SIEMENS | Stiftung

Leveraging decentralized entrepreneurial approach to safe water supply

A comprehensive study on safe water kiosks and their impact in rural Kenya

Conducted by

eed ADVISORY

In partnership with

SkyJuice FOUNDATION
Safe Water for Every Child

Document title: Leveraging decentralized entrepreneurial approach to safe water supply: a comprehensive study on safe water kiosks and their impact in rural Kenya

Submitted to: Siemens Stiftung

Date: 26 February 2024

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Acknowledgment

The development of this report was facilitated by Siemens Stiftung. Throughout this study, multiple stakeholders were engaged ranging from field experts, Implementing partners (KWAHO and SWAP Kenya among others), County Government Officers, Maji Safi Kiosks owners, operators, and the end users. We would like to extend our gratitude to them for enabling the successful completion of this study.

The drafting of this report was made possible by contributions from EED advisory's internal team including the Statisticians, Analysts, and GIS experts whom we value their effort.

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List of abbreviations

AWF : African Water Facility
CAPEX : Capital Expenditure
CHVs : Community Health Volunteers
CoK : Constitution of Kenya
CWS : Centre for Water Security and Cooperation
DHS : Demographic and Health Survey
GoK : Government of Kenya
IDA : International Development Association
IRC WASH : International Water and Sanitation Centre
MO : Master Operator
NGOs : Non-Governmental Organizations
O&M : Operations and Maintenance
PHOs : Public Health Officers
PPCP : Public-Private Community Partnership
SDGs : Sustainable Development Goals
SWE : Safe Water Enterprises
SSWSPS : Small-Scale Water Service Providers
UNHROHC : United Nations Human Rights Office of the High Commissioner
WASH : Water, Sanitation, and Hygiene
WASREB : Water Services Regulatory Board
WSP : Water Service Providers
WSTF : Water Sector Trust Fund
WUAs : Water Users Associations

Definition of key terms used in this report

Health impact: Has been used in this report to refer to the health benefits that the community enjoys from using water derived from the Safe Water Enterprise (SWE) kiosks

Maji Safi kiosk: These are Safe Water Enterprise kiosks, locally known as MajiSafi kiosks

Maji Safi Users: Households that derive water from the Safe Water Enterprise kiosks

Non-Maji Safi Users: Households that do not depend on water from the Safe Water Enterprise kiosks

Scalability: Has been used to refer to the capacity of the Safe Water Enterprise (SWE) kiosks to expand or adapt the water kiosk infrastructure, services, and resources to meet the growing needs of the community/consumers it serves

Sustainability: Has been used in this report to refer to the ability of the Safe Water Enterprise (SWE) kiosks to withstand both the financial, environmental, and social factors to consistently provide safe water to the consumers

SWE kiosks: These are the Safe Water Enterprise kiosks

Reliability: Three parameters have been used to define the reliability of the kiosks; hours of supply, reported frequency of breakdowns in the past three months, and response time taken to restore the system in case of a breakdown

Accessibility: This encompasses the distance to the water point, the time spent to get to the water point and fetch water, and the quantity of water that households can fetch

Non-revenue water (NRW): This refers to the water that has been produced and is "lost" before it reaches the customer.

Executive summary

Introduction and context of the study

For Kenya, universal access to water, sanitation, and hygiene services (WASH) by 2030 is a USD 22 billion investment question to expand and improve the current services.

Universal access to water in Kenya is a multi-faceted challenge encompassing both a local and socio-economic dimension; stark disparities exist between urban and rural access and high to low-income households. For Kenya, universal access to water, sanitation, and hygiene services (WASH) by 2030 is a USD 22 billion investment question to expand and improve the current services. Presently only USD 11 billion is projected to be available for investment between 2023 – 2030. In the wake of the water delivery service gap, unregulated small-scale service providers flourish, filling a critical gap. Whereas traditional centralized service solutions are critical in closing the gap, for most developing countries, the financial investment required to meet the need is often inadequate.

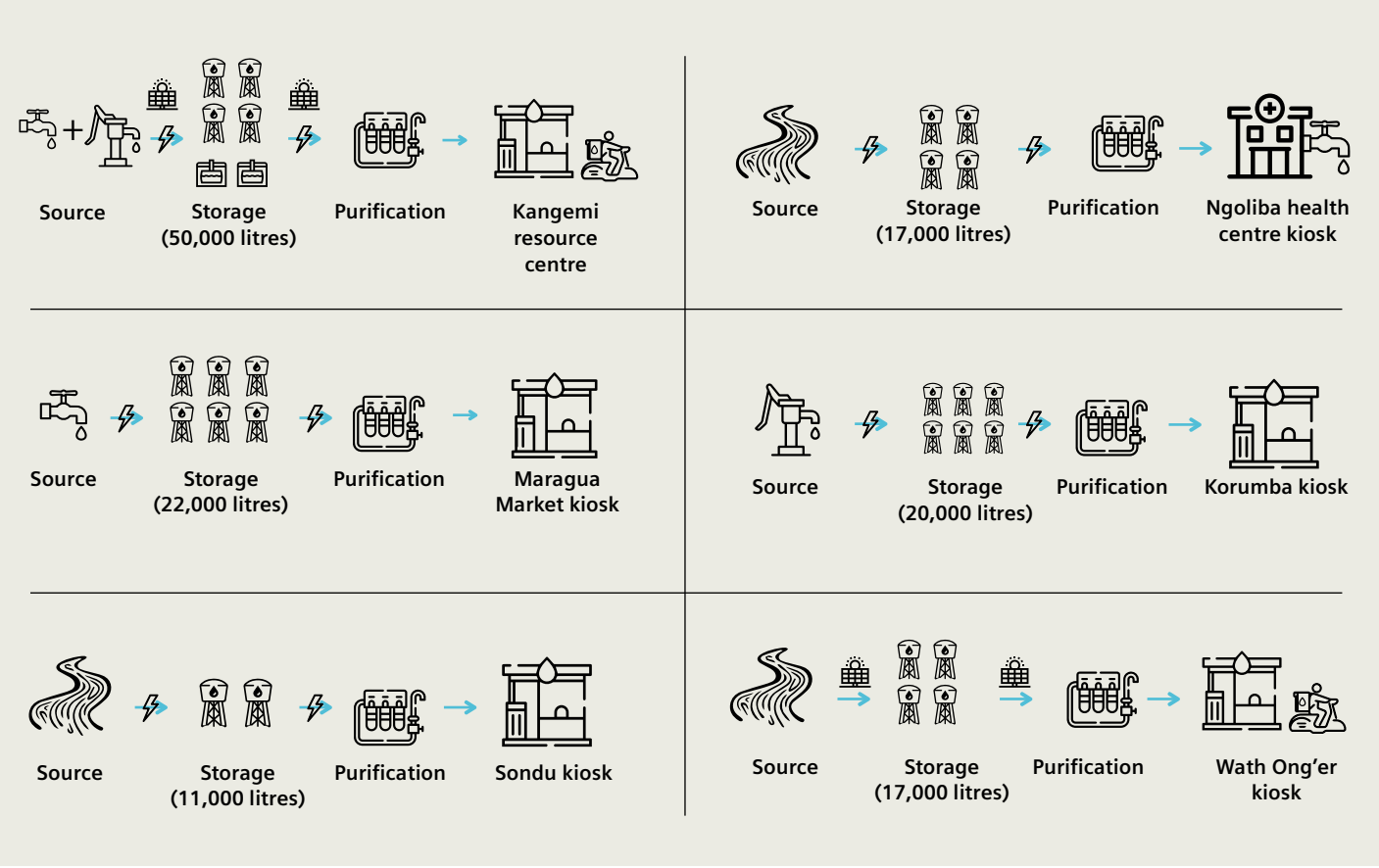
As governments struggle to mobilize enough resources for investment, entrepreneurs, impact investors and donor organizations have experimented with decentralized solution approaches to expand access to safe drinking water. Cognizant of the water access challenges in rural and underserved communities, Siemens Stiftung and SkyJuice Foundation Inc. together initiated the Safe Water Enterprise (SWE) project across several counties in Kenya in 2012/13. These included Kisumu, Migori, Homa Bay, Nandi, Kwale, Nairobi, Muranga, and Kiambu counties. As the project drew to a close, the Siemens Stiftung team handed over all safe water kiosks to the respective County governments as per the Water Act 2016 to hold the assets in trust for the community.

Approach and methodology

Siemens Stiftung commissioned this study to assess six safe water kiosk sites with regard to **1) the extent to which the applied community-led social entrepreneurial kiosk model has been achieved, i) the technical and business performance goals, ii) financial sustainability, iii) scalability as well as iv) the potential social impacts.** The study also aims to 2) identify the i) best practices and ii) success factors, iii) challenges and weaknesses of the model in order to be able to structure further interventions. A mixed methodology approach was employed in obtaining the needed data for this study as demonstrated below and comprehensively discussed in **Annex 3** of this report.

Activity	Technical and business performance evaluation	Sustainability and scalability assessment	Social and health impact analysis	Identifying lessons learnt	Identifying best practices and key success factors
Target respondent	• Kiosk management • Kiosk operators	• Key informants • Kiosk management and operators • Households	• Households • Businesses • Water vendors • Key informants	• Kiosk management • Kiosk operators • Partners • Siemens Stiftung team	• Kiosk management • Key informants
Data collection method	• Key informant interviews (KIIs)-(n=27)	• Vendors interviews-(n=27)	• Households' interviews-(n=512)	• Business interviews-(n=57)	• Observations-(n=6)
Data collection tool	• KII guides	• HHs questionnaire	• Business questionnaire	• Vendors questionnaire	• Observations checklist

A randomized control study design was employed to understand the impact of the safe water enterprise kiosks on the community. This involved selecting an equal number of participants from both the intervention arm *(consumers who obtained water from the kiosk)* and the control arm *(the consumers who did not obtain water from the kiosk)*. The six SWE kiosks evaluated in this study are equipped with different water supply set-ups and operate in different contexts and serve different clients. The SWE kiosks were implemented in partnership with different community partners and have varying governance, and or management structures. Four of the water kiosks are owned and governed by Community-Based Organizations (CBOs) now officially registered as Water User Associations (WUAs), comprising member committees while two are managed by host institutions as shown below.



Assessment findings

The Safe Water Enterprise (SWE) technology uses a low-key membrane ultrafiltration unit that works without electricity by using gravity and produces up to 10,000 litres of safe drinking water per day without requiring chemical treatment.

The Safe Water Enterprise (SWE) technology uses a low-key membrane ultrafiltration unit that works without electricity by using gravity and produces up to 10,000 litres of safe drinking water per day without requiring chemical treatment. The water from the kiosks is accessible, highly affordable, and is primarily used for drinking with consumers from Wath Ong'er, Ngoliba and Maragua kiosks having 24/7 access via water ATMs. However, in some of the kiosks, especially those in rural areas, distance to the kiosks remains an issue, and water vendors are stepping in to fill the existing gap as the kiosks look to scale.

A scoring matrix outlined in chapter three (36) of this report was developed to rate the technical efficiency of the six kiosks. Based on the ratings, all kiosks fall within the moderate to high technical viability range. Except for the Korumba and Ngoliba kiosks which have moderate technical viability, the rest of the kiosks have high technical viability. To improve technical efficiency, the SWE kiosks could:

i. Establish alternative methods to enhance the dependability of their water supply.

ii. Reduce their Non-Revenue Water (NRW) that currently affects the revenues for water which they otherwise would have sold to consumers.

iii. Embrace more regular water testing both from the source and at the kiosk to enhance overall water quality

iv. Establish mechanisms to manage the operation and maintenance needs (O&M) either by having a permanent technician or considering a guaranteed service model

Over three years, most of the SWEs indicated revenue growth, regardless of the setting (rural/peri-urban). Kangemi and Maragua SWEs had a year-on-year increase in their revenue streams with a compounded annual growth rate of 28% and 20%. Wath Ong'er, Ngoliba, and Sondu had a CAGR of 9%, 3%, and 15%, respectively - with fluctuations in their year-on-year revenue, all notably higher than the industry CAGR indicated by the water utilities (2.9%).

Except for Wath Ong'er that has been paying loans in that period, the kiosks, and the main expense classes are homogeneous and primarily related to the operations across the SWEs. The kiosks' expenses revolve around, wages, repairs and maintenance, electricity costs, and transportation.

Although the tariffs seem to provide adequate cost coverage, Kangemi and Korumba's fluctuations highlight the need to develop elaborate cost-effective coping strategies for when production is low. These may include introducing additional water storage to ensure a base supply that can allow sufficient revenue collection to cover the usual times of the water supply system. For longer times – lower production than normal, the kiosks' operators will need to be aware of where they can easily reduce their costs.

