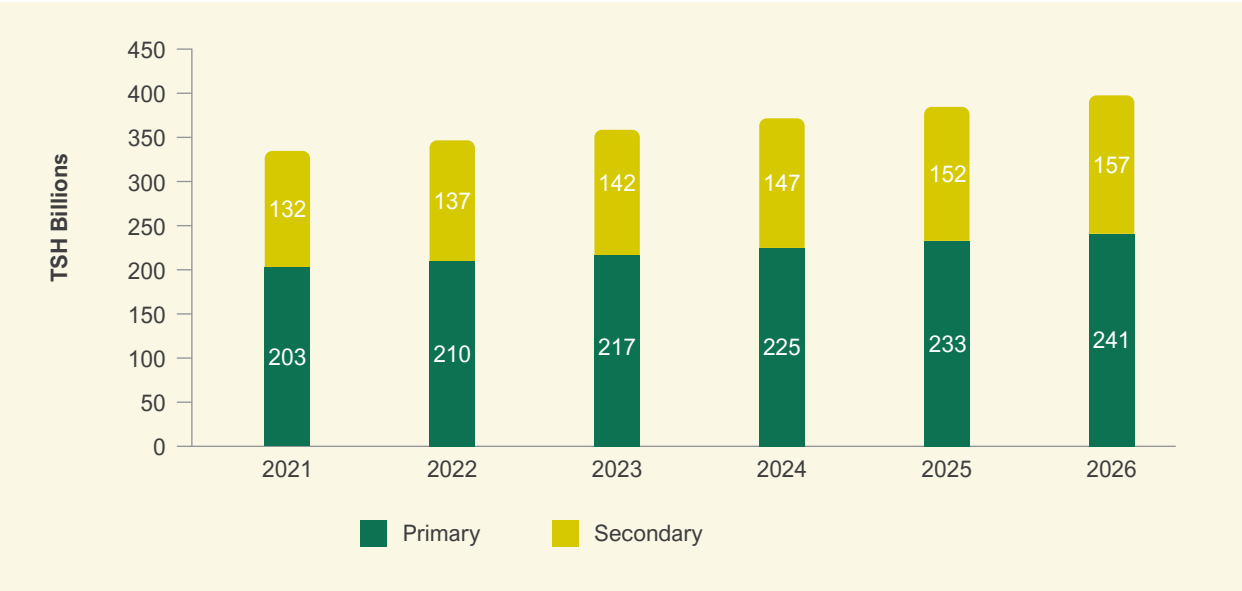
FIGURE 6: PROJECTED INVESTMENTS REQUIRED IN TSH 2021–2026 – STANDARD PACKAGE, BY SEX



Source: EMIS 2020 and MoEST Costed Action Plan 2019.

Under the modelled scenario of near-universal schooling for all children up to upper secondary by 2026 (minus the 3 per cent yearly dropout rate), around 60.5 per cent of investments would be required for primary schools, with the rest going to secondary schools (see Figure 7). If dropout rates do not fall to these levels, the reality is that investment requirements are likely to be even more skewed towards primary schools.

FIGURE 7: PROJECTED INVESTMENTS REQUIRED IN TSH 2021–2026 – STANDARD PACKAGE, BY LEVEL



Source: EMIS 2020 and MoEST Costed Action Plan 2019.

4.3 Intermediate package

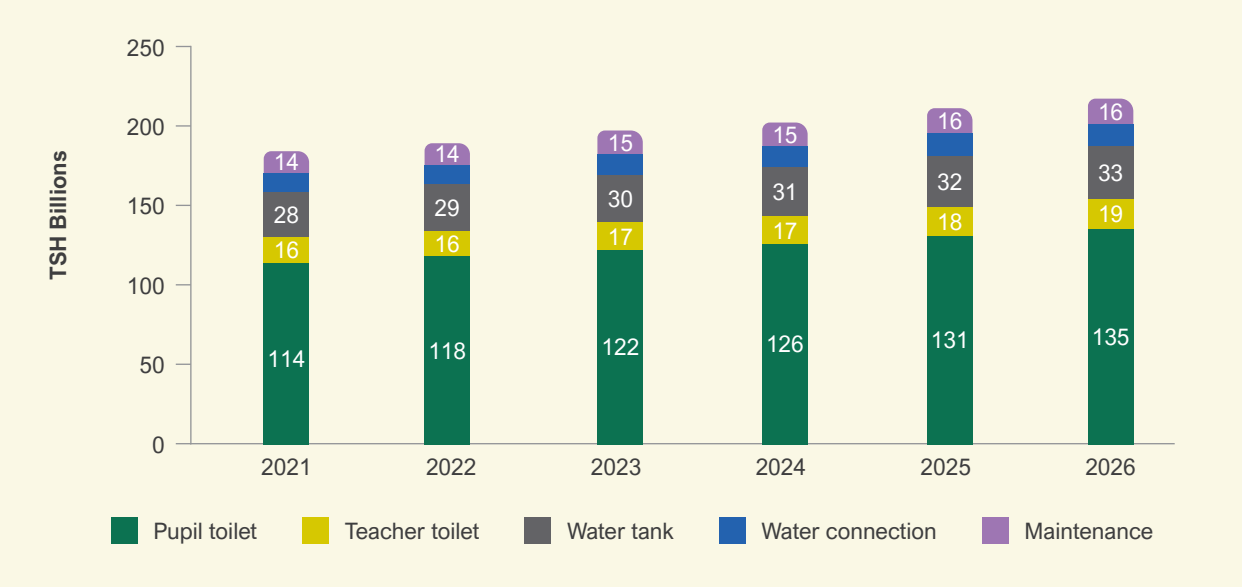
Aspect of WASH facility	Intermediate package
Girls' toilets	40 girls per toilet
Boys' toilets	50 boys per toilet
Toilets for persons with disability	2 per school
Teachers' toilets	2 per school
Water tank	1 per school
Water connection	Tap water

Under the intermediate package, the target pupils to toilet ratio are more permissive, and this substantially reduces the costs of this package.

Based on the projected infrastructure requirement shown against the estimated investment required in SWASH for the intermediate package is TSh 1.2 trillion over the period 2021–2026. As before, this takes into account a projected 3.5 per cent inflation rate between 2021 and 2026 (in line with MoEST projections). Of the needed TSh 1.2 trillion investment, 62 per cent is required for children's toilets followed by water tanks (15 per cent), teachers' toilets (9 per cent) and connection to the piped water network (6 per cent).

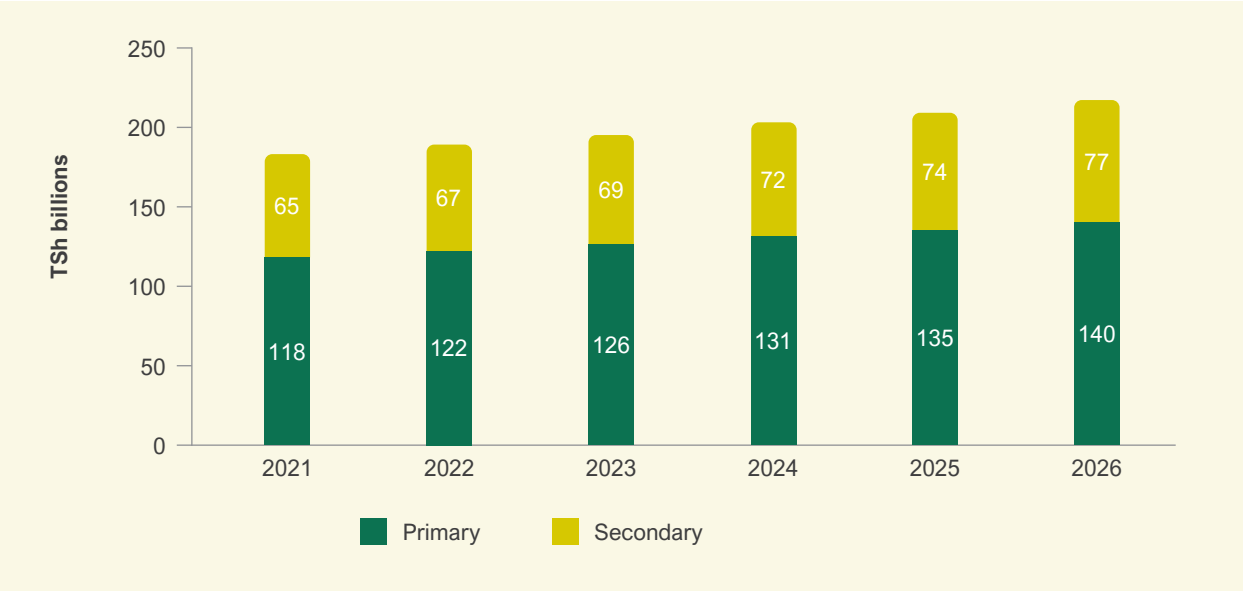
Overall, around 35 per cent of investment needs on the Mainland would go to girls' toilets, whereas 28 per cent would go to boys' toilets. As with the standard package, the imbalance between girls and boys is due lower ratio of the number of girls/toilet as well as the fact that fewer girls than boys are currently enrolled in secondary school. The projections indicate that 154,457 girl toilets and 116,677 boy toilets would be required by 2026 to meet the criteria of the intermediate package and on the basis of near-universal primary and secondary enrolment. Overall, on the basis of these assumptions, 65 per cent of all investments are required for primary schools and 35 per cent in secondary schools.

FIGURE 8: PROJECTED INVESTMENTS REQUIRED 2021–2026 – INTERMEDIATE PACKAGE, BY ITEM



Source: EMIS 2020 and MoEST Costed Action Plan 2019.

FIGURE 9: PROJECTED INVESTMENTS REQUIRED 2021–2026 – INTERMEDIATE PACKAGE, BY LEVEL



Source: EMIS 2020 and MoEST Costed Action Plan 2019.