All the water kiosks are technically, financially, and environmentally sustainable with only Korumba and Ngoliba exhibiting moderate viability. They will require a few or minor adjustments to ensure long-term sustainability, while the rest are ranked as highly viable. The sustainability of a water kiosk is crucial for its ability to scale. For example, sustainable water kiosks must generate enough revenue to cover their operational costs, maintenance, and potential expansion.

The potential for the kiosks to scale in their present condition is low without external support. Scalability involves the capacity to expand or adapt the water kiosk infrastructure, services, and resources to meet the growing needs of the community it serves. None of the kiosks, in their current state, can scale their operations; enhance the production capacity, set up satellite and or alternative kiosks, and supply water to high-water consumption facilities consistently. One of the ways to scale is to seek financial aid; this can come from either donor partners or banking institutions.

The Safe Water Enterprise (SWE) kiosks have positively impacted the health and well-being of the beneficiary communities. Access to clean water through a water kiosk can profoundly impact a community's health and enhance social equity by reducing disparities in access to clean water, particularly in marginalized communities. The following are some of the success indicators of the project:

i. **Reduced waiting time as a majority of the users experienced minimal wait times, with an average wait of 5 minutes or less.** The time that would otherwise be used queueing or walking to fetch water is now used for doing other household chores.

Scalability involves the capacity to expand or adapt the water kiosk infrastructure, services, and resources to meet the growing needs of the community it serves.

ii. **Rise in business establishments** such as butcheries, saloons, and restaurants that obtain water from the kiosks. Water vending has also become popular across the six sites.

iii. Across the six sites, users report a **reduction in waterborne diseases**, with over 90% of respondents rating the water as clean and safe hence lowering incidences of illnesses like diarrhea and cholera. This is coupled with improved hygiene and sanitation practices.

Access to safe water not only contributes to better health but also spurs community growth in many aspects. For rural and underserved communities where access to safe water is limited due to the multiplicity of unsafe water sources, the Safe Water Kiosks can be seen as a game changer, and Maji Safi is a popular phrase. The following are some of the lessons learned:

i. Efficient water provision requires reliable technology.

ii. Revenues generated from the kiosks may only ensure sustainability but not scalability of the kiosks.

iii. Adequate and continued stakeholder engagement is instrumental for the decentralized systems.

iv. Ultimately, the kiosks can only project what they can track.

Conclusion and recommendations

In conclusion, **the SWE kiosks have increased access to clean and safe drinking water and influenced the establishment and growth of businesses and social amenities in the respective communities in the six sites under assessment.** Further, there is potential to reduce the non-revenue water and increase revenues that would inform their scalability. The following are thus recommended:

i. There is a greater need to capacity-build the kiosk management and operators on fiscal management and maintenance practices. This would go a long way in influencing their potential to scale up and remain sustainable.

ii. To address their operation and maintenance (O&M) challenges, the kiosk may adopt a guaranteed service model in which the entity is granted a portion of the operating costs to cover infrastructural maintenance based on annual contractual agreements.

iii. It will be important for the kiosk management to partner with local health centers/ dispensaries and other interest groups to facilitate awareness creation on the continued use of safe water for drinking and improving their hygiene practices.

iv. For the kiosks to be scalable, there is a need for the local administrations especially the county government to support the community-based social enterprise models through partnerships for collective action with private sector actors.

1.
Introduction

1.1 Water service provision in Kenya

For Kenya, universal access to water, sanitation, and hygiene services (WASH) by 2030 is a USD 22 billion investement question to expand and improve the current services.

For Kenya, universal access to Water, Sanitation, and Hygiene Services (WASH) by 2030 is a USD 22 billion investment question to expand and improve the current services. Presently only USD 11 billion is projected to be available for investment between 2023 – 2030.[1] By definition the term *"universal access to water and sanitation"* is amorphous. For this reason, organizations such as the Centre for Water Security and Cooperation (CWSC) offer perspicuity by redefining access to anchor and placing emphasis on water being physically available in the home, and in reliable and sufficient quantities to meet domestic needs safely.[2] According to Kenya's Demographic and Health Survey (DHS 2022), only 68% of the household population have access to at least basic drinking water services[3] – an improved water source with not more than a 30-minute round-trip collection time. Only 46% of the households have access to drinking water on their premises with 67% of these households indicating sufficient quantities of drinking water within the previous 30 days.[4] By CWSC's definition, only 31% of Kenyan Households have universal access in 2022.

The lack of access to water in Kenya is a multi-faceted challenge encompassing both a local and socio-economic dimension. This means that stark disparities arise when *comparing urban to rural access and high- and low-income* households. In rural areas, the proportion of households with drinking water on their premises is 35% which is half that in urban areas at 70%. For the lowest wealth quintile, only 14% of households have access to water on their premises compared to 84% in the highest quintile.[5] Indicating that for every 6 households in the highest wealth quintile with access to water on their premises, there is only 1 household in the lowest wealth quintile reporting the same.

1. World Bank (2023). *Unblocking Sector Financing for Universal Access to Water Supply and Sanitation in Kenya.* Sector Note. https://www.usaid.gov/kenya/document/water-sanitation-and-hygiene-finance

2. CWSC (2021). Access *Defined Linking Source, Shelter and Service.* https://drive.google.com/file/d/1Pgnp3vFI6b2vzTbHo0C094g0xz2fJJ8W/view

3. KNBS (2023). *Kenya Demographic and Health Survey 2022. Key Indicators Report.* https://dhsprogram.com/pubs/pdf/DM186/DM186.pdf

4. KNBS (2023). *Kenya Demographic and Health Survey 2022.* Volume 1. https://dhsprogram.com/pubs/pdf/FR380/FR380bis.pdf

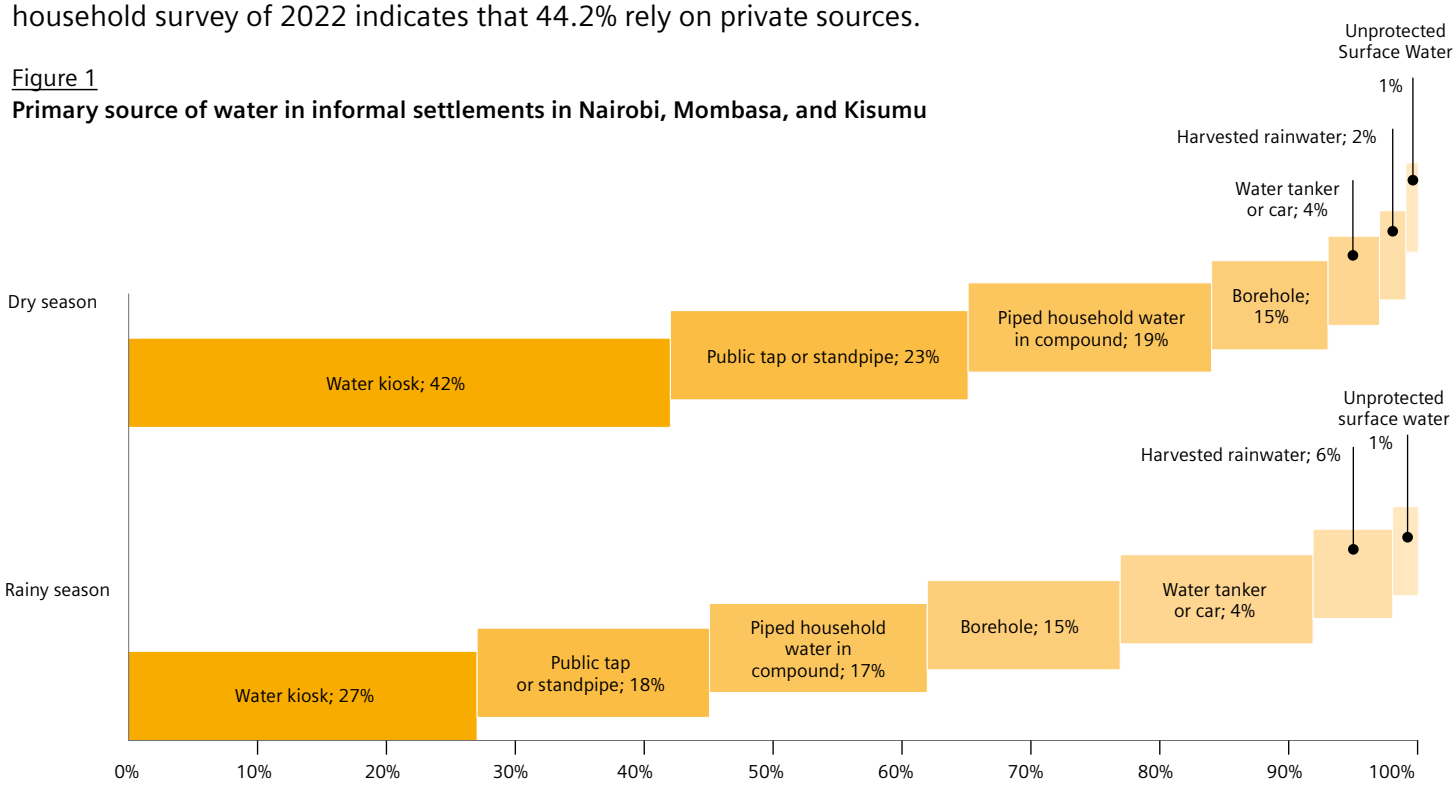
5. ibid

To understand the dynamics of access and underinvestment in rural and urban low-income areas, a review of water service delivery provision is essential. Historically, the legal framework and institutional arrangements for the Government of Kenya (GoK) to develop water supply systems date back to the Water Act, 1952, Chapter 372 (enacted during the colonial period), and the National Water Master Plan (1974).[6] The latter intimated the goal to ensure access to drinking water, at reasonable distances to all households, by the year 2000. However, by the year 2000 – supply systems were developed in only 10 municipalities serving 3.9 million urban dwellers. An additional 550 rural water schemes[7] serving 2.3 million people accessed some level of service through community-operated self-help groups whose capital investments were often from donor organizations.[8] Water Sector Reforms introduced through the 2002 Water Act oriented water supply service provision to a private sector model. Ultimately encouraging efficiency but creating different service levels based on disposable incomes. Water Service Providers focused on middle and high-income areas where revenue gains and growth were higher.[9]

In the wake of the water delivery service gap, unregulated small-scale service providers flourish, filling a critical gap. Often regarded as predatory due to their previously reported exorbitant prices[10], the significance of their role is still not clear. However, what is evident is the sizeable population in urban and rural areas relying on their services. For example, a study by the United Nations Human Rights Office of the High Commissioner (UNHROHC) indicates that, depending on the season, at least 33% - 55% of residents of low-income areas in the 3 major cities of Nairobi, Mombasa, and Kisumu rely on private sources (**Figure 1**).[11] For rural areas, the demographic household survey of 2022 indicates that 44.2% rely on private sources.

Figure 1

Primary source of water in informal settlements in Nairobi, Mombasa, and Kisumu



6.Albert Mumma (2007). *Kenya's New Water Law: An Analysis of the Implications of Kenya's Water Act, 2002, for the Rural Poor.* https://www.iwmi.cgiar.org/Publications/CABI_Publications/CA_CABI_Series/Community_Law/protected/Ch%2010.pdf

7. Githu, I. (2022). *Where Community Management Works: The evolution and professional management of piped water supplies in Rural Kenya. A Doctoral Thesis.*

8. ibid

9. KMT (2019). *The Journey of Changing Water Services Delivery in Kenya.* https://marketshareassociates.com/wp-content/uploads/2020/07/2019-The-Journey-of-Changing-Water-Services-Delivery-in-Kenya.pdf

10. World Bank (2019). Informal Water Markets in an Urbanising World: Some unanswered questions.

11. UN Human Rights (2019). Right to Water in Kenya; Assessment of Access to Water in Informal Settlements. https://www.ohchr.org/sites/default/files/Documents/Countries/KE/Assessment_right_water_Kenya2020.pdf

1.2 Significance of the Safe Water Enterprise (SWE) models

Whereas traditional centralized service solutions are critical in closing the gap, for most developing countries, the financial investment required to meet the need is often inadequate. Despite a doubling of the investments towards the water and sanitation sector in Kenya between the years of 2012 and 2017, that is, from KES 15 billion to 30 billion – the annual expenditure is less than a third of what is needed (KES 105 billion/year).[12] Traditionally these centralized solutions provide access to improved sources, that do not involve treatment at the point of consumption.[13]

As governments struggle to mobilize enough resources for investment, entrepreneurs, impact investors and donor organizations have experimented with decentralized solution approaches to expand access to safe drinking water. The Safe Water Enterprises (SWE) use market approaches to deliver high-quality water treated at the point of consumption. Often, these solutions offer the full range of services across the value chain – from extraction, treatment, and payment collection.[14] In the context of middle- and low-income countries, these enterprises have installed Water ATMs which increase accessibility and provide affordable safe drinking water.[15]

Serving more than 3 million people, SWE models are a low-cost solution.[16] A 2023 report on the performance of the SWE model in India indicates that at capex costs of about USD 20,000 – USD 30,000 serving about three to five thousand, SWEs offer safe drinking water at approximately USD 1/person/year or USD 15/person.[17] The latter is considerably cheaper than the per capita costs reported for a new piped water connection through a small-scale water service provider in urban – USD 50, and in rural settings – USD 20 in Kenya in 2011.[18,19]

Despite a doubling of the investments towards the water and sanitation sector in Kenya between the years of 2012 and 2017, that is, from KES 15 billion to 30 billion – the annual expenditure is less than a third of what is needed.

12. MoWSI (2023). *The Kenya National Water and Sanitation Investment and Financing Plan 2022 – 2030.*

13. Dalberg Advisors (2017). *The Untapped Potential of Decentralized Solutions to Provide Safe, Sustainable Drinking Water at Large Scale. The State of the Safe Water Enterprises Market.*

14. ibid

15. Safe Water Network (2023). *Sustainable Enterprises for water and health financial and operational performance of safe water enterprises in India.*

16. Dalberg Advisors (2017).

17. Safe Water Network (2023).

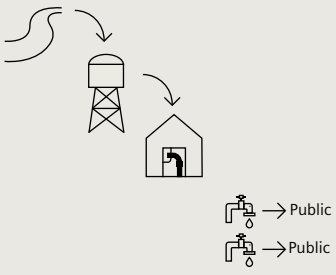
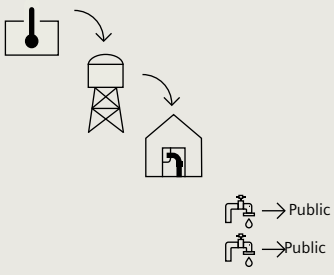
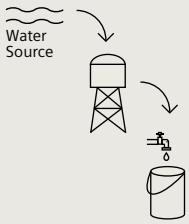
18. IFC (2011). *SSAWA Market Brief No. 1: The Market for Small-Scale Piped Water Systems in Kenya*

19. Conversion rate from KES to USD = 87 as per the 2011 report.

Using the SWE per capita cost from India as a proxy to the costs to be expected in Kenya, USD 15/person is ten times cheaper than the USD 155/person (*USD 603 per household*) for a new urban piped connection through the public utilities in Kenya.[20] With the additional benefit of offering high drinking water quality, though granted, it would not be accessible to the households at their premises.

Figure 2

Per capita cost of implementing varied decentralized solutions - piped small scale water supply systems vs. Safe Water Enterprise in urban and rural settings in Kenya and India (EED Advisory, 2023)

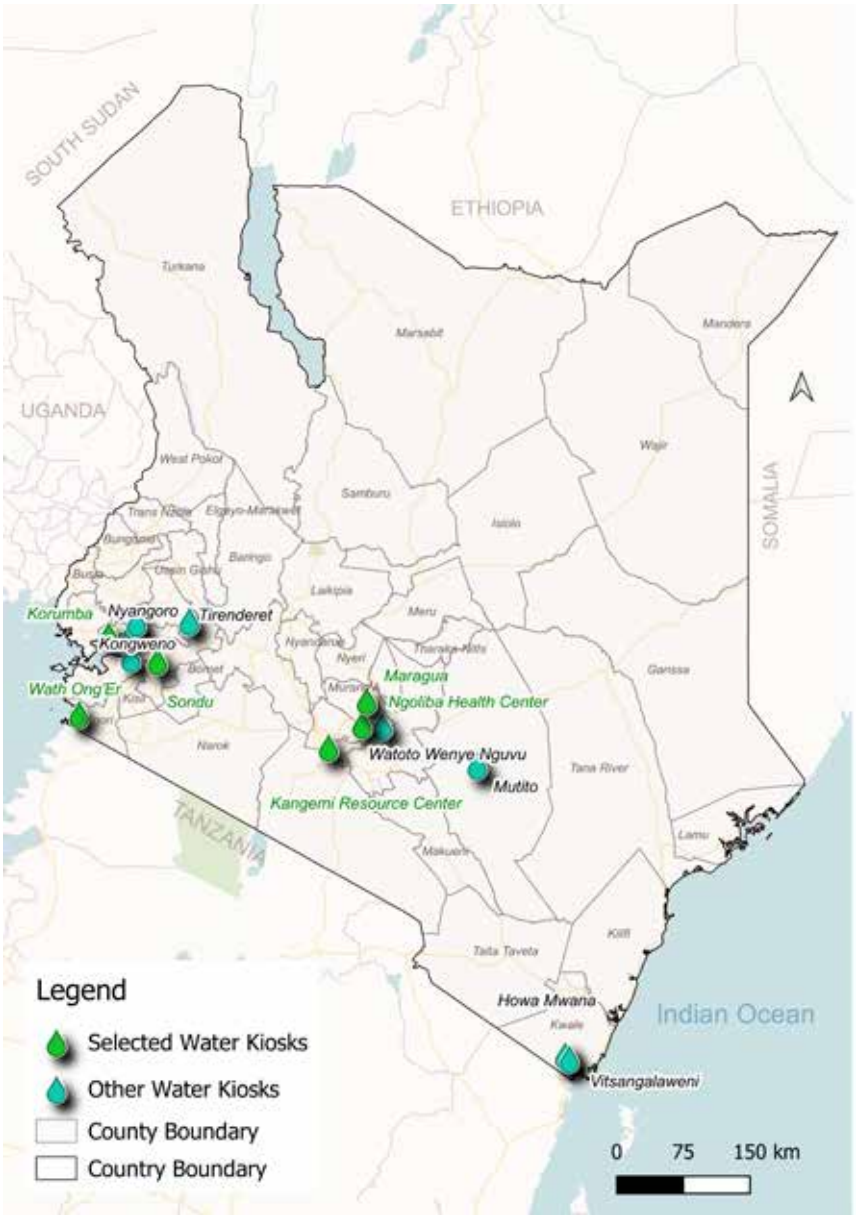
Characteristics	Urban setting	Rural setting	Urban or rural setting
Type of system	Small scale piped supply	Small scale piped supply	Safe Water Enterprise
Water supply system schematic			
No. of people served	20,000	5,000	3,000
per capita cost	USD 50	USD 20	USD 15
Year	2011	2011	2023
Region	Kenya	Kenya	India

20. MoWSI (2023). *The Kenya National Water and Sanitation Investment and Financing Plan 2022 – 2030.*

1.3
About the Safe Water Enterprise (SWE) project in Kenya

Cognizant of the water access challenges in rural and underserved communities, Siemens Stiftung and Sky Juice Foundation Inc. together initiated the Safe Water Enterprise (SWE) Project in Kenya in 2012/13. Further, Siemens Stiftung was motivated by the need to proof-concept the decentralized Water kiosk model as a social entrepreneurial business providing safe water to rural communities at an affordable price. Siemens Stiftung implemented the Safe Water Enterprises (SWE) project, locally labeled and known as Maji Safi kiosks, setting up 16 kiosk sites over 7 years to increase access to a steady supply of clean drinking water in underserved rural and peri-urban communities with limited infrastructure. **Figure 3** illustrates the SWE project sites across Kenya, highlighting the 6 sites selected for this assessment.

Figure 3
SWE / Maji Safi kiosk sites – locations and selection



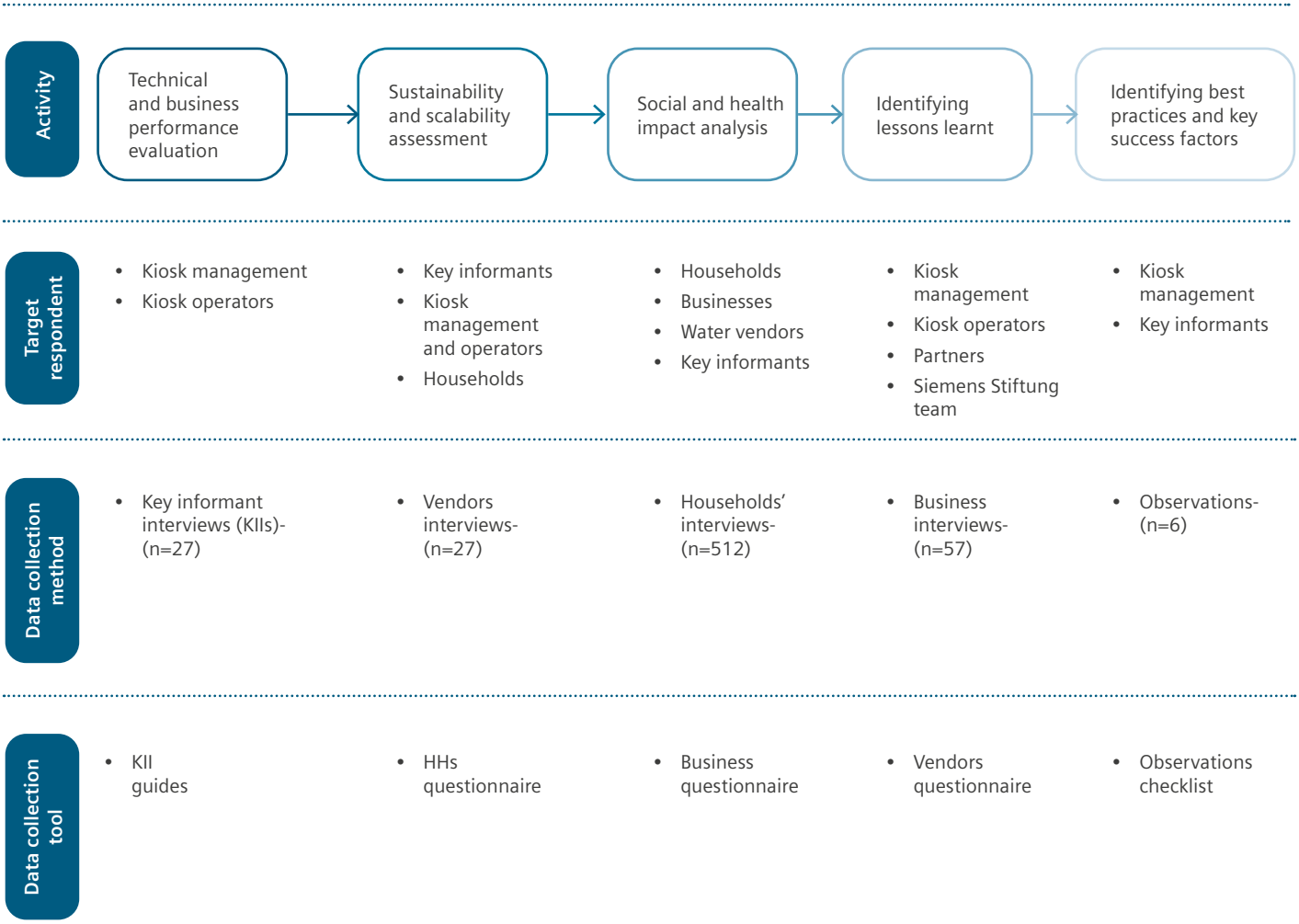
As the project drew to a close, the Siemens Stiftung team handed over the water kiosks to the respective County governments as per the Water Act 2016 to hold the assets in trust for the community. In line with Kenyan laws, community-based organizations registered as Water User Associations (WUAs) are to be sub-licensed by the respective county to run a Safe Water Enterprise.

In line with this objective, Siemens Stiftung has commissioned this study to assess i) the extent to which the applied community-led social entrepreneurial kiosk model has been achieved, ii) the technical and business performance goals, iii) financial sustainability, (iv) scalability as well as v) the potential social impacts. The study also aims to identify the i) best practices and success factors, ii) challenges, and weaknesses of the model in order to be able to structure further interventions. The results of this study are expected to inform the development of future strategies and activities by Siemens Stiftung in the WASH sector.

1.4 Summary of the approach and methodology

A mixed methodology approach was employed in obtaining the needed data for this study.[21] **Figure 4** presents a summary of the data collection methods and tools used in obtaining the needed data for this assessment. These methods are comprehensively discussed in **Annex 3**.