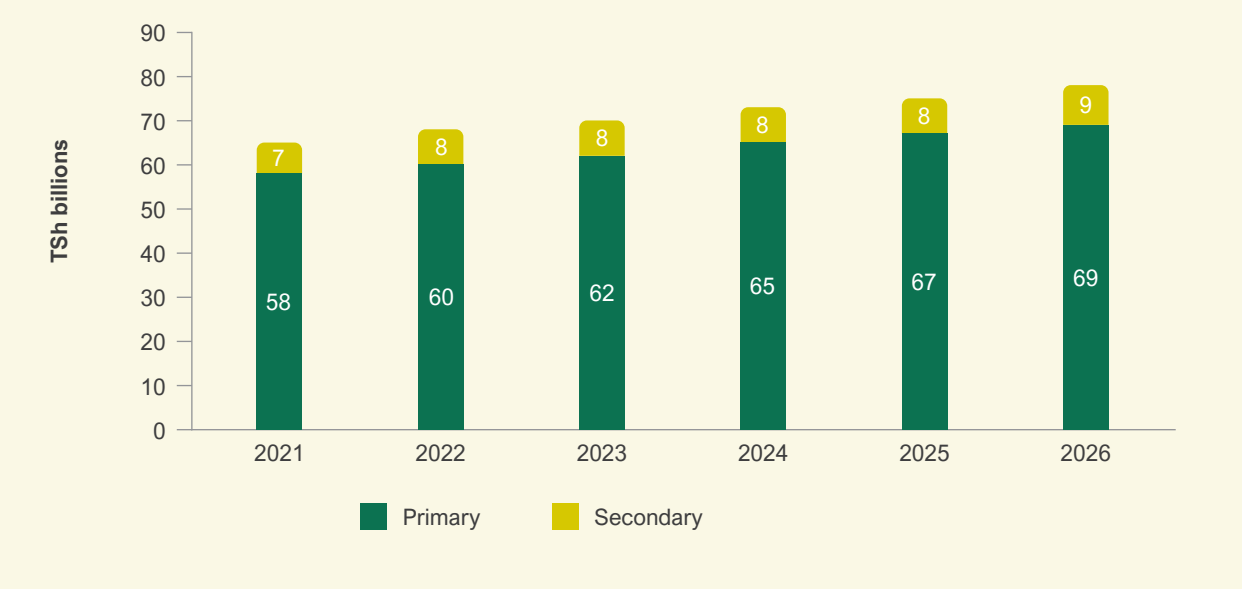
4.4 Projected needs and costs – minimum package

Aspect of WASH facility	Minimum package
Girls' toilets	4 per school
Boys' toilets	4 per school
Toilets for persons with disability	2 per school
Teachers' toilets	2 per school
Water tank	-
Water connection	Clean water

Under the minimum MoEST package, the number of toilets required is fixed per school, regardless of size, and this has a substantial impact on costs and the quality of services provided.

The overall minimum package would be about five times cheaper than the standard package (TSh 420 billion over five years, factoring in inflation). These investments would be heavily skewed towards primary schools, representing 89 per cent of all the required investments (see Figure 10). This reflects the fact that secondary school students tend to be concentrated in a small number of large schools, which would become even larger under the assumption of full universal secondary schooling.

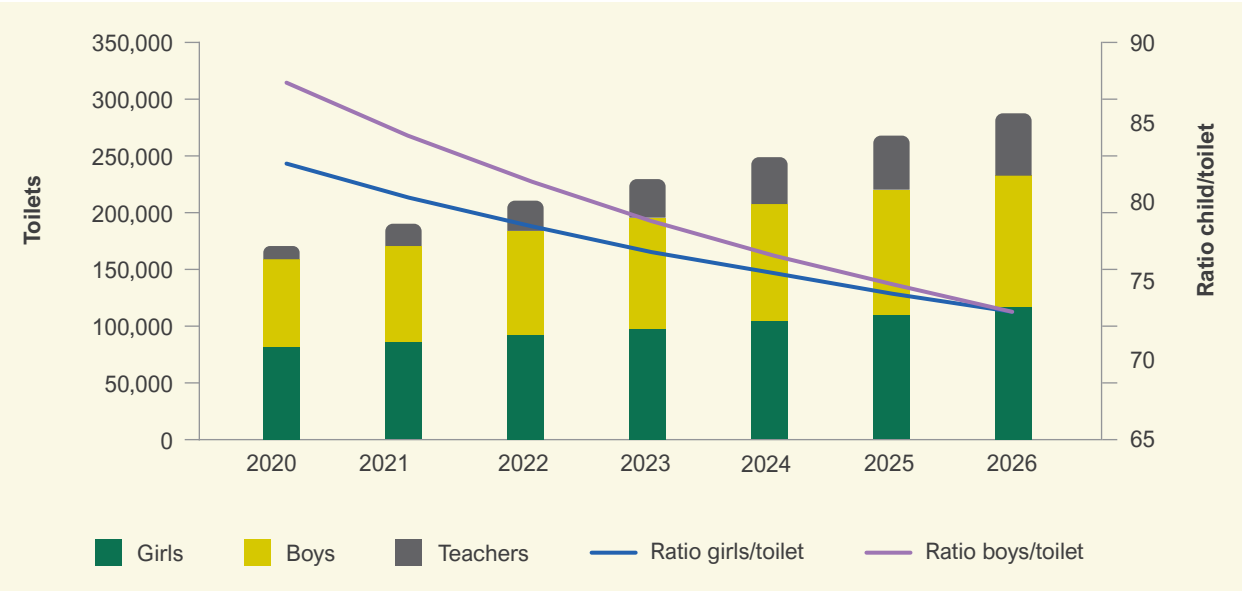
FIGURE 10: PROJECTED INVESTMENTS REQUIRED 2021–2026 – MINIMUM PACKAGE, BY LEVEL



Source: EMIS 2020 and MoEST Costed Action Plan 2019.

However, this would come at the cost of significant compromises as the pupil/toilet ratio in 2026 would be almost three times higher (73 pupils per toilet) than under the standard package. In primary schools, the pupil/toilet ratio would decrease from around 100 pupils per toilet today to around 54 pupils per toilet. The minimum package would be particularly less advantageous for girls, as the combined primary/secondary girls/toilet ratio would be the same as for boys (73 pupils per toilet) (see Figure 11).

FIGURE 11: PROJECTED NUMBER OF TOILETS NEEDED 2020–2026 – MINIMUM PACKAGE, BY SEX



Source: EMIS 2020 and MoEST Costed Action Plan 2019.

4.5 Regional summary

The regional summary of investment costs and needs across the three packages is shown below (see Table 3). It shows that the largest investments will be required in Dar es Salaam (TSh 26,407 million/year) and Mwanza (TSh 22,308 million/year) under the standard package, reflecting the fact that these are the two most populous regions.

Under the intermediate package, the same two regions (Dar es Salaam and Mwanza) still entail the largest investment, but the investment requirements are much lower at TSh 12,616 million/year and 12,582 million/year, respectively. Under the minimum package, the largest investments would be in the Kagera (TSh 4,551 million/year) and Tabora (TSh 3,844 million/year) regions. Although these are not among the most populous regions, they are largely rural, which means that they have a large number of small schools. Under the minimum package, Dar es Salaam would have a pupil/cubicle ratio of 164 by the year 2026, reflecting the fact that its pupils are concentrated in a relatively small number of large schools. At the other extreme, Njombe and Lindi would have a pupil/cubicle ratio of 44 and 48, respectively.

Under the standard package, all regions would achieve desired pupil/cubicle ratios, with differences reflecting mostly the variations in demographic composition.

TABLE 3: TOTAL YEARLY INVESTMENT REQUIRED AND YEARLY NUMBER OF GIRLS'/BOYS' TOILETS (STANDARD, INTERMEDIATE AND MINIMUM PACKAGES – MAINLAND), BY REGION

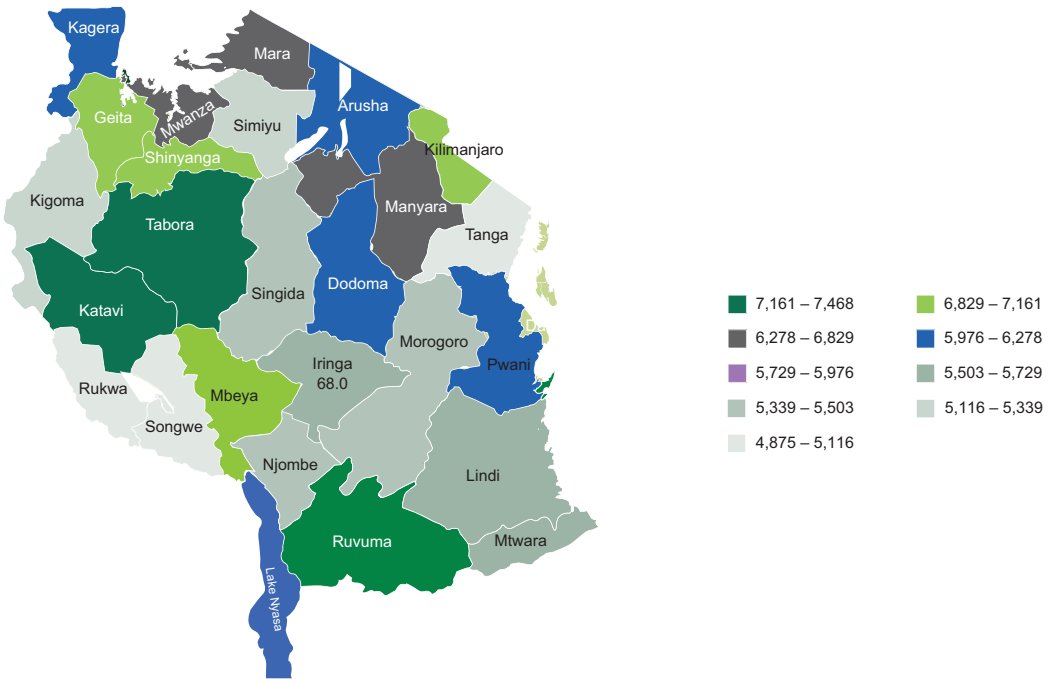
Region	Standard package		Intermediate package		Minimum package	
	Yearly cost	Pupil / toilet ratio	Yearly cost	Pupil / toilet ratio	Yearly cost	Pupil / toilet ratio
Arusha	11,334	21	5,979	39	2,845	59
Dar es Salaam	28,519	22	12,616	42	1,367	164
Dodoma	15,145	21	8,310	40	2,969	74
Geita	15,917	21	8,548	41	2,144	102
Iringa	7,576	21	4,309	38	1,664	57
Kagera	17,100	21	9,870	39	4,551	64
Katavi	4,323	21	2,323	40	665	90
Kigoma	15,136	21	8,185	40	2,550	88
Kilimanjaro	12,804	20	7,238	38	3,305	50
Lindi	6,847	20	4,122	37	2,069	48
Manyara	10,100	21	5,853	39	2,769	58
Mara	17,429	21	9,629	40	3,451	77
Mbeya	12,750	21	6,849	39	2,221	69
Morogoro	17,535	21	9,568	40	3,198	76
Mtwara	10,164	21	5,713	39	2,438	60
Mwanza	24,093	21	12,582	41	3,407	98
Njombe	5,021	20	2,960	37	1,431	44

Region	Standard package		Intermediate package		Minimum package	
	Yearly cost	Pupil / toilet ratio	Yearly cost	Pupil / toilet ratio	Yearly cost	Pupil / toilet ratio
Pwani	9,686	21	5,434	38	2,483	57
Rukwa	7,805	21	4,364	40	1,356	80
Ruvuma	10,212	20	5,841	38	2,392	51
Shinyanga	10,951	21	6,117	39	2,496	67
Simiyu	11,666	21	6,670	40	2,526	77
Singida	10,829	21	6,227	39	2,505	69
Songwe	9,255	21	5,210	40	1,832	78
Tabora	15,812	21	9,256	39	3,844	70
Tanga	17,027	21	9,080	39	3,166	66

Source: Author's calculations based on HBS 2018 and EMIS 2020.