Figure 4
Summary of data collection methods used in this study



21. No single method was used to collect the data required.

2.
The Safe Water Enterprise (SWE) kiosks project in Kenya

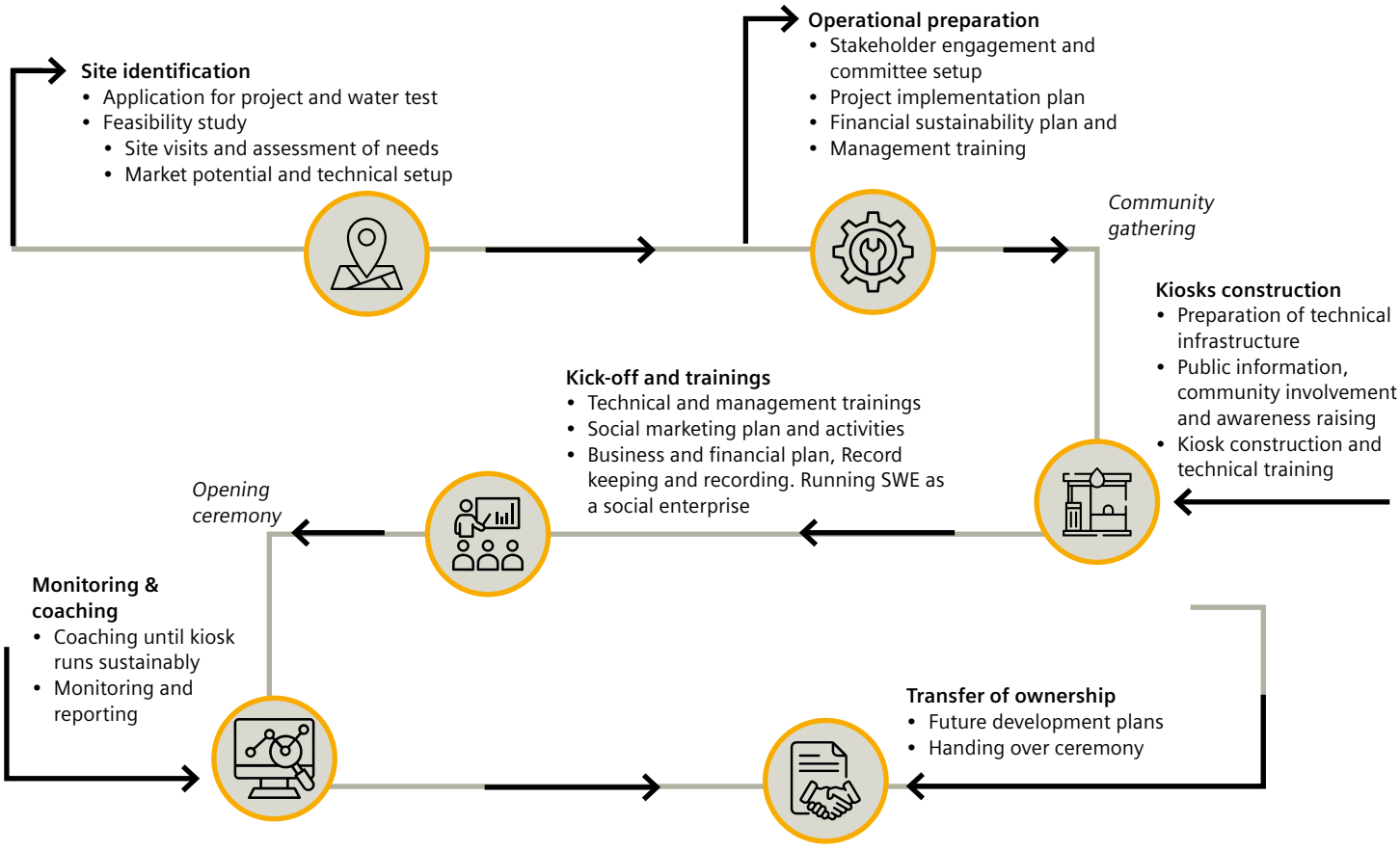
2.1 Project implementation process (PIP)

2.1.1 Project initiation

Conventionally, the process of setting up a kiosk to the point where it is financially independent and entirely owned and operated within a community is considered to take two to three years. However, this is not usually the case due to unprecedented challenges attributed to the technical capability of the operators and their financial standing. **Figure 5** summarises Siemens Stiftung's SWE project implementation process.

The process begins with site identification, visits, and conducting a feasibility study to help analyze and understand the situation on the ground. The purpose is to gain an understanding of the true challenges facing the community/ village and a sense of daily water consumption. It is also at this stage where the project team engages the local regional and local government representatives. The other processes continue sequentially up to the point where the kiosk is handed over to the community to run in consultation with the relevant county department as indicated in the figure below.

Figure 5
Project implementation process (PIP)



2.1.2
Components of the SWE project

Siemens Stiftung identified and continuously monitored four components of the Safe Water Enterprise (SWE) model, across the project sites. These components are described below:

Figure 6:
Components of the SWE project

1. Technology

The kiosk uses a low-key membrane ultrafiltration unit that works without electricity by using gravity and produces up to 10,000 litres of safe drinking water per day without requiring chemical treatment.

The kiosk is standardized, pre-fabricated modular expandable according to the demands; some use Water ATMs.

2. Social entrepreneurial business model

SWE is designed to become financially self-sustainable, which means the revenues from water sales cover running costs (even though margins are low in the water sector) and, ideally, kiosk operations create a surplus that can either help the kiosk business to grow or contribute to building capital in village savings and loans associations (VSLAs).

3. Community participation

Involving the community is crucial for the buy-in of customers and clients. Social marketing strategies including common price-setting were conducted.

WASH awareness trainings targeting kiosk operators, water and food vendors, science teachers at Primary schools as well as representatives of the local health care system (PHOs[22], CHVs[23]). Therefore, Siemens Stiftung was working with the Kenya Water for Health Organization (KWAHO).

4. Community-led ownership model

Community-based organizations (CBOs) sign a MoU in order to form a Water Committee which collaborates with WSP and/or County Water Department to get registered as Water Users Associations and sub-licensed as small scale water service providers.

As a related alternative model, some kiosks are attached to a health centre or a resource centre where access to safe water is needed.

22. Public Health Officers (PHOs)

23. Community Health Volunteers (CHVs), now called Community Health Promoters (CHPs)

2.1.3
SWE project stakeholders (beneficiaries and actors)

The project had three main target groups which form part of this assessment. These are highlighted in the **Figure 7** below:

Figure 7:
Project's target group

General

- **Underserved communities** in rural, informal and peri-urban areas in Kenya
- **Decision makers** and relevant stakeholders such as Government Officials and local representatives

SWE Kiosk level

- Water **Management Committee** / Water Users Associations
- **Kiosk operator** and assistant
- **Kiosk customers and clients** (Individuals as well as water and food vendors)

Community level

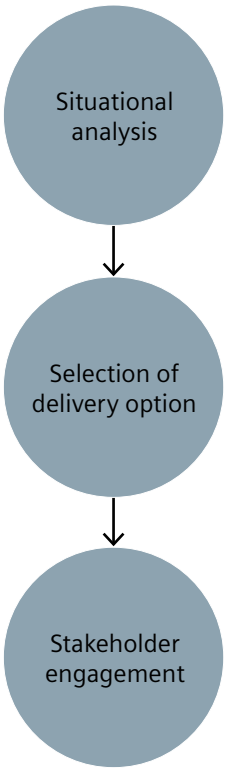
- **Multipliers in health sector:** Public Health Officers, Community Health Volunteers
- **Multipliers in education sector:** Head and science teachers in primary schools

2.2 Setting up Safe Water Enterprise (SWE) project in Kenya

The provision of basic water services to rural and underserved communities is a responsibility of the county governments under current regulations (Water Act, 2016).[24] Section 72(1) as read together with section 94(3) requires WASREB to determine and prescribe national standards and make recommendations on how to provide basic water services to marginalized areas.[25] These areas are predominantly places where the formal water utilities have limited or no coverage.

To decentralize water services to underserved communities, WASREB envisions three-pronged steps in the identification of delivery options; situational analysis, selection of delivery options, and stakeholder engagement. At the heart of water service delivery to these areas, is the continued partnership with the county government to among others, establish different water service delivery options based on coverage. The consultations are aimed at obtaining information on the technical, financial, commercial, governance, legal, socio-economic (*willingness and ability to pay for water and sanitation services*) and environmental assessments, market research, and commercial viability analysis of the targeted small-scale water utilities or an underserved area.

Figure 8:
Components of the SWE project



24. Water Act, 2016. Available at: https://wra.go.ke/download/the-water-act-2016/

25. WASREB. (2019). *Sanitation Services in Rural and Underserved Areas in Kenya Guideline; Water Services for all for Provision of Water and Sanitation.*

WASREB recognizes water kiosks as the most common type of water vending in Kenya[26] and are either privately owned, utility-owned, or community-owned. Further, consumers obtain water from the kiosks either directly (using their containers) or indirectly through water vendors who ferry the water to their premises, and or houses. Just like the supply system designed under the SWE project indicated in **Table 1** below, WASREB describes water kiosks as having three components highlighted below

Table 1:
Components of a water kiosk according to WASREB's guidelines (2019)

#	Stakeholder	Thematic areas
1	Source	The source can be a borehole, river, or piped water into the kiosk
2	Storage	The water storage is in most cases an elevated tank mounted on top of the water kiosk
3	Distribution	Some kiosks vend water directly to customers through a piping system or wait for customers to come and collect at a central point

The multiplicity of the water vending systems including the establishment of water kiosks calls for a new approach to ensure water safety through better regulations. WASREB recognizes that a participatory, multi-stakeholder approach is necessary to ensure that the kiosks operate within the set regulations. While the Water Act of 2016 mandates utilities to provide safe water to consumers, WASREB regulates the interests and rights. According to WASREB, water utilities are at the grassroots of their authority levels and are better suited to regulate water vending rather than view them as competitors who are out to unmask their inability to ensure adequate water coverage. Specifically to water kiosks, **Table 2** highlights some of the regulatory provisions.

26. WASREB. (2019a). *Guideline on Water Vending. 1–42.*

Table 2:

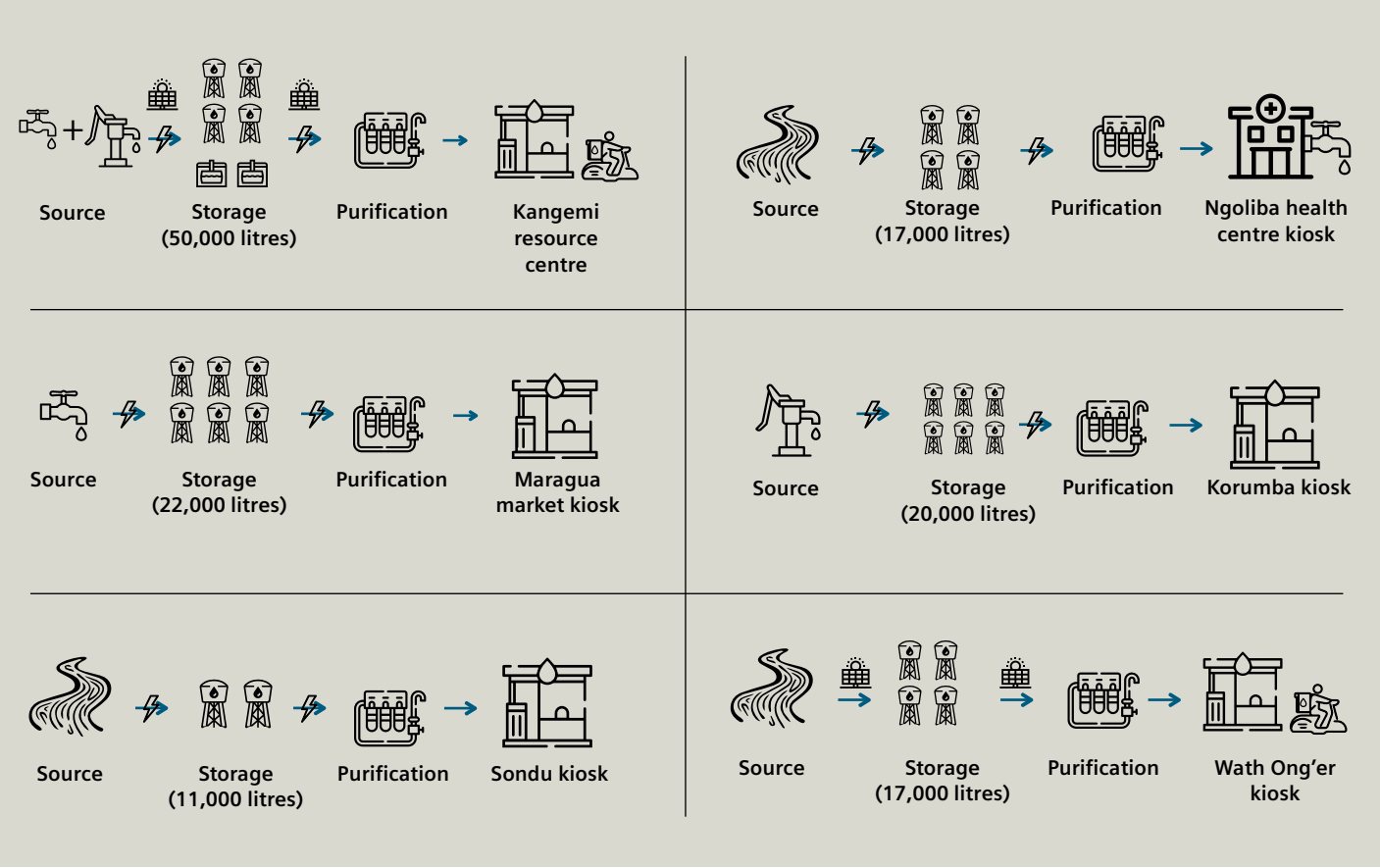
Regulatory provisions for water kiosks

#	Area/component	Regulatory provision by WASBREB	SWE kiosk approach
1	Kiosk ownership	The kiosks shall be owned by either the WSPs, private individuals (including landlords), or community organizations	The SWE kiosks are primarily owned by community-based organizations, but some are owned by the institutions from which they are established that are based in the community. For example, Kangemi water kiosks are owned by the Kangemi Resource Centre.
		In cases where the land does not belong to the kiosk owner, she/he/they will be required to have approval or consent or a Memorandum of Understanding from the owner of the land on which the kiosk is built.	The majority of the SWE kiosk owners own the land on which they are built. Some have acquired the land through credit like Wath Ong'er to have the kiosk set up.
2	The water kiosk structure	The kiosk will typically be a concrete/steel structure capable of supporting an overhead tank of a given capacity with a lockable and secure door.	The design of the SWE kiosk complies with this regulation (Made of a steel structure).
		The floor of the water kiosk and the area around the kiosk should be free-draining so that no water can stagnate.	All the SWE water kiosks evaluated have free-draining floors and surroundings.
		The kiosk and its surroundings must always be kept in a clean and tidy state.	All the SWE kiosks have water operators who ensure the kiosks and their surroundings are kept clean.
3	Water kiosk operators	A kiosk operator must be literate (*can read and write) and numerate (can understand and use* numbers) i.e. a person who has at least received primary school education.	All the SWE kiosks have literate individuals who understand their roles and responsibilities including safe handling of the filtration system.
4	Business hours	The operating hours of the kiosks will be determined by the WSPs and will be dependent on the number of clients, the amount of water they require, and their water-fetching habits.	The SWE kiosks with ATMs operate 24/7 hence customers can obtain water at their convenience. For kiosks with no ATM, the operating hours are at least 8 hours a day.
5	Kiosk metering and billing	Every water kiosk will have a water meter to monitor water consumption and this will form the basis of billing the kiosk operator.	With the Water ATMs, the SWE kiosks can monitor sales volumes from the sales records. However, with the reported potentially high non-revenue water from two kiosks (Kangemi and Ngoliba), it will be imperative to have meters installed to track supply and consumption. This would be particularly for the school and hospital respectively.
6	Water retail prices /tariffs	The price will be set in such a way that the water users find it affordable while at the same time, it guarantees a good profit for the kiosk operator after settling his bills.	For most of the SWE kiosks evaluated, the tariffs are friendly and affordable with the cost of a 20-litre jerrican ranging between KES 5.00-10.00. Consumers are satisfied with the amount they pay for water at the SWE kiosks which they deem as affordable. This cost only changes and becomes expensive when the customers have to rely on water vendors to supply the water at the household level. All the kiosks have reported positive growth in their revenues which is sufficient to cover their management and operational needs.
7	Record keeping, and reporting	The kiosk operator will be required to keep a record of his operations at the kiosk. Some of the things to be recorded will include the opening and closing meter reading, daily cash collections, bill payment dates and receipts, water outages or poor quality of water, and any other incidences that may occur.	Based on the evaluation, while some records are available – the SWE kiosks are not consistent with their record-keeping with some having limited to no records. All six kiosks have financial records on sales and bills.
8	Kiosk handover	The regulation requires that the county executive committee member for water in the county, and with advice from the water services director, commission the handing over of the small-scale service providers once the situational assessment and viability analysis are completed, and the agreed service delivery option adopted.	While Siemens Stiftung remained cognizant of this regulatory provision, some counties were not willing to take over the SWE kiosks. For example, in Kiambu County, the officers remained reluctant despite the clear provisions mandating the County Executive Committee member in charge of water affairs to handle the handover processes. Moreover, since the kiosks are located within a health facility, it was not clear whether it would still fall under the Ministry of Water or be placed under the Ministry of Health.

2.3
SWE kiosks profiles and the water supply system

The six SWE kiosks under assessment are located within a community set up across the five counties. In **Figure 9** below, we highlight the water supply system across all the SWE kiosks indicating the source of water, storage, filtration/purification, and point of distribution. As illustrated below, some of the kiosks (Kangemi and Ngoliba) supply institutions within the kiosk location. The individual kiosk profiles have been discussed in **Annex 3**.

Figure 9:
The SWE kiosks water supply system. Source: EED Advisory, 2023



As demonstrated in Figure 9, the six SWE **kiosks** evaluated in **this study are equipped with different water supply set-ups and operate in different contexts including community, social, and business environments hence serving different clients.** The SWE kiosks were implemented in partnership with different community partners and have varying governance, and or management structures. Most of the water kiosks are owned and governed by Community-Based Organizations (CBOs) comprising member committees. In Wath Ong'er, the kiosk is governed by a Water User Association (WUA) that was registered in 2022 under the name Lower Nyatike Water Users Association. Similarly, in Kisumu, Korumba recently registered as a Water Users Association. **Table 3** below provides more information about the year of establishment, location of the kiosks, surrounding population, sources of water and energy, and storage capacity. Three out of the six water kiosks, including Ngoliba, Wath Ong'er, and Maragua Market, are equipped with a water ATM system hence providing a water supply for 24 hours. The rest of the kiosks range between 8-12 hours of water supply depending on the season.

Table 3:
Summary information on the SWE kiosks evaluated

Site location	Kiosk	Kangemi Resource Centre	Ngoliba Health Centre	Maragua Market	Korumba	Sondu	Wath Ong'er
	Location	Kangemi informal settlement, Nairobi County	Kiambu County	Murang'a County	Kisumu County	Kisumu County	Migori County
Characteristics	Population of the surrounding community	11,472 households	4,812 households	3,344 households	1,777 households	2,846 households	1,828 households
	Year of establishment	2014	2014	2014	2015	2017	2019
	Source of water	Nairobi Water and Sewerage Company and a private borehole	Thika river	Murang'a Water and Sewerage Company (MUWASCO)	Borehole	River Sondu	River Kuja
	Source of energy	Electricity and solar	Electricity	Electricity	Electricity	Electricity	Solar
	Storage capacity (Litres)	50,000	17,000	22,000	20,000	11,000	17,000
	Management governance	NGO (Kangemi resource centre)	Public Institution (Ngoliba health centre)	CBO (registration as WUA underway)	WUA (Korumba)	CBO (registration as WUA underway)	WUA (Lower Nyatike Water)

3.
Technical performance of the SWE kiosks

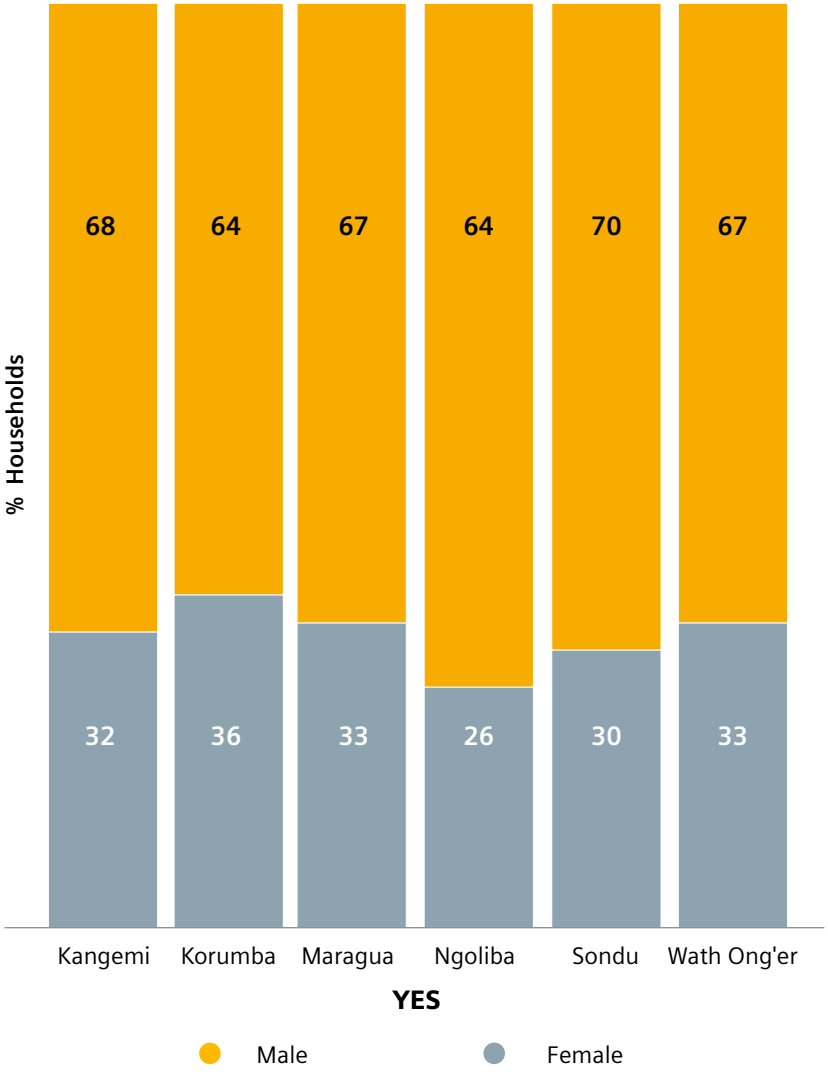
3.1
Overview and context

This chapter presents the demographic characteristics and an objective technical assessment of six SWE kiosks from the five counties (Nairobi, Kiambu, Muranga, Kisumu, and Migori) to establish their technical viability. The initial sections provide a contextual overview of each kiosk location and the technical information of each water kiosk. The assessment culminates in the scoring and ranking of the water kiosks. The findings are based on the methods and indicators described in **Section 1.4** and **Annex 3**.

3.2 Socioeconomic and demographic analysis: Who is using the safe water from the kiosks?

Across all six kiosks under the study, both Maji Safi (*households that obtain water from the kiosks*) and non-Maji Safi (*households that do not obtain water from the kiosks*) households are headed by males. **Figure 10** highlights the gender distribution of the household heads for Maji Safi users.

Figure 10:
Gender of household head (Maji Safi users)

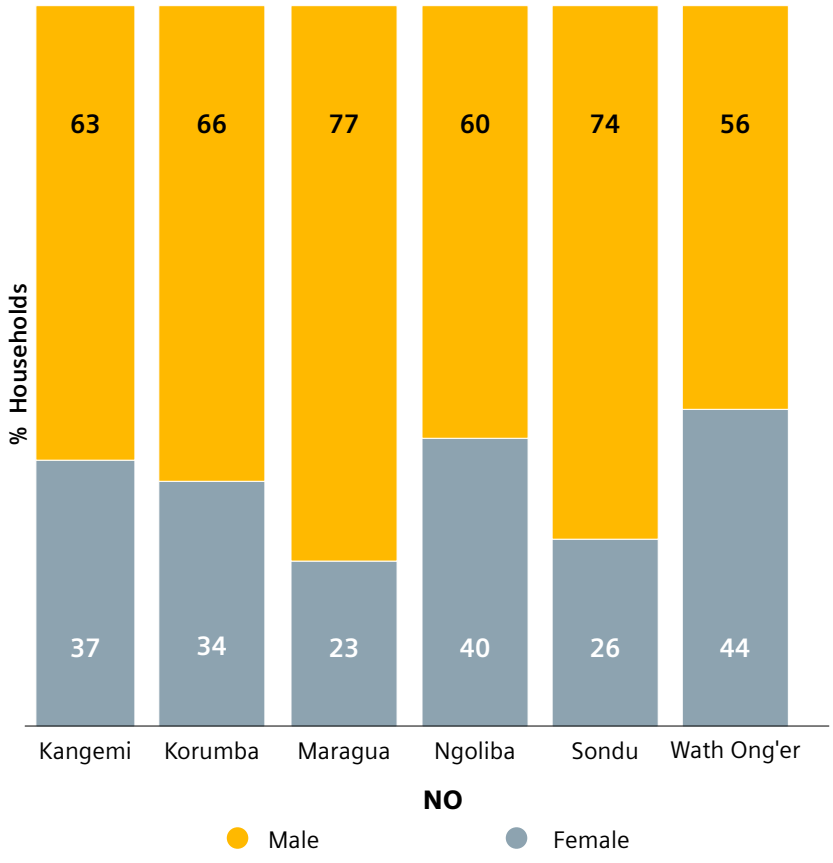


Globally, women and girls aged 15 and above are mainly responsible for water collection in 7 out of 10 households that do not have water supplies within their premises.