The estimated cost per capita of investing in the standard package displayed by region is shown below (see Figure 12). The highest per capita costs are expected in Katavi and Tabora regions at over TSh 7,000 per person. By contrast, the cost in Songwe is estimated to be below TSh 5,000 per capita. The differences reflect the investment needs in relation to the projected school population (i.e., current WASH situation plus increase in school enrolment) as well as the ratio of school-age population to total population (more children = higher per capita costs).

FIGURE 12: ESTIMATED COST IN TSH PER CAPITA (STANDARD PACKAGE – MAINLAND), BY REGION



4.6 Summary of annual costs to deliver the different packages of SWASH services

The comparative costs of the different implementation packages are shown below (see Table 4). A distinction has been drawn between the required infrastructure investment in SWASH facilities and expected annual costs of maintaining this infrastructure, including the provision for eventual infrastructure capital maintenance and/or replacement.

Overall, the cost differences between the packages are significant. The costs of implementing the standard package are estimated at TSh 330 billion to 370 billion per year over the next five years; this compares with TSh 180 billion to TSh 220 billion per year for the intermediate package and TSh 66 billion to TSh 78 billion per year for the minimum package. The main driver of SWASH package costs is the construction of pupil toilets, as these are directly linked to the number of children attending the school.

As per the institutional arrangements for SWASH in Mainland Tanzania, it is expected that the required capital costs would need to be mobilized largely at the central level through the engagement of PO-RALG with the Ministry of Finance, in addition to efforts of the MoEST and MoHCDGEC to mobilize funds for SWASH from development partners. The operational and maintenance requirements for WASH infrastructure would reasonably fall on the schools to cover, either through provisions in the capitation grant or through local revenue generation. Provisions for capital maintenance of SWASH infrastructure would fall on the LGAs and should be routinely captured in LGA budgeting.

The differences in the projected costs of different packages reflects substantial differences in the level of SWASH services that would be delivered. Under the minimum package scenario, for example, no region would meet the national targets related to the SWASH provision. The required investment to deliver the intermediate package of services is around three times that of the minimum package but would see all the regions meeting the interim SWASH standards laid out in the National SWASH Guidelines. SWASH services under this package

TABLE 4: COMPARATIVE COSTS OF DIFFERENT INTERVENTION PACKAGES BY YEAR (TSH BILLIONS)

Package	2021	2022	2023	2024	2025	2026	Total
Standard package	338	351	364.5	378	378	392	2,201
Infrastructure costs	312.5	325	337.5	350	350	363	2,038
Maintenance costs	25	26	27	28	28	29	163
Intermediate package	183	189	196	203	210	217	1,198
Infrastructure costs	169	175	181	188	194	201	1,109
Maintenance costs	14	14	15	15	16	16	89
Minimum package	66	68	70	73	75	78	430
Infrastructure costs	61	63	65	67	70	72	398
Maintenance costs	5	5	5	5	6	6	32

do not meet the stricter MoEST-defined standards for basic SWASH facilities but considering the availability of resources and existing capacities and opportunities, the intermediate package may be the most practical means of progressively improving SWASH services in Mainland Tanzania.

The standard package for SWASH services meets the MoEST basic standards but comes at a substantial cost – approximately twice the cost of the intermediate package and five times that of the minimum package. The levels of investment required to meet the standard package are likely out of reach given existing national fiscal constraints and development partners' ability and willingness to invest.

Overall, it is clear that improving SWASH services under all the scenarios will require political commitment and a greater allocation of public resources. The status quo where most funding is externally subsidized will not be sufficient to deliver better and safer learning environments for children. The subsequent sections explore the impact of not investing in SWASH services on both schooling, livelihoods and long-term economic outcomes.

CHAPTER 5

Cost of inaction

KEY MESSAGES

- The economic analysis of EMIS and HBS data indicates that access to SWASH infrastructure plays a significant role in keeping children in school for a longer period. That is, on average, access to SWASH is shown to significantly impact the effective number of years that a child stays in school.
- The size of this affect is driven by the package of SWASH infrastructure that is accessed. For example, it is estimated that if a standard package is implemented in all schools, rural school children might stay in school for 1.1 years longer whereas urban children might stay in school for 1.4 years longer. These impacts decrease, but remain significant, for the other packages of SWASH infrastructure modelled.
- When aggregated across all school children in Mainland Tanzania, this analysis indicates that access to SWASH would lead to tens of millions additional years of schooling for the Tanzanian children.
- The analysis clearly shows that the amount of time a child stays in school has a significant impact on their future earning potential. At the margin, an additional year of schooling at secondary school has a bigger impact of earnings than an additional year of schooling at primary school, but both remain important drivers of future earnings.
- As a result of the relationship between SWASH access and effective schooling, this analysis suggests that on average access to the standard package of SWASH infrastructure could lead to a **2.5 per cent increase in average lifetime earnings in rural areas and over a 4 per cent increase in urban areas.**

This section estimates the cost of inaction with respect to investments in SWASH. This is done in three steps: (1) estimate of the relationship between SWASH infrastructure, as reported in the EMIS data set, and effective years of schooling of children who attend those schools (currently, previously or live in the catchment area); (2) estimate of the relationship between effective years of schooling and lifetime earnings; and (3) combine both strands of information to estimate the impact of investments on SWASH on future lifetime earnings of children, using the HBS 2018.

Due to limitations of data, it is not possible to estimate region-specific relationships between SWASH and schooling/earnings, although region-specific differences are considered in the model. That means, for instance, that it is not possible to say that SWASH will have twice as much effect on school dropout in Dar es Salaam than in Arusha, although we do take into account the fact that school dropout rates tend to be higher overall in Arusha than in Dar es Salaam.

5.1 Years of education lost due to poor WASH in schools

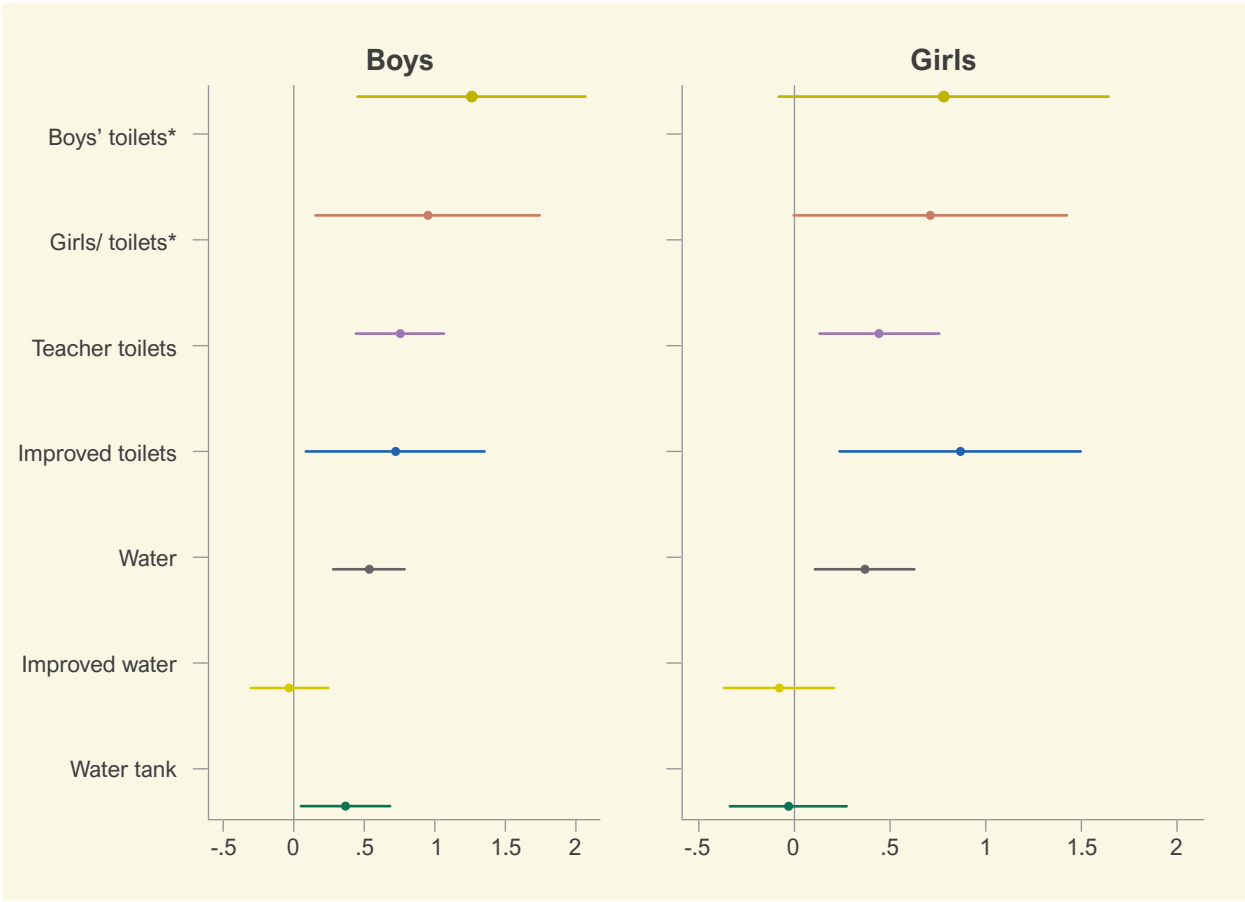
This section looks at the relationship between SWASH infrastructure and effective years of schooling. This is done by comparing the information on SWASH infrastructure contained in the EMIS data set with the information on school enrolment and attendance contained in the HBS. A

standard ordinary least squares (OLS) regression is used to estimate the effect of various types of SWASH infrastructure (girls'/ boys' toilets, teachers' toilets, water tanks, connection to sewage system) on schooling outcomes. Differences in individual characteristics of children, such as age, sex, as well as socioeconomic differences (income, parents' education, etc.), school characteristics (school type, level, etc.) and location (areas of residence, region) are taken into account in order to robustly isolate the effect of SWASH infrastructure.