In Korumba, Maragua, and Sondu, there is a higher number of Maji Safi households headed by females compared to non-Maji Safi users in the same regions. However, in the remaining three kiosk regions, there is a higher percentage of female-headed households using non-Maji Safi compared to the Maji Safi users.

Globally, women and girls aged 15 and above are mainly responsible for water collection in 7 out of 10 households that do not have water supplies within their premises.[27] As such, they are more likely to be in charge of selecting the water source for use by the household.[28] In another study, it was highlighted that male-headed households are less likely to choose an improved source compared to female-headed households.[29] However, from this data, we observe that there is no direct relationship between a higher percentage of households being led by females and the use of Maji Safi. **Figure 11** highlights the gender distribution of the household heads for non-Maji Safi Users.

Figure 11:
Gender of household head in non-Maji Safi households



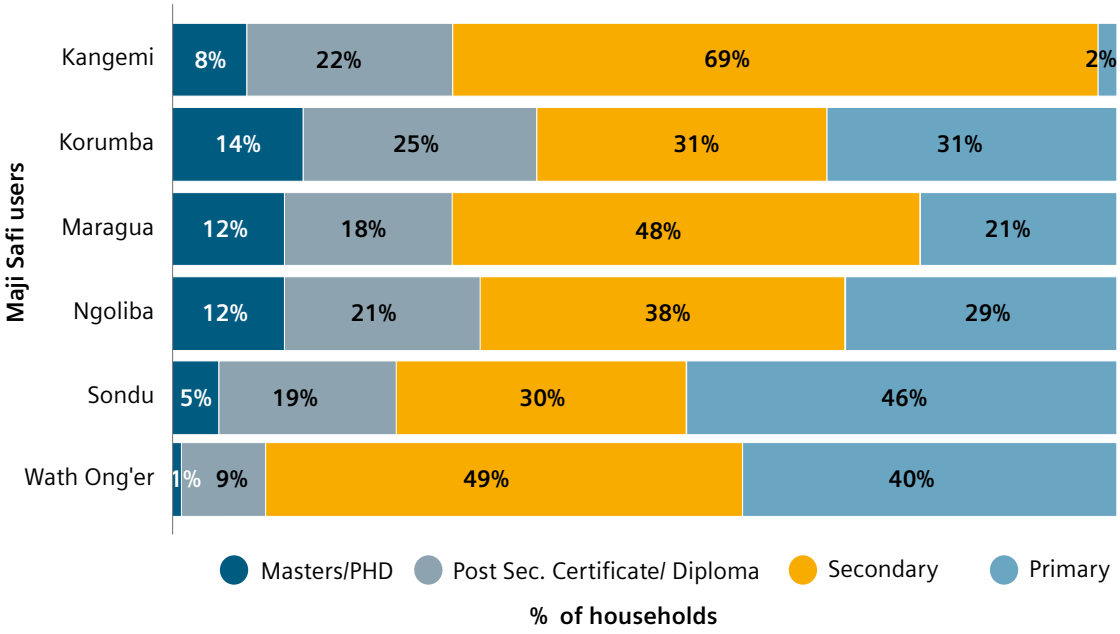
27. UNICEF and WHO (2023). *Progress on household drinking water, sanitation and hygiene 2000-2022: Special focus on gender* https://data.unicef.org/resources/jmp-report-2023/

28. ibid

29. Morakinyo O.M. et. Al (2015). *Wealth status and sex differential of household head: implication for source of drinking water in Nigeria.*

Maji Safi users have a higher percentage of household heads with post-primary education compared to non-Maji Safi users - Kangemi (90.0%), Wath Ong'er (60.0%), and Maragua (78.8%). On the other hand, in Ngoliba, Sondu, and Korumba, there is a higher percentage of non-Maji Safi household heads with post-primary education.

Figure 12:
Education level of household head in Maji Safi households

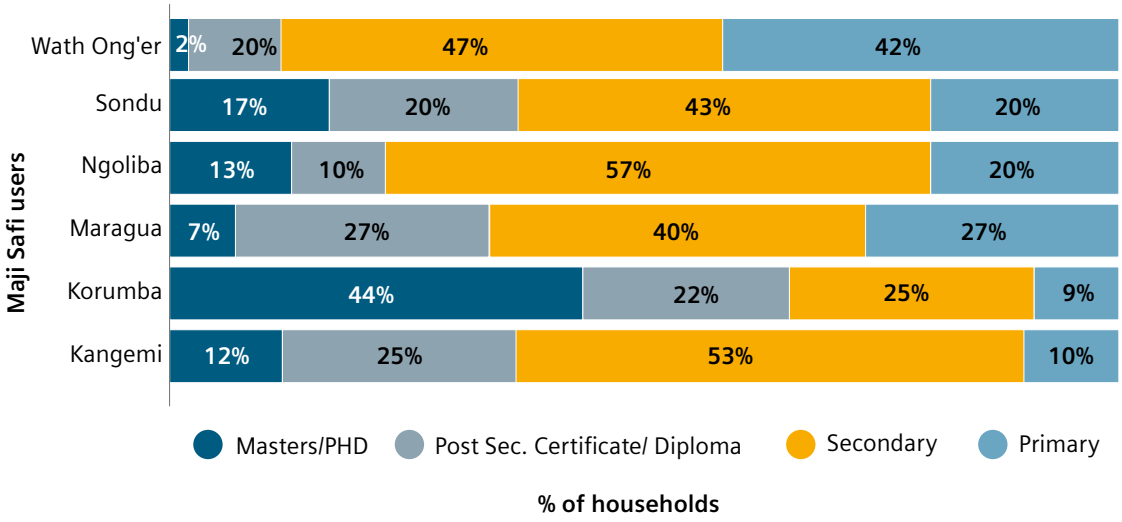


A study was conducted in Cameroon to establish the determinants of access, use, and sustainability of improved water sources by households. From the results, the likelihood of households using improved water sources has a positive association with the education level, and wealth, among others.[30] A separate study in Bomet, Kenya corroborates these findings, the author aimed to determine the effects of socio-economic factors on access to improved water sources and sanitation. From their findings, the occupation and education level of the head of the household strongly impact the choice of water source used within the household.[31] However, as seen in this research, the household head's level of education does not correspond with the increased use of Maji Safi.

30. Tankoua L.B. (2021). *Determinants of access, use and sustainability of improved water sources by households in Cameroon*

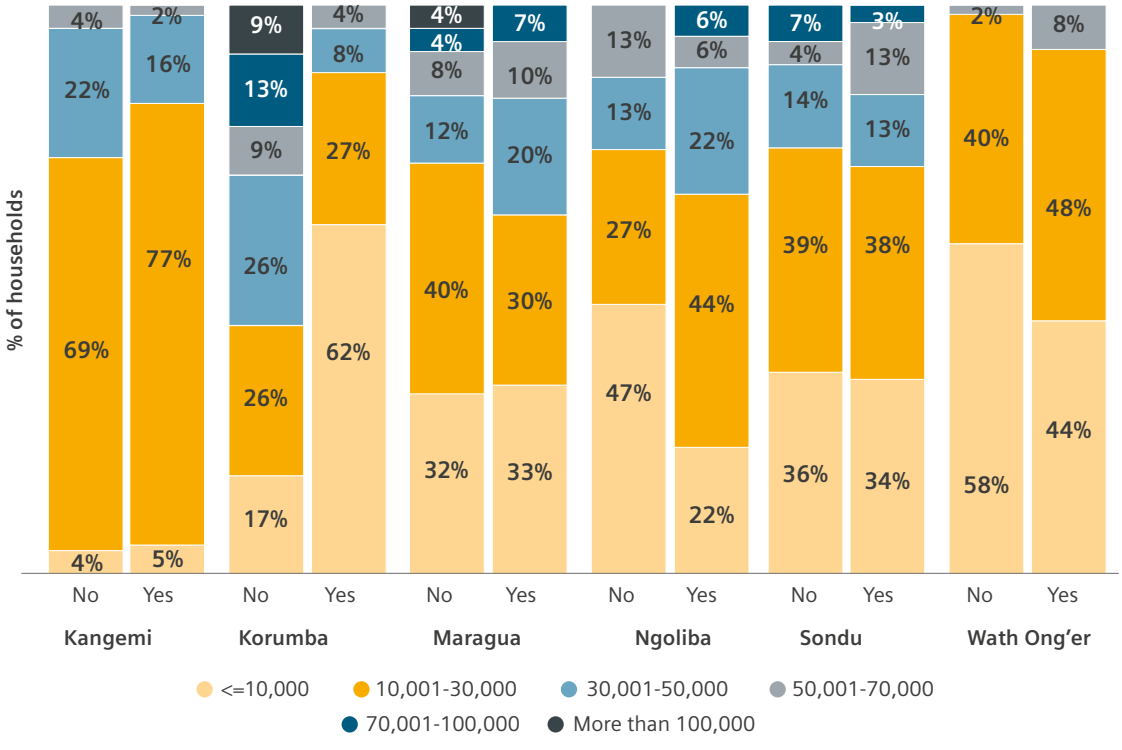
31. ibid

Figure 13:
Education level of household head in non-Maji Safi households



In Kangemi (77.0%), Ngoliba (44.0%), Wath Ong'er (48.0%), and Sondu (37.5%) majority of Maji Safi users earn an average income of between KES 10,000 – 30,000. In Maragua (33.3%) and Korumba (61.5%) majority of Maji Safi users earn an income below KES 10,000. Although the choice to use Maji Safi water, is not only associated with higher incomes, it is worth noting that the median price of a 20-litre Maji Safi jerrican within these regions is either the same or slightly lower than that of non-Maji Safi. It's only in Maragua where the price of Maji Safi is slightly higher than that of non-Maji Safi. Therefore, the income levels would not determine a household's decision to either use or not use water from the Maji Safi kiosk.

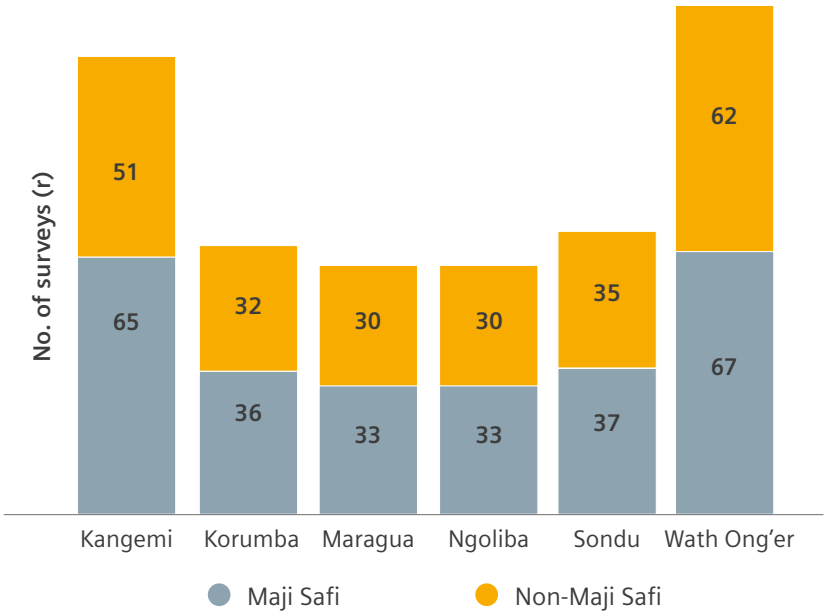
Figure 14:
Head of household income ranges (no represents non-Maji Safi users and yes represents Maji Safi users)



3.3
Water sources and use

To understand the impact of the project on the community, the study targeted both consumers who obtain water from the kiosks and those who do not. **Figure 15** below provides a breakdown of the Maji Safi and non-Maji Safi users interviewed across each kiosk site.

Figure 15:
Distribution of Maji Safi and non-Maji Safi users across the study respondents



The Maji Safi kiosk water is used for drinking, followed by cooking and household cleaning. The least common activities include livestock and crop farming (**Table 4**). About 3.1% of users in Kangemi use the Maji Safi water for crop farming; this is reportedly for kitchen gardening as Kangemi is an informal settlement. Out of the six kiosks, Korumba has the highest percentage of households (58.3%) using Maji Safi for all their needs. Ngoliba and Maragua have the lowest percentage of households using Maji Safi for all their household needs because they use this water for drinking purposes only. The excessive cost of transportation, river water being available for free, and the presence of a large tank for water harvesting are the other reasons why households in Maragua and Ngoliba report lower usage of Maji Safi for all their household needs.

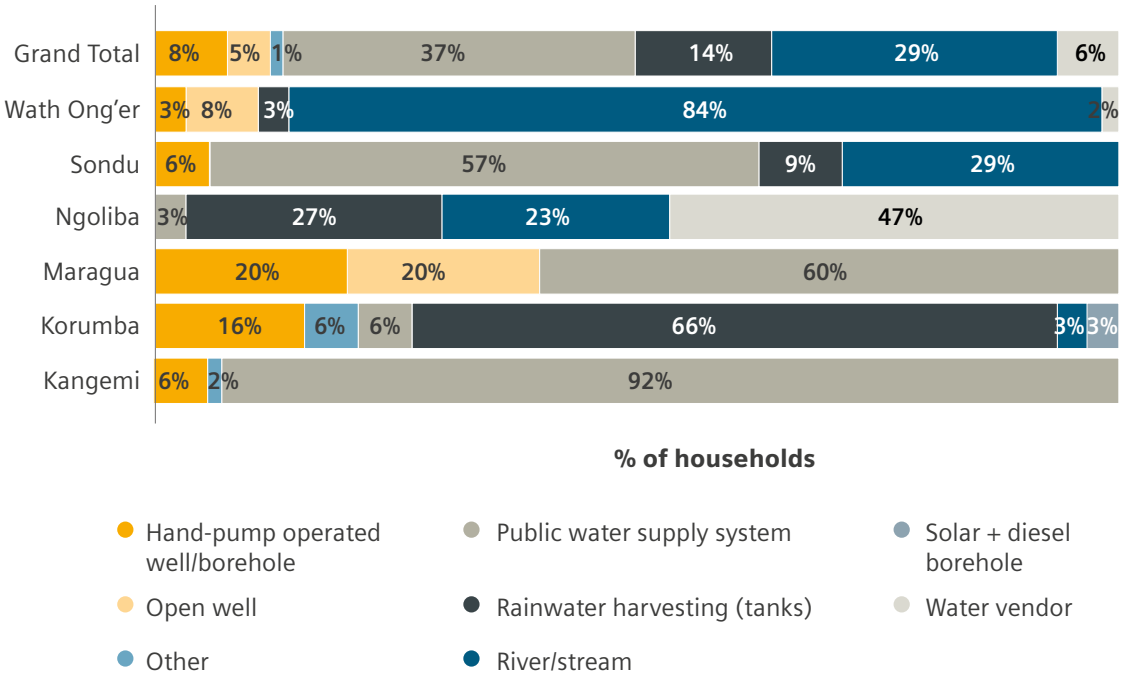
Table 4:
Household uses of Maji Safi

Kiosk	% of households using Maji Safi for all household needs	Different uses of Maji Safi within the household (*multiple choice answer as a percentage of the proportion of the population using Maji Safi*)					
		Drinking[1]	*Household cleaning*[2]	*Cooking*[3]	*Bathing*[4]	*Livestock*[5]	*Crop farming*[6]
Kangemi	49.2%	93.8%	87.5%	84.4%	81.3%	9.4%	3.1%
Korumba	58.3%	100.0%	90.5%	100.0%	100.0%	9.5%	4.8%
Maragua	24.2%	100.0%	50.0%	100.0%	62.5%	-	-
Ngoliba	14.7%	100.0%	100.0%	100.0%	100.0%	60.0%	-
Sondu	29.8%	100.0%	18.2%	90.9%	36.4%	27.3%	-
Wath Ong'er	49.2%	100.0%	4.0%	44.0%	16.0%	-	-

Ranking order	*The consumers ranked the purposes for which Maji Safi is used in order of priority with drinking as the highest[1] and crop farming as the lowest[6]*

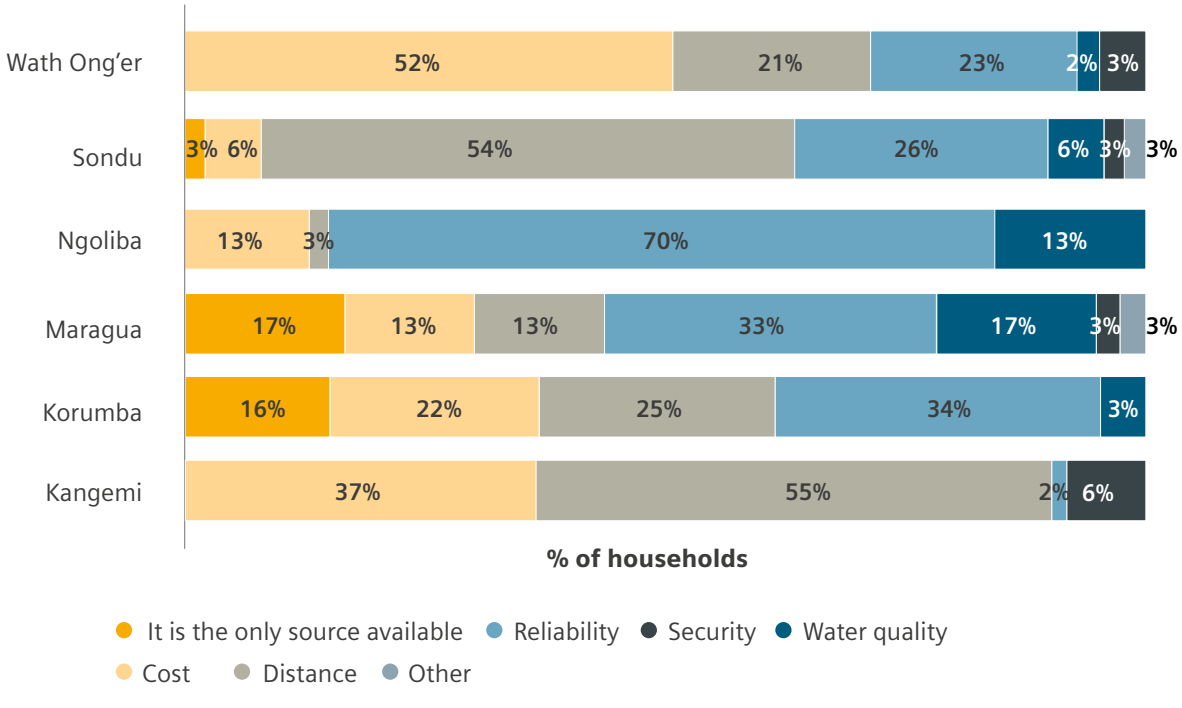
The alternative sources of water for non-Maji Safi users include hand-pump-operated wells/boreholes, open wells, public water supply systems, rainwater harvesting, river/stream, solar/diesel-pump-operated boreholes, and water vendors. The majority of non-Maji Safi users in Kangemi (92.0%), Maragua (60.0%), and Sondu (57.0%) get their water from a public water supply system. Ngoliba stands out from the other kiosks with 47% of users sourcing water from water vendors fetching water from the Thika river. Non-Maji Safi users in Wath Ong'er (84.0%) source their water from the river/stream, followed by Sondu (29.0%), and Ngoliba (23.0%). Rainwater harvesting serves as the main source of water for households in Korumba (66.0%) whereas none of the interviewed households in Kangemi and Maragua use harvested rainwater.

Figure 16:
Household uses of Maji Safi



For the non-Maji Safi users, the three top considerations for the selection of their main water sources include cost, distance, and reliability. When selecting their source, households in Wath Ong'er (52.0%), Kangemi (37.0%), and Korumba (22.0%) consider cost as a key factor. Households in Ngoliba (70.0%), Korumba (34.0%), and Maragua (33.0%) place emphasis on reliability when choosing their main water source. Distance to the water point features as a critical consideration for households in Kangemi (55.0%), Sondu (54.0%), and Korumba (25.0%). It is interesting to note that only 2% of Wath Ong'er, 3% of Korumba, and 6% of Kangemi/Sondu households pay attention to water quality when selecting their main source. This is presumably because the households either trust their water vendors or assume the quality is an intangible element. However, the households pay attention to the smell, colour, and taste of the water they consume.

Figure 17:
Reasons for selection of water source among non-Maji Safi households



3.4 Water access

For this study, accessibility encompasses distance to the water point, time spent to get to the water point and fetch water, and the quantity of water that households can fetch.

3.4.1 Distance to the water point and time spent queuing

Among Maji Safi users, households in Ngoliba cover the longest distance to get to the water point at an average of 8.3km. Consequently, they spend almost one hour to and from the water point, which is the longest duration among all Maji Safi users. Further, the households spend an average of 37.6 minutes at the water point to fetch water, which is almost 9 times longer than users in Kangemi. The extent of this situation is reflected in their satisfaction assessment where 61.77% and 55.58% are dissatisfied with the distance and the duration of queuing at the water point, respectively.

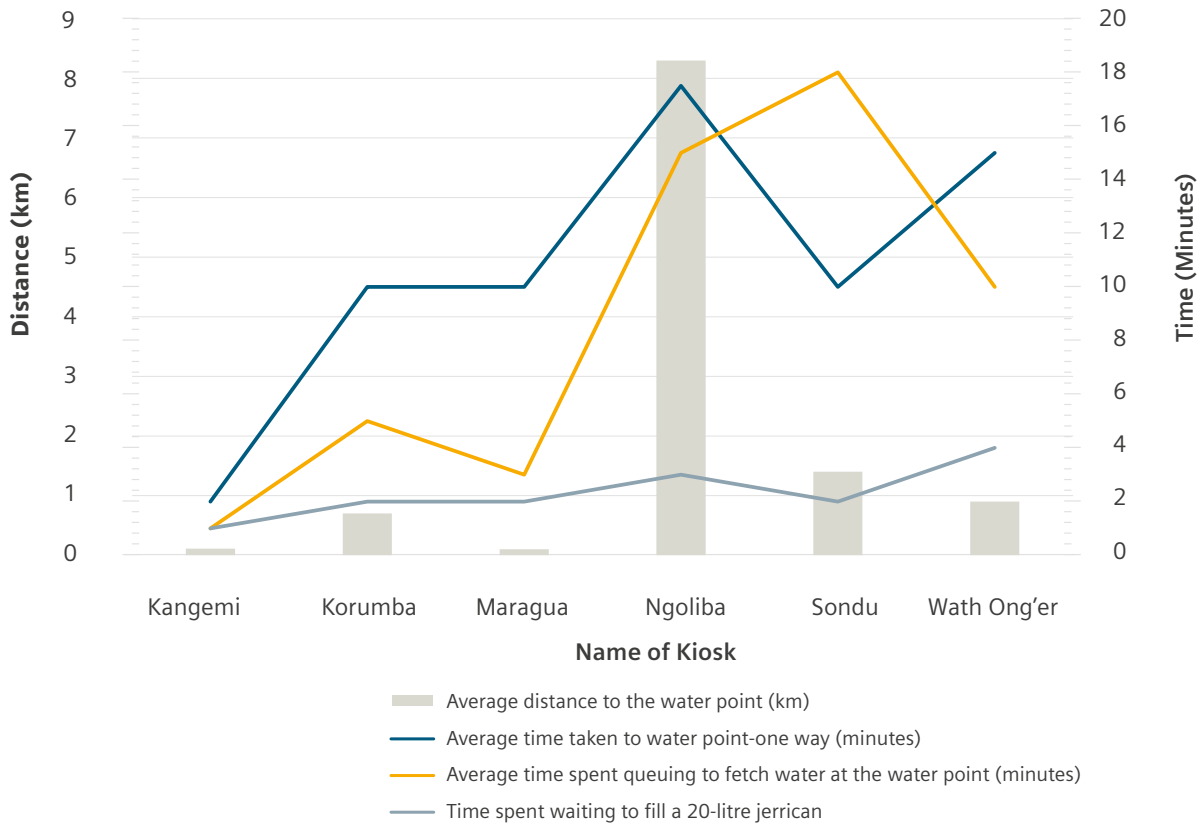
Ngoliba households were furthest to the water kiosk while Kangemi households spent the least amount of time to reach the water point, at 3.0 minutes. In addition, users in Kangemi spend the least amount of time waiting to fill a 20-litre jerrican and this corresponds with their satisfaction with the pressure of water which stands at 96.9%. About 62.2% of Maji Safi users in Sondu are dissatisfied with the considerable amount of time spent queuing to fetch water at almost half an hour.

Among non-Maji Safi users, most households are located at an average distance below 1km, except Ngoliba where the average is 3.9km. Generally, Ngoliba can be regarded as having a challenge with access to water sources across both study groups. This can be attributed to the fact that Athi River, which could have been a potential water source in this community, is highly contaminated and cannot be used for safe water consumption. As a result, there are limited water sources in the area, among them the Thika river.