The coefficients obtained when regressing effective years of schooling on different SWASH infrastructure items, controlling for above-described differences in individual/school characteristics are shown below (see Figure 13). The analysis shows that toilets for boys and for teachers play an important role in increasing effective years of schooling for boys, whereas girls' toilets and access to improved toilets are more significant factors when it comes to girls' education.

For girls, it is not just the number of toilets that matters. The toilets have to be improved and of adequate quality. This is a less decisive factor for boys, probably due to the physiological differences between boys and girls. Improved water is not found to be a decisive factor for boys or for girls in this simplified assessment.[7]

FIGURE 13: EFFECTS OF SWASH ON EFFECTIVE YEARS OF SCHOOLING (POINT ESTIMATES + 95% CONFIDENCE INTERVALS), BY SEX



Source: Author's calculations based on HBS 2018. *Coefficients scaled 1/10 for comparability

[7] These results are illustrative of the key relationship between SWASH and schooling outcomes. They do not capture the full set of non-linearities and interactions between explanatory variables that characterize the relation between SWASH and schooling outcomes, as these are difficult to represent in graph or table format. For the results of the full model used to generate the predictions reported in this section, please see Annex A.1.

A comparative assessment of the projected years of effective schooling by the age of 20 years for boys/girls in urban/rural areas assuming five different scenarios, is shown below (see Figure 14): (1) no WASH – outcome if no WASH facilities were available in schools; (2) current – based on current WASH infrastructure in school; and scenarios (3) to (5) reflecting the minimum, intermediate and standard packages of infrastructure as previously defined (see Table 2). The first scenario can be thought of as a long-term scenario if no investment in WASH were to take place and the existing infrastructure were left to decay. It is provided as a baseline to understand the worst-case outcome.

The figure shows, for instance, that with current WASH infrastructure, rural boys currently aged 6–20 years are expected to have effectively spent 4.1 years in school by the time they reach the age of 20 years. That is comparable to the average time effectively spent in school by persons currently aged 20 years. Based on the current trends, current school-age girls are expected to stay slightly longer in school than boys (+0.2 years in both urban and rural areas).

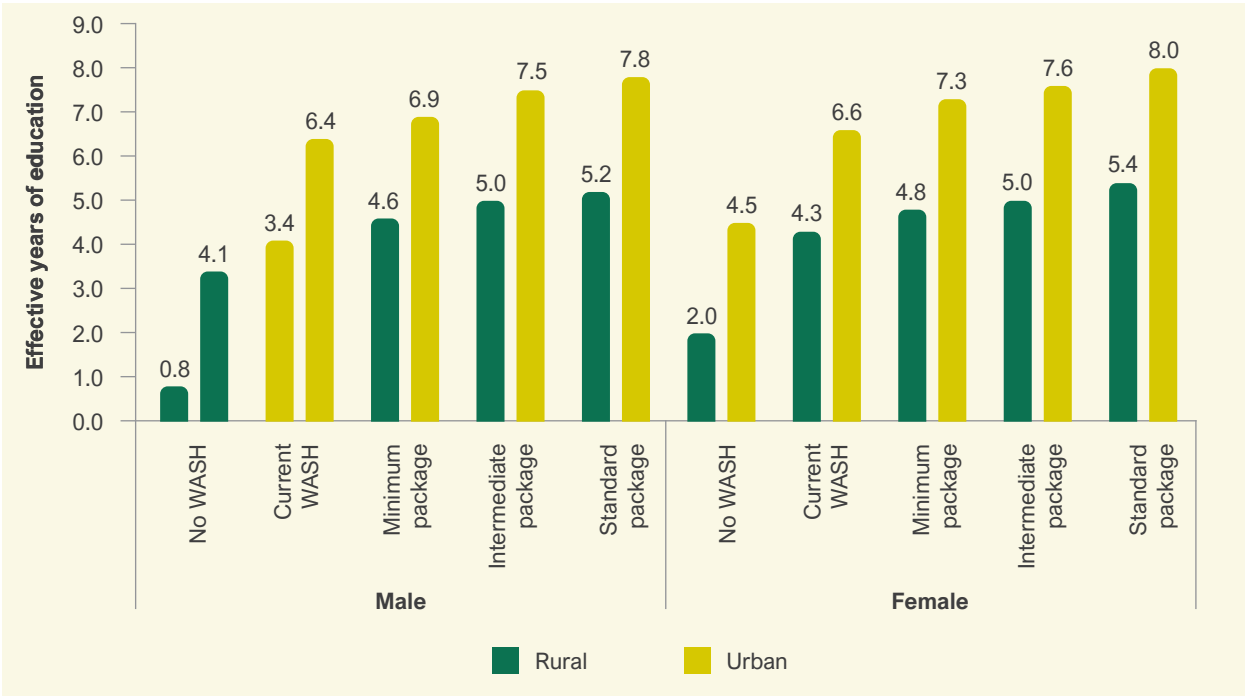
The model predicts that urban children will stay in school 2.3 years longer, on average, than rural children. This probably under-estimates the true urban/rural gap since the model is heavily biased towards rural areas, where most of the observations are located.[8] The current urban/rural gap is closer to 4 years.

Importantly, the model clearly shows that WASH infrastructure plays an important role in keeping children in school. It estimates that without WASH facilities, the average effective schooling for boys may be as much as three years lower in both urban and rural areas. The impact on girls is slightly less pronounced, but still significant and of the same order of magnitude as the impact on boys. It is important to note that these predictions represent averages for all children aged 6–19 years. On the margin, lack of WASH infrastructure may push more boys than girls out of school, as boys tend to have higher dropout rates, fall into child labour and display difficulty in concentration than girls, especially in primary school. This does not deny the fact that for specific groups of girls, such as teenage girls, access to WASH facilities may be a critical factor for accessing school, which may force girls to drop out who might otherwise have done well in school. Secondary school girls only represent 8.5 per cent of all school pupils in Mainland Tanzania and will therefore only have a very minor influence on the overall predictions of this model. Due to data limitations, it is not possible to estimate a specific model for this small group of girls.

The model also shows that further investments in WASH infrastructure could have significant effects on schooling rates. If the standard package were implemented in all the schools, rural school children might stay in school for 1.1 years longer than under current projections, whereas urban children might stay in school for 1.4 years longer. Under the intermediate package of WASH investments, the gains would be still be significant at around 1 year longer in rural areas and between 0.7 and 1.3 additional years of education in urban areas. Under the minimum package, gains would be more modest, but still significant at around +0.5 years.

[8] This is a feature of the OLS regression methodology, which tries to minimize prediction errors at the mean, and therefore pulls predictions in towards the average value, which is heavily tilted towards rural areas because of the composition of the sample. We have tried to mitigate this problem by accounting for the child's area of residence in the model, but this is not sufficient to completely eliminate the bias. The only way to remove the bias would have been to construct a separate model for urban areas only. Unfortunately, it was not possible to construct a sufficiently robust model for such a small sample.

FIGURE 14: PREDICTED EFFECTIVE YEARS OF SCHOOLING AT AGE 20 OF CHILDREN CURRENTLY AGED 0–20, BY LEVEL OF INVESTMENT IN SWASH (% CHANGE COMPARED TO AVERAGE SCHOOLING OF CURRENT 20-YEAR-OLDS) – BY SEX AND AREA OF RESIDENCE



Source: Author's calculations based on HBS 2018 and EMIS 2020.

Overall, therefore, this analysis shows that investment in SWASH infrastructure would lead to Tanzanian children staying in school longer. Applying this impact to the cohort of young Tanzanians who are set to benefit from the modelled SWASH investments, the estimates suggest that investments in SWASH infrastructure would lead to tens of millions of additional effective years of schooling for Tanzanian children (see Table 5). The analysis indicates that if all primary and secondary schools in Mainland Tanzania had the standard package of SWASH facilities, this would result in aggregate benefit of over 35 million additional effective years of schooling for Tanzanian children. Investments to the level of the intermediate package would deliver over 25 million additional effective years of schooling and investment in even the minimum package would lead to an additional 16 million effective schooling years.

Subsequent sections now look to estimate the 'economic value' of these additional years of schooling, and the overall investment case for investing in SWASH.

TABLE 5: ADDITIONAL EFFECTIVE YEARS OF SCHOOL BY LEVEL OF INVESTMENT IN SWASH – BY SEX AND AREA OF RESIDENCE

Package	Sex	Additional school years (rural)	Additional school years (urban)	Additional school years (total)
Standard package	Male	12,125,984	5,498,212	17,624,196
	Female	11,713,476	6,221,633	17,935,109
	Total	**23,839,460**	**11,719,845**	**35,559,305**
Intermediate package	Male	9,259,120	4,403,842	13,662,962
	Female	7,354,098	4,358,169	11,712,267
	Total	**16,613,218**	**8,762,010**	**25,375,228**
Minimum package	Male	6,057,272	2,155,392	8,212,664
	Female	5,488,518	3,070,792	8,559,310
	Total	**11,545,790**	**5,226,184**	**16,771,974**

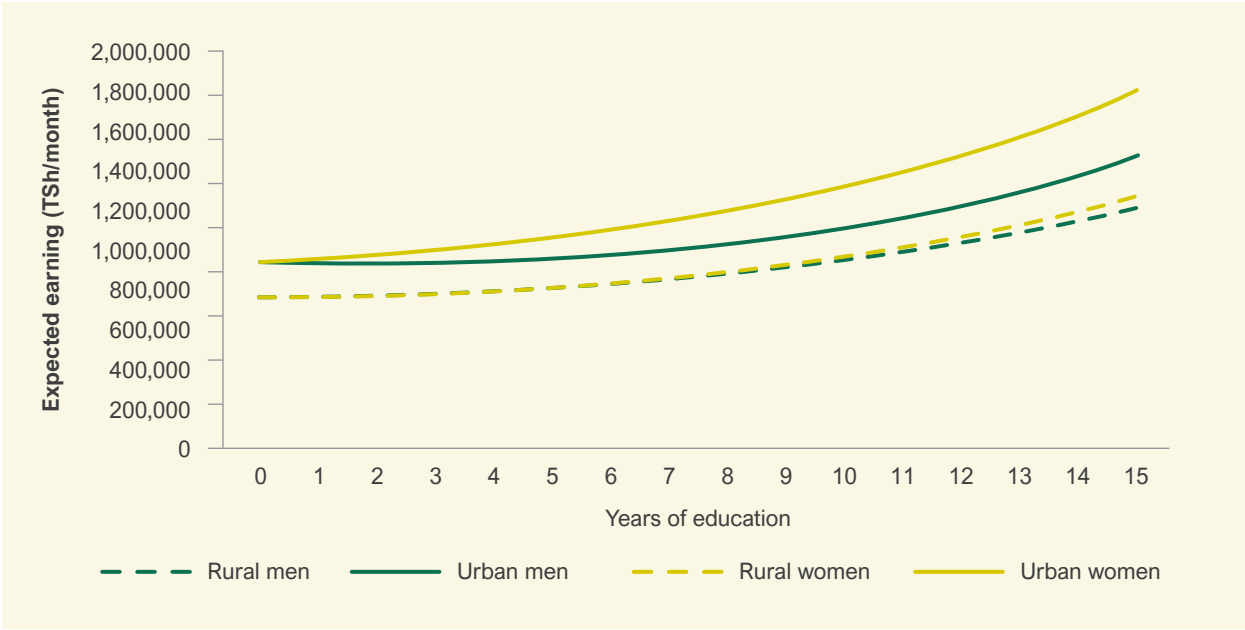
5.2 Income loss from school dropout

This section looks at the link between effective years of schooling and earnings calculated through an economic analysis of the 2018 Household Budget Survey.

In Mainland Tanzania, the median estimated income for women currently aged 21–65 years is TSh 615,254 per month in rural areas and TSh 1.13 million per month in urban areas. Median earnings for men are estimated to be TSh 631,357 per month in rural areas and TSh 998,200 per month in urban areas.

Even when controlling for other factors, individual earnings are heavily influenced by the number of years of schooling. The estimated relationship between effective years of schooling and earnings for the current working-age population, keeping all other variables such as parents' education constant, is shown below (see Figure 15) (for detailed results of the regression analysis, see Annex A.2 below). It shows that expected earnings increase with years of schooling for both women and men in urban and rural areas. The increase is sharpest for women living in urban areas where there is nearly a twofold difference between the median earnings of uneducated women compared to median earnings of women completing secondary school. This reflects the fact that there are more employment opportunities for educated women in urban areas. In all the cases, there is a greater marginal benefit in terms of median earnings for every additional year of secondary education versus primary education. This emphasizes the importance of ensuring effective transition of pupils, particularly female, between primary and secondary age groups.

FIGURE 15: RELATIONSHIP BETWEEN EFFECTIVE YEARS OF SCHOOLING AND INCOME FOR CURRENT WORKING-AGE POPULATION, BY SEX AND AREA OF RESIDENCE



Source: Author's calculations based on HBS 2018.

The HBS analysis to assess the relationship between the projected future average lifetime earnings[9] of Tanzanian children, based on different levels of schooling, has been used below (see Figure 16).

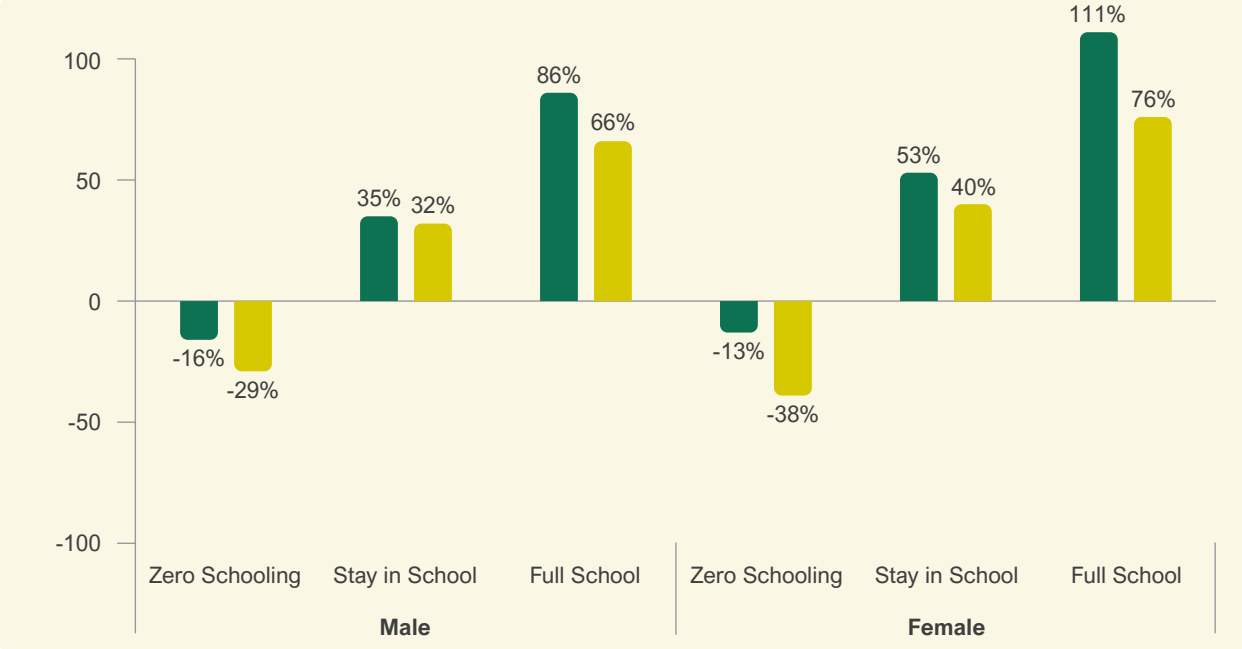
This impact of schooling is explored under three scenarios as follows: (i) *stay-in-school* where children who are currently enrolled in school remained enrolled until the end of secondary schooling, (ii) *full schooling (upper bound estimate)* where all children, including not only enrolled, complete a full cycle of schooling and (iii) *zero schooling (lower bound estimate),* if no children had gone to school. These scenarios are compared against the projected median income based on current trends to best illustrate the marginal impact of higher or lower schooling on earnings.

for all children who are currently enrolled in school remained enrolled until the end of secondary school ('stay in school'), the median lifetime earnings would be about 35 per cent higher for rural boys and 32 per cent higher for urban boys (see Figure 16). For girls, the effect would be even more pronounced at +53 per cent in rural areas and +40 per cent in urban areas, assuming that the labour market remained unchanged.[10] If 'full schooling' is achieved, the impact on lifetime earnings would be between 66 and 111 per cent higher depending on sex and location. Under the 'zero schooling' scenario, the lifetime earnings are projected to fall by between 13 and 38 per cent.

[9] Note that by looking at lifetime earnings, we are able to take into account the fact that children will earn different incomes at different times of their life cycle, due to seniority, productivity, child-care, etc.

[10] In practice, it is possible that very high school completion rates might lower the returns on education due to the oversupply of graduates. Such effects cannot be modelled here.

FIGURE 16: PREDICTED FUTURE EARNINGS IN TSH/MONTH OF CHILDREN CURRENTLY AGED 0–20 YEARS OVER THEIR WORKING LIVES (AGE 21–65 YEARS), BY SCHOOLING (% CHANGE COMPARED TO CURRENT MEDIAN INCOME FOR PERSONS CURRENTLY AGED 21–65 YEARS) – BY SEX AND AREA OF RESIDENCE



Source: Author's calculations based on HBS 2018.

Overall, the findings in this section suggest that there are extremely strong relationships between, firstly, the provision of SWASH infrastructure and number of years children will stay in school and, secondly, the number of years of effective education and average lifetime earnings. The implications of these findings for SWASH investment decision-making is discussed further below.

5.3 Expected effects of SWASH investments on future earnings

In this subsection, we combine the information from the previous two subsections to obtain an estimate of what impact the planned investments in SWASH are likely to have on future lifetime earnings of children. These elements have been brought together below (see Figure 17). Here the numbers on top of the bars represent the percentage change compared to the predicted lifetime earnings of children under the current situation.

We start with the no-WASH scenario, which provides a worst-case baseline by showing what would happen in the long run if no investments are made in WASH – that is, if existing infrastructure were left to decay until no schools had any WASH-related facilities left. Under this scenario, urban children would earn about 5 per cent less than they are currently projected to do (i.e., if current infrastructure were maintained, but not improved upon). The impact in rural areas would be even larger at a 5.7 per cent drop in earnings for both boys and girls.

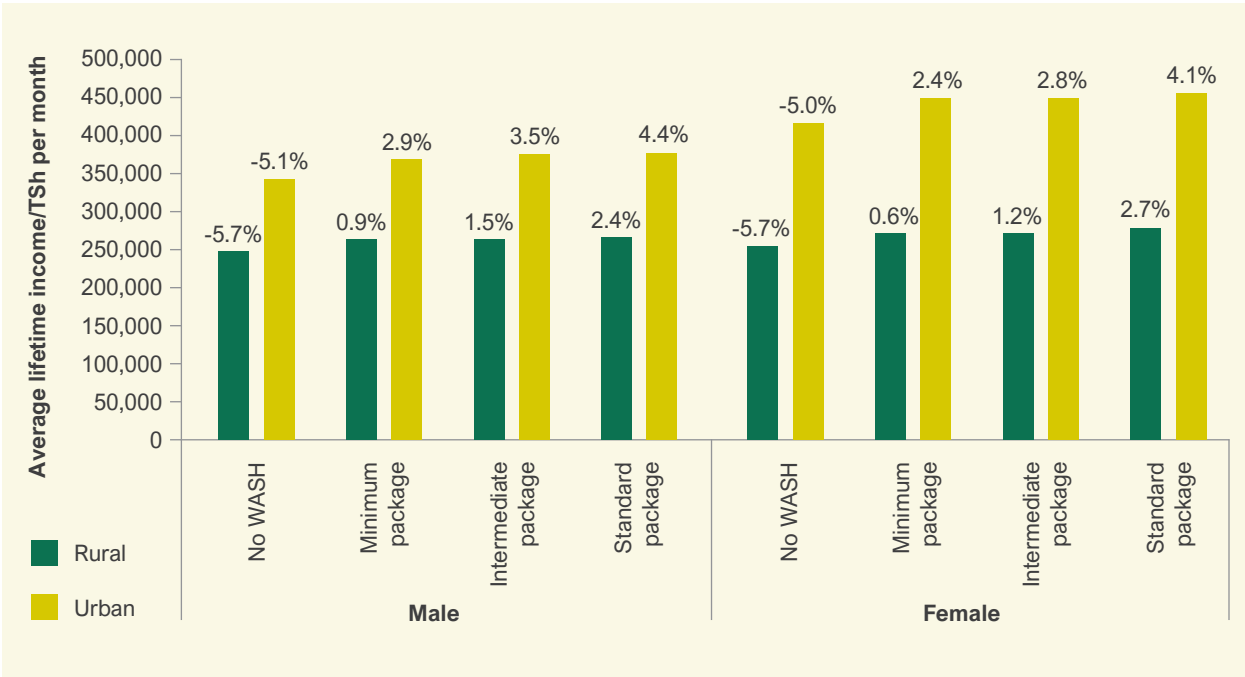
On the other hand, the projections show that investments in WASH could have significant returns on the expected future earnings of children through improved productivity and reduced unemployment. If the standard package were fully

implemented, the average lifetime earnings could be over 2.5 per cent higher in rural areas and over 4 per cent higher in urban areas. The higher returns on investment in urban areas most likely reflect the fact that there are more employment opportunities for skilled graduates in urban areas. While 4 per cent may not sound like much, it adds up to earnings of over TSh 500,000 per year for urban children. Over a lifetime, this could accrue up to over TSh 20 million in additional earnings for each urban child benefiting from improved SWASH.

In rural areas, the return on investment for the standard package appears to be slightly larger for girls than for boys (2.7 per cent versus 2.4 per cent), whereas in urban areas, it is the other way round (4.1 per cent for girls versus 4.4 per cent for boys). Again, this probably reflects the differences in the structure of labour markets and employment opportunities for female and male graduates in urban versus rural areas.

The projected increases in earnings under the intermediate package would be slightly lower but still significant at 3 per cent in urban areas and just over 1 per cent in rural areas. The projected increases under the minimum package are lower still and comparatively less beneficial to girls. This may reflect the fact that the minimum package does not take into account the higher needs of girls in terms of cubicles per pupil. The building of equal number of male and female toilets under the minimum package would therefore be disadvantageous to girls.

FIGURE 17: PREDICTED FUTURE EARNINGS IN TSH/MONTH OF CHILDREN CURRENTLY AGED 0–20 YEARS OVER THEIR WORKING LIVES (AGE 21–65 YEARS), BY LEVEL OF INVESTMENT IN SWASH (% CHANGE COMPARED TO PREDICTED LIFETIME EARNINGS BASED ON CURRENT WASH) – BY SEX AND AREA OF RESIDENCE



Source: Author's calculations based on HBS 2018 and EMIS 2020.

CHAPTER 6

Expected returns on investments

KEY MESSAGES

- **There is a compelling economic case to prioritize investments in SWASH infrastructure and services.** This analysis shows that under all the scenarios, providing universal access to SWASH services provides a staggeringly high return on investment over the medium and long term. Specifically, across all investment scenarios – including the most high-cost approach – the future economic benefits to the economy are well over **100-fold higher than the initial investment requirements.**
- The key drivers of this extremely high RoI include (i) the **strong quantitative relationship** this study has established between SWASH provision, years of schooling and future earnings, (ii) the fact that under the full-coverage investment scenario these benefits are realized across all school-aged children in Mainland Tanzania and (ii) these benefits continue to be realized across the full working life of the child.
- Improving the **effective years of education for urban girls is a critical driver** of the economic returns on SWASH investments.
- As all the packages of SWASH infrastructure show a positive RoI, the Government of Tanzania and their partners have an important decision to make about which package of services is appropriate and affordable. Overall, this study recommends that **full SWASH coverage** should become a key investment priority for the Government and this should be formally adopted as a medium-term strategic goal, keeping the intermediate package standards as a benchmark. Where difficult investment choices need to be made, as an interim measure, decision makers may choose to prioritize the achievement of the intermediate package in urban secondary schools in the first instance, while simultaneously ensuring that **all other schools in all areas** have access to the minimum package of infrastructure.
- This study has **broken new ground** in the sector by using secondary data and econometric techniques to quantitatively assess the relationships between SWASH provision and years of schooling. The apparent strength of this relationship is extremely significant to WASH and education practitioners and policymakers alike. Nevertheless, it is important to note that this analysis subject to several limitations, as outlined in section 3.4 and should be considered indicative of the order of magnitude of economic returns on SWASH. Moreover, due to budgetary and data constraints, this analysis does not provide a full picture of the benefits or costs of SWASH. For example, the analysis does not capture the full potential economic benefits of the SWASH – such as health, learning and female empowerment – which are hard to measure. Nor does it fully capture behaviour change and other software costs which are necessary to help ensure SWASH infrastructure is fully and appropriately used and maintained over time.

In the previous sections, we have used econometric techniques to demonstrate the strong relationship between the provision of SWASH infrastructure and effective years of education and in turn the clear relationship between education and average lifetime earnings. We have also calculated the costs of delivering different levels of SWASH services under three different scenarios, reflected

in different packages of SWASH investments: the standard package, the intermediate package and the minimum package.

In this section, we combine this information to estimate a return on investment (RoI) of SWASH under each of these three scenarios and where RoI is defined as the time required for the returns to the Tanzanian economy to exceed the investment cost required in SWASH.

6.1 Calculating the economic returns of SWASH investments

The strong relationship we have shown between SWASH provision, years of schooling and future earnings means that at the aggregate level the returns on SWASH investments are extremely high. SWASH infrastructure such as toilets and water connections come with significant capital and operational costs; however, the benefits of these investments provide real benefits for all children who access and use them, and these benefits are experienced over a long time frame (i.e., the working life of the child). This leads to substantial aggregate economic benefits, which flow from the provision of SWASH infrastructure. For example, if the standard package of SWASH investments were implemented in all the schools, the analysis indicates the following outcomes:

Accordingly, the aggregate benefits of SWASH investments for all school-aged children are staggering, as indicated below (see Table 6). Over an assumed 40-year working life, the economic returns on the standard package would have a net present value of nearly TSh 250 trillion, which equates to average economic returns of TSh 518 billion per month across all children benefiting from

STANDARD PACKAGE OF SWASH INVESTMENTS WERE IMPLEMENTED IN ALL THE SCHOOLS

Every school-aged child in **rural areas** may receive an **average of 1.1 additional effective years of schooling** that they would have without the SWASH investments. This figure rises to an average of **1.4 additional effective years of schooling** for every school-aged child in **urban areas**.

There are clear economic benefits to additional effective years of education for children in the form of **higher future earnings**. These earnings are accrued over the **entire working life of the child**[11] as the children will remain in the labour market for up to 40 years or more after they finish their education. The benefits from education will therefore continue to accrue for many years after the investment has been completed.

The average increases in lifetime earnings as a result of SWASH investments are estimated to be **2.5 per cent higher in rural areas** and **4 per cent higher in urban areas**. Although 4 per cent may not sound like much, it adds up to earnings of over TSh 500,000 per year for urban children. Over a lifetime, this could accrue up to over TSh 20 million in additional earnings for just one urban child benefiting from improved SWASH.

[11] The analysis shows that on average these benefits accrue in some form to all groups of children - including to those who may now spend greater time in primary school or those children who would not go on the complete secondary school. The main difference is that the economic value of an extra year in education, in terms of future lifetime earnings, is higher for those spending an extra year in secondary school compared to an extra year of secondary school.

TABLE 6: RETURN ON INVESTMENT FOR DIFFERENT SWASH INVESTMENT PACKAGES

SWASH package	RoI over 40 years (TSh billion)	RoI per year (TSh billion)	RoI per month (TSh billion)
Standard package	248,675	6,217	518
Intermediate package	189,409	4,735	395
Minimum package	111,584	2,790	232

this infrastructure. The returns on the intermediate package are still substantial at TSh 189 trillion over 40 years and at TSh 395 billion for month. Even the minimum package when applied to all schools is expected to deliver significant returns at TSh 232 billion per month.

6.2 Comparing the cost of action and cost of inaction

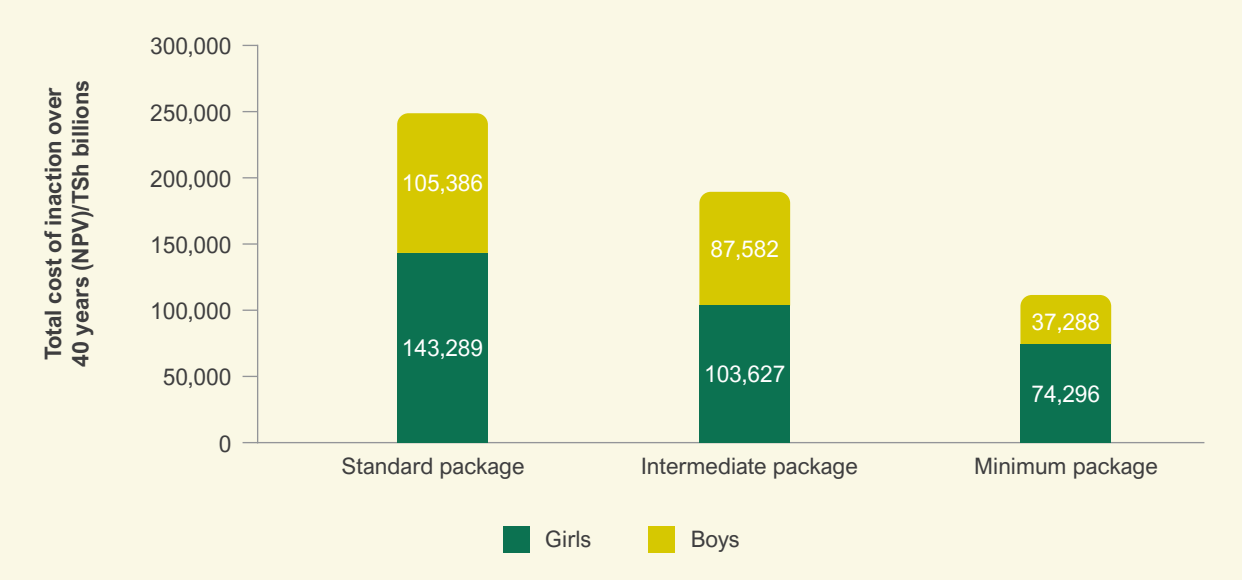
6.2.1 Cost of action

The 'cost of action' analysis provides estimates of the costs of delivering and maintaining specific packages of SWASH infrastructure over a five-year period. The overall costs of these packages are TSh 2.2 trillion for the standard package, TSh 1.2 trillion for the intermediate package and TSh 430 billion for the minimum package of SWASH services. For a comparison against the economic benefits accrued, the RoI analysis also factors in the additional costs of sustaining SWASH access and maintaining the SWASH infrastructure up until 2038. This date reflects the latest possible year when a current child under 20 years of age could finish their secondary education.

6.2.2 Cost of inaction

This 'cost-of inaction' analysis quantifies the economic costs of failing to invest in SWASH services. As illustrated (see Table 6 and also Figure 18), the failure to invest in the standard package of SWASH services would lead to a total loss of income of TSh 248,675 billion over

FIGURE 18: TOTAL COST OF INACTION NET PRESENT VALUE (NPV) (ALL SCHOOLS – MAINLAND), BY SEX – STANDARD, INTERMEDIATE AND MINIMUM PACKAGES



a 40-year period due to loss of productivity and future employment opportunities for children. The loss of income would be particularly stark for urban girls (TSh 143,289 billion for girls compared to TSh 105,387 billion for boys). The projected cost of inaction is lower when considering the intermediate and minimum packages of SWASH services, although the disproportionate impact of under-investment on girls remains.

6.2.3 Comparing costs and benefits across packages

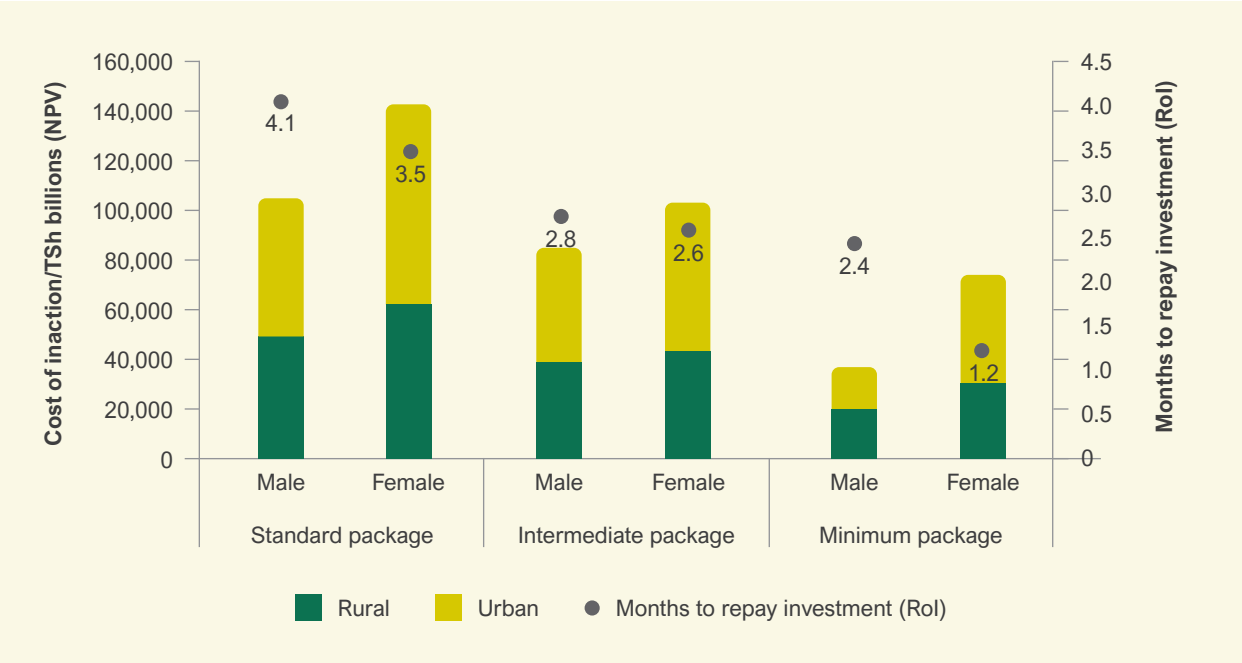
Data on the 'cost of action' and 'cost of inaction' has been brought together in order to assess the RoI on SWASH services, defined as the number of years required to recover the investments made (see Figure 19).

In the case of the standard package, it would take just **4.1 months of future earnings** for boys and **3.5 months of future earnings** for girls to earn back the total combined costs of the **standard SWASH package**. In this sense, that it would take children a handful of months to earn back the investment cost in the form of higher earnings made possible by productivity and employment gains that would not have existed in the absence of investment in SWASH infrastructure. Over the total working life of the children, the lifetime RoI of the standard package would be very significantly positive at 118 times for boys and 138 times girls.

In the case of intermediate package, the economic cost of inaction is slightly lower than the standard package of investment, and total investment cost is also lower. This means that it would take fewer months to recover the investment (2.8 months for boys and 2.6 months for girls). The RoI over the entire working life of children is also extremely positive at 173 times for boys and 183 times for girls.

Finally, in the case of the minimum package, both the cost of inaction and cost of action are much lower than those for the other packages. This means that initial investment costs are recovered sooner (2.5 months for boys and 1.2 months for girls). The RoI is also very high (195 times for boys and 389 times for girls). The higher RoI for

FIGURE 19: TOTAL COST OF INACTION VERSUS COST OF ACTION (ALL SCHOOLS - MAINLAND), BY SEX AND AREA OF RESIDENCE – STANDARD, INTERMEDIATE AND MINIMUM PACKAGES



Source: Author's calculations based on HBS 2018 EMIS 2020.

girls reflects the fact that the minimum package does not differentiate between boys and girls, and therefore has the same cost for both genders, even though the expected benefits in terms of increased earnings are higher for girls.

As all packages of SWASH infrastructure show a positive RoI, the Government of Tanzania and their partners have an important decision to make about which package of services are appropriate and affordable in the Tanzanian context.

The recommendation from the study is that full SWASH coverage should become a key investment priority for the GoT. Within this, the study recommends that the GoT formally adopt the universal SWASH coverage with the intermediate infrastructure package as a medium-term strategic goal, while recognizing that given prevailing resource constraints, the approach to realizing this target will require further nuancing over time. For example, the analysis demonstrates that i**mproving the effective years of education for urban girls is a critical driver of the economic returns on SWASH investments.** Therefore, as an interim measure to maximize RoI, decision makers may choose to prioritize the achievement of the intermediate package in urban secondary schools in the first instance, while at the same time ensuring that all other schools in all areas at the very least are provided access to the minimum package of infrastructure, with the expectation that the quality of this access will progressively improve over time. Policymakers and funders of SWASH may also want to consider targeting SWASH funding at the underserved communities and LGAs, particularly in those regions with very low SWASH access, such as Rukwa, Songwe and Simiyu.

Finally, it is important to remember that this analysis only captures the direct financial benefits accruing to children in the form of higher earnings. The total social RoI is likely to be higher once other benefits are taken into account, such as health, learning, among others. Many of these benefits cannot be easily quantified in financial terms, such as female empowerment resulting from increased schooling for girls. Similarly, on the costing side, future analysis should seek to factor in additional software investments (such as staff training, school-level hygiene and MHH interventions and other behaviour change activities) to complement infrastructure investments. The experience of the Government of Tanzania with the national sanitation campaign has shown how such interventions are necessary to help ensure SWASH infrastructure is fully and appropriately used and maintained over time.

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Annex A: Regression results: cost of inaction

A.1 Estimating the impact of SWASH on years of education

Number of strata	= 1	Number of obs	= 13,552
Number of PSUs	= 13,552	Population size	= 15,377,509
		Design df	= 13,551
		F(87, 13465)	= 142.86
		Prob > F	= 0.0000
		R-squared	= 0.4402

yearsofeduc	Coef.	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnconspae	5.698365	1.70807	3.34	0.001	2.35031	9.046421
c.lnconspae#c.lnconspae	-.2221227	.0751168	-2.96	0.003	-.3693621	-.0748834
age	.6576775	.0667669	9.85	0.000	.5268051	.7885498
c.age#c.age	-.0060089	.0026493	-2.27	0.023	-.011202	-.0008158
_IREGION_2	.085099	.267198	0.32	0.750	-.4386462	.6088442
_IREGION_3	.2580659	.295321	0.87	0.382	-.3208043	.8369362
_IREGION_4	-.3173462	.2750563	-1.15	0.249	-.8564948	.2218025
_IREGION_5	.3613342	.2742148	1.32	0.188	-.1761649	.8988333
_IREGION_6	.3395713	.3067363	1.11	0.268	-.2616745	.9408171
_IREGION_7	-.2742646	.2609774	-1.05	0.293	-.7858166	.2372875
_IREGION_8	-.2630252	.2936469	-0.90	0.370	-.8386139	.3125636
_IREGION_9	.1115563	.3166568	0.35	0.725	-.5091352	.7322477
_IREGION_10	.4952183	.2689852	1.84	0.066	-.0320302	1.022467
_IREGION_11	.5628302	.2697649	2.09	0.037	.0340534	1.091607
_IREGION_12	-.6771562	.3026956	-2.24	0.025	-1.270482	-.0838307
_IREGION_13	.8678006	.2600562	3.34	0.001	.3580543	1.377547
_IREGION_14	.4002224	.2623417	1.53	0.127	-.1140038	.9144486
_IREGION_15	-.5437932	.2904402	-1.87	0.061	-1.113096	.0255099
_IREGION_16	.1401173	.288747	0.49	0.627	-.425867	.7061016
_IREGION_17	-.2123569	.2829164	-0.75	0.453	-.7669123	.3421985
_IREGION_18	-.4611825	.2678958	-1.72	0.085	-.9862956	.0639305
_IREGION_19	-.1618039	.2562121	-0.63	0.528	-.6640152	.3404074
_IREGION_20	.1402788	.2387395	0.59	0.557	-.3276838	.6082415
_IREGION_21	.5509873	.2868914	1.92	0.055	-.0113598	1.113334
_IREGION_22	.2108613	.3236798	0.65	0.515	-.4235962	.8453188
_IREGION_23	.4100009	.375901	1.09	0.275	-.3268173	1.146819
_IREGION_24	-.4465275	.2433569	-1.83	0.067	-.9235409	.0304859
_IREGION_25	.2705513	.2341139	1.16	0.248	-.1883445	.729447
_IREGION_26	-.4534106	.3280597	-1.38	0.167	-1.096453	.1896321
_Ischtype_2	-.7370052	.283307	-2.60	0.009	-1.292326	-.181684
schdist	-.0053931	.00142	-3.80	0.000	-.0081765	-.0026098
_Ischlevel_2	7.914062	.9928048	7.97	0.000	5.968026	9.860097
_Ischmiss_1	0	(omitted)				
toil_boys	1597.721	469.2807	3.40	0.001	677.866	2517.577
c.toil_boys#c.toil_boys	-21822.89	7959.373	-2.74	0.006	-37424.37	-6221.414
toil_girls	-1252.743	386.9702	-3.24	0.001	-2011.259	-494.2278
c.toil_girls#c.toil_girls	12517.75	4075.565	3.07	0.002	4529.077	20506.43
imprwater	.5485106	.4892202	1.12	0.262	-.4104291	1.50745
sex						
Female	1.158819	.5735812	2.02	0.043	.0345198	2.283118
sex#c.toil_boys						
Female	-1191.976	615.0532	-1.94	0.053	-2397.566	13.61337
sex#c.toil_boys#c.toil_boys						
Female	18053.22	9713.263	1.86	0.063	-986.1231	37092.57
sex#c.toil_girls						
Female	997.3735	538.6184	1.85	0.064	-58.39335	2053.14
sex#c.toil_girls#c.toil_girls						
Female	-10738.05	5353.605	-2.01	0.045	-21231.86	-244.2373

WAT_allyear	1.074675	.5329954	2.02	0.044	.0299301	2.11942
c.toil_boys#c.WAT_allyear	-3240.259	879.8622	-3.68	0.000	-4964.911	-1515.607
c.toil_boys#c.toil_boys#c.WAT_allyear	43824.9	12922.9	3.39	0.001	18494.22	69155.58
c.toil_girls#c.WAT_allyear	2989.547	816.8594	3.66	0.000	1388.389	4590.705
c.toil_girls#c.toil_girls#c.WAT_allyear	-35492.1	10653.6	-3.33	0.001	-56374.64	-14609.55
c.imprwater#c.WAT_allyear	-.9270888	.5985915	-1.55	0.121	-2.100411	.2462338
sex#c.WAT_allyear						
Female	-2.139812	.7596557	-2.82	0.005	-3.628843	-.6507814
sex#c.toil_boys#c.WAT_allyear						
Female	2101.002	1224.738	1.72	0.086	-299.6545	4501.659
sex#c.toil_boys#c.toil_boys#c.WAT_allyear						
Female	-35692.04	16965.6	-2.10	0.035	-68946.97	-2437.115
sex#c.toil_girls#c.WAT_allyear						
Female	-1745.852	1131.308	-1.54	0.123	-3963.373	471.6677
sex#c.toil_girls#c.toil_girls#c.WAT_allyear						
Female	26056.05	13938.2	1.87	0.062	-1264.759	53376.85
sex#c.imprwater#c.WAT_allyear						
Female	2.411546	.8927975	2.70	0.007	.6615385	4.161553
c.imprtoil#c.WAT_allyear	-.2481855	.8469548	-0.29	0.770	-1.908335	1.411964
c.toil_boys#c.imprtoil#c.WAT_allyear	3341.106	906.7766	3.68	0.000	1563.698	5118.515
c.toil_boys#c.toil_boys#c.imprtoil#c.WAT_allyear	-46236.37	13399.69	-3.45	0.001	-72501.62	-19971.11
c.toil_girls#c.imprtoil#c.WAT_allyear	-3098.198	837.9783	-3.70	0.000	-4740.752	-1455.644
c.toil_girls#c.toil_girls#c.imprtoil#c.WAT_allyear	37508.69	10847.3	3.46	0.001	16246.47	58770.92
c.imprwater#c.imprtoil#c.WAT_allyear	1.26959	.8776329	1.45	0.148	-.4506931	2.989872
sex#c.imprtoil#c.WAT_allyear						
Female	1.774195	1.16339	1.53	0.127	-.5062109	4.054602
sex#c.toil_boys#c.imprtoil#c.WAT_allyear						
Female	-2246.61	1255.777	-1.79	0.074	-4708.108	214.8868
sex#c.toil_boys#c.toil_boys#c.imprtoil#c.WAT_allyear						
Female	39136.01	17472.37	2.24	0.025	4887.743	73384.28
sex#c.toil_girls#c.imprtoil#c.WAT_allyear						
Female	1925.968	1158.463	1.66	0.096	-344.7803	4196.716
sex#c.toil_girls#c.toil_girls#c.imprtoil#c.WAT_allyear						
Female	-29236.61	14143.49	-2.07	0.039	-56959.81	-1513.411
sex#c.imprwater#c.imprtoil#c.WAT_allyear						
Female	-3.559104	1.2377	-2.88	0.004	-5.985169	-1.133039
notank	.0632008	.1572325	0.40	0.688	-.2449969	.3713984
toil_teachers	.6458034	.1617675	3.99	0.000	.3287166	.9628903
_Iarea_2	.9582326	.1176331	8.15	0.000	.7276554	1.18881
disabscore	-.3262228	.0441507	-7.39	0.000	-.4127644	-.2396813
dadeduc	.2443983	.0357141	6.84	0.000	.1743937	.314403
1.nodad	-23.70148	3.417382	-6.94	0.000	-30.40003	-17.00294
nodad#c.dadeduc						
1	0	(omitted)				
mumeduc	.5237575	.0808511	6.48	0.000	.3652782	.6822369
1.nomum	-49.33083	7.712207	-6.40	0.000	-64.44783	-34.21383
nomum#c.mumeduc						
1	0	(omitted)				
_cons	-42.47928	9.743406	-4.36	0.000	-61.57771	-23.38085

A.2 Estimating the impact of education on income

Number of strata	= 1	Number of obs	= 14,413
Number of PSUs	= 14,413	Population size	= 17,162,729
		Design df	= 14,412
		F(39, 14374)	= 42.03
		Prob > F	= 0.0000
		R-squared	= 0.1598

lnincpc	Coef.	Linearized Std. Err.	t	P>|t|	[95% Conf.	Interval]
disabscore	-.0038572	.0060663	-0.64	0.525	-.0157479	.0080336
age	-.0254656	.0063714	-4.00	0.000	-.0379543	-.0129769
c.age#c.age	.0003447	.0000771	4.47	0.000	.0001936	.0004957
_IREGION_2	.1358411	.071447	1.90	0.057	-.0042043	.2758864
_IREGION_3	-.0094495	.0739103	-0.13	0.898	-.1543231	.1354242
_IREGION_4	.0380348	.0780227	0.49	0.626	-.1148997	.1909693
_IREGION_5	.0570576	.0799552	0.71	0.475	-.0996648	.21378
_IREGION_6	.1258481	.0800722	1.57	0.116	-.0311037	.2827999
_IREGION_7	.4915911	.0698033	7.04	0.000	.3547677	.6284146
_IREGION_8	-.3191097	.0749833	-4.26	0.000	-.4660866	-.1721329
_IREGION_9	-.0906264	.0905918	-1.00	0.317	-.268198	.0869452
_IREGION_10	-.1351414	.0722732	-1.87	0.062	-.2768062	.0065233
_IREGION_11	-.2986502	.0746736	-4.00	0.000	-.4450201	-.1522803
_IREGION_12	-.4176317	.0778495	-5.36	0.000	-.5702266	-.2650367
_IREGION_13	-.1039339	.0741989	-1.40	0.161	-.2493732	.0415055
_IREGION_14	.234141	.0768579	3.05	0.002	.0834897	.3847923
_IREGION_15	-.2107319	.0712744	-2.96	0.003	-.3504388	-.071025
_IREGION_16	-.2352296	.0730023	-3.22	0.001	-.3783234	-.0921358
_IREGION_17	.1634255	.0736139	2.22	0.026	.0191329	.3077182
_IREGION_18	-.1785317	.0692356	-2.58	0.010	-.3142424	-.0428211
_IREGION_19	.1728665	.072058	2.40	0.016	.0316236	.3141095
_IREGION_20	.2341807	.0723401	3.24	0.001	.0923847	.3759767
_IREGION_21	.0597361	.078333	0.76	0.446	-.0938066	.2132788
_IREGION_22	-.0795757	.0775272	-1.03	0.305	-.231539	.0723877
_IREGION_23	.3397463	.0820218	4.14	0.000	.1789729	.5005196
_IREGION_24	.3786604	.0709561	5.34	0.000	.2395773	.5177435
_IREGION_25	.3068075	.073129	4.20	0.000	.1634651	.4501498
_IREGION_26	.2194366	.0863179	2.54	0.011	.0502424	.3886309
yearsofeduc	.0030589	.0090573	0.34	0.736	-.0146946	.0208124
c.yearsofeduc#c.yearsofeduc	.0018381	.0005721	3.21	0.001	.0007167	.0029595
sex						
Female	.004215	.0476951	0.09	0.930	-.0892736	.0977036
sex#c.yearsofeduc						
Female	-.0010394	.0125932	-0.08	0.934	-.0257236	.0236449
sex#c.yearsofeduc#c.yearsofeduc						
Female	.0002856	.0008063	0.35	0.723	-.0012948	.001866
area						
Urban	.2118947	.1117619	1.90	0.058	-.007173	.4309623
area#c.yearsofeduc						
Urban	-.0120594	.0176775	-0.68	0.495	-.0467097	.0225908
area#c.yearsofeduc#c.yearsofeduc						
Urban	.0007325	.0008157	0.90	0.369	-.0008663	.0023313
sex#area						
Female#Urban	-.0103256	.1425009	-0.07	0.942	-.2896456	.2689945
sex#area#c.yearsofeduc						
Female#Urban	.0271503	.0248374	1.09	0.274	-.0215342	.0758347
sex#area#c.yearsofeduc#c.yearsofeduc						
Female#Urban	-.0011062	.0012414	-0.89	0.373	-.0035395	.0013272
_cons	13.54534	.1394853	97.11	0.000	13.27193	13.81875

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