Figure 18:

Comparison of distance to water point and collection time among Maji Safi and non-Maji Safi users

Distance to water point and time spent to access water at non-Maji Safi water points



Distance to water point and time spent to access water at non-Maji Safi water points

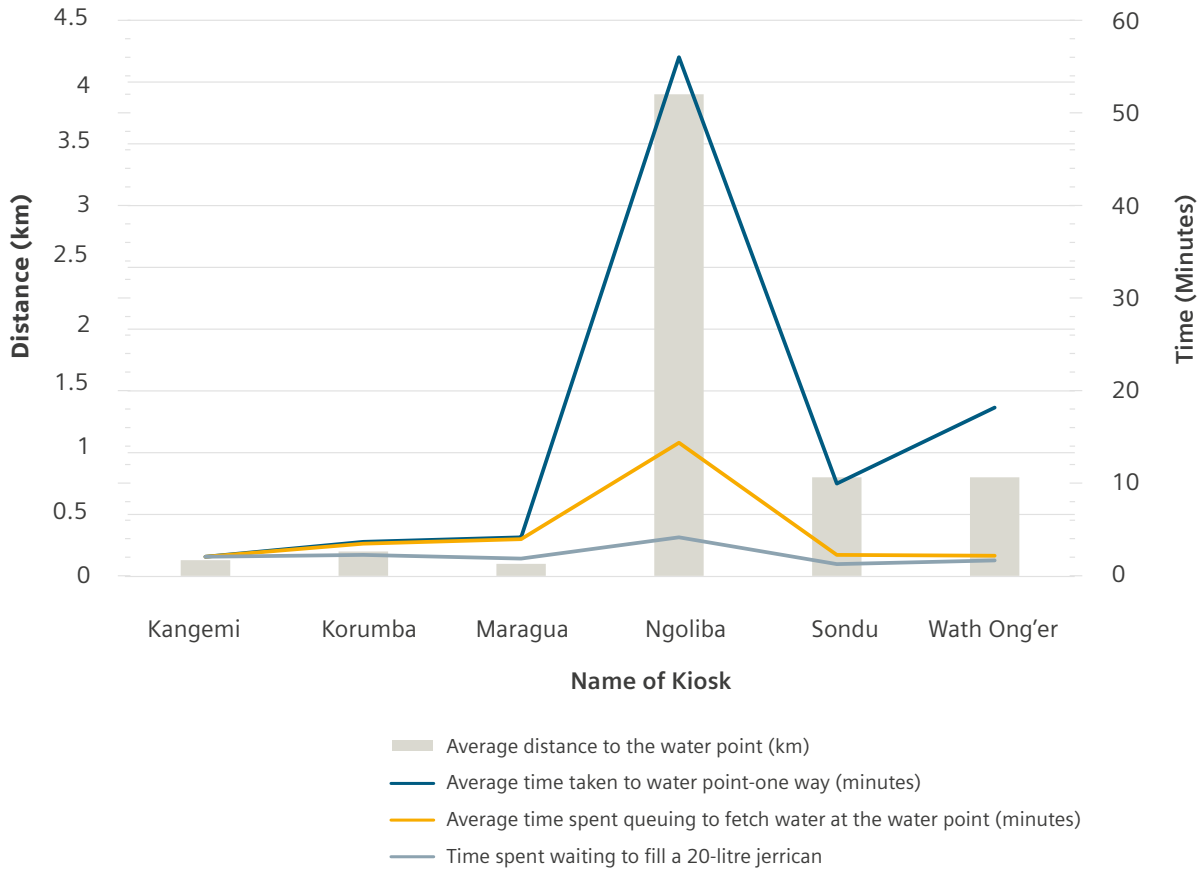
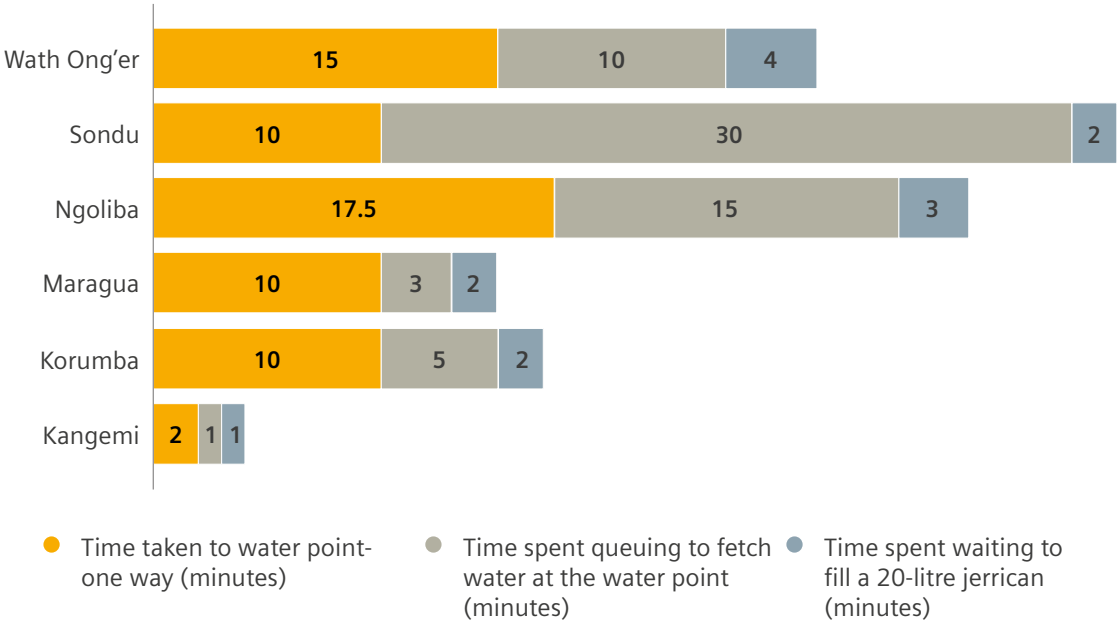


Figure 19 illustrates the time spent by both Maji Safi and Non-Maji Safi users to get to the kiosk and fetch water. Residents in Ngoliba spend the highest amount of time at the kiosks while Kangemi spends the lowest. These residents live furthest from the kiosk as indicated in **Figure 18**. It takes much more time to fill a 20-litre jerrican in Wath Ong'er and Ngoliba than the rest of the kiosks due to pressure differences. The findings indicated in the figure below are based on the median values and not average values which did not reflect the actual time estimates.

Figure 19:
Time spent collecting water among Maji Safi households (minutes)



The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation, and Hygiene (JMP service ladder is used to compare drinking water service levels across regions. The main parameters considered when assessing service levels include access, affordability, availability, and quality of the main source of water used by households for drinking, cooking, and other domestic uses such as personal hygiene and cleaning. **Figure 20** below summarizes these service-level classifications.

Figure 20:
JMP water service levels ladder

Safely managed	Drinking water from an improved source that is: • Accessible on premises • Available when needed • Free from faecal and priority chemical contamination
Basic	Drinking water from an improved source,provided collection time is more than 30 minutes for a roundtrip including queuing
Limited	Drinking water from an unprotected dug well or unprotected spring
Unimproved	Drinking water from an improved source for which ollection time exceeds 30 minutes for a roundtrip including queuing
Surface water	Drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal

According to the JMP ladder, improved sources of water refer to those that have the potential to deliver safe water by nature of their design and construction including piped water, boreholes or tube wells, protected dug wells, protected springs, rainwater, and packaged or delivered water. For this study, we classify the Maji Safi water under basic or limited source because although it should be free from fecal and priority chemical contamination, it is not accessible on premises by households and in some instances, it is not always available when needed. From here we classify the various kiosks under basic or limited service levels as demonstrated in the table below. Only the Kangemi, Korumba, and Maragua kiosks can be considered to provide a basic level of service as the total average collection time is not more than 30 minutes.

Table 5:
Classification of Maji Safi service level as per the JMP ladder

Kiosk	Average collection time in minutes (roundtrip including queuing)	JMP classification[32,33]
Kangemi	5	Basic access
Korumba	25	Basic access
Maragua	23	Basic access
Ngoliba	50	Limited access
Sondu	38	Limited access
Wath Ong'er	40	Limited access

32. **Basic access** - Drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing

33. **Limited Access** - Drinking water from an improved source, for which collection time exceeds 30 minutes for a round trip, including queuing

3.4.2
Quantity of water

In Kangemi, none of the households experienced any restrictions and 100.0% of the households are generally satisfied with the amount of water they receive. Similarly, none of the households in Korumba reported any case of restriction with a satisfaction rate of 97.2%. The rest of the kiosks also experienced some restrictions: Sondu (13.5%), Maragua (12.1%), and Ngoliba (5.9%). The situation is different in Wath Ong'er where 31.34% of Maji Safi users interviewed have experienced restrictions as a result of malfunctioning equipment (water pump) (61.90%), higher customer demand (42.86%), low water volumes (19.05%), extended drought (4.76%).

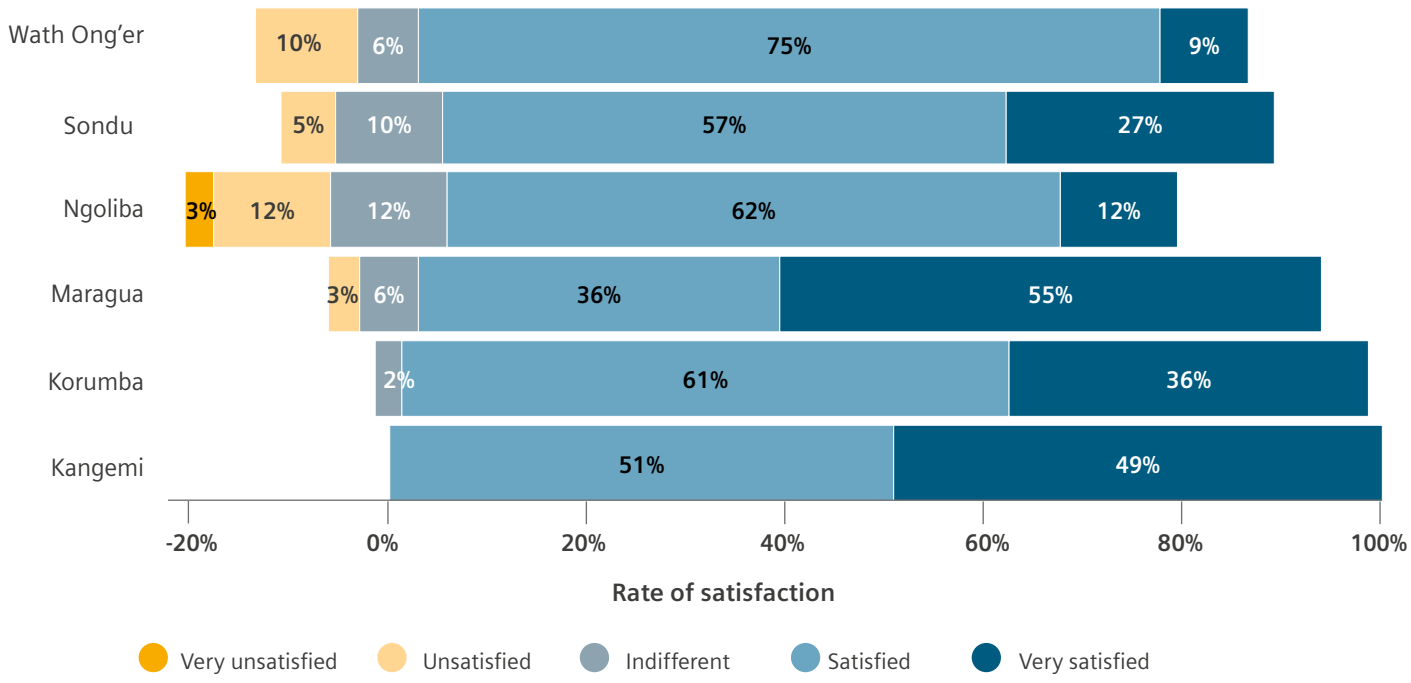
This is despite the Wath Ong'er Maji Safi kiosk recording the highest water volumes sold (2019-2022) compared to the others and sourcing their water from a river, which offers a consistent supply. Based on the operator at Wath Ong'er, water vendors are often prioritized whenever there are any issues in the water supply, leaving some household users dissatisfied. In addition, during the maintenance of equipment, the kiosk shuts off the intake from the river and fills up the storage tank for purchase by buyers. Although scheduled maintenance is only undertaken periodically, unexpected breakdowns result in long downtimes[34], and due to the limited supply available, the amount of water available for purchase is restricted.

Although scheduled maintenance is only undertaken periodically, unexpected breakdowns result in long downtimes, and due to the limited supply available, the amount of water available for purchase is restricted.

About 29.9% of Wath Ong'er users reported that the system has broken down over the past 3 months and took an average of 3.6 days to restore services. The months reported to have the most frequent breakdowns include August and September. This offers some insight into the high restriction rate reported in the study. Overall, despite these restrictions, most of the users in Wath Ong'er are satisfied with the amount of water received, with only 10.5% expressing dissatisfaction. The figure below summarizes the satisfaction rate across the Maji Safi users in the six kiosks.

34. In Sondu and Wath Ong'er, the operators reported that some times it could take 2-3 days to fix a pump especially when they do not have money for the repairs.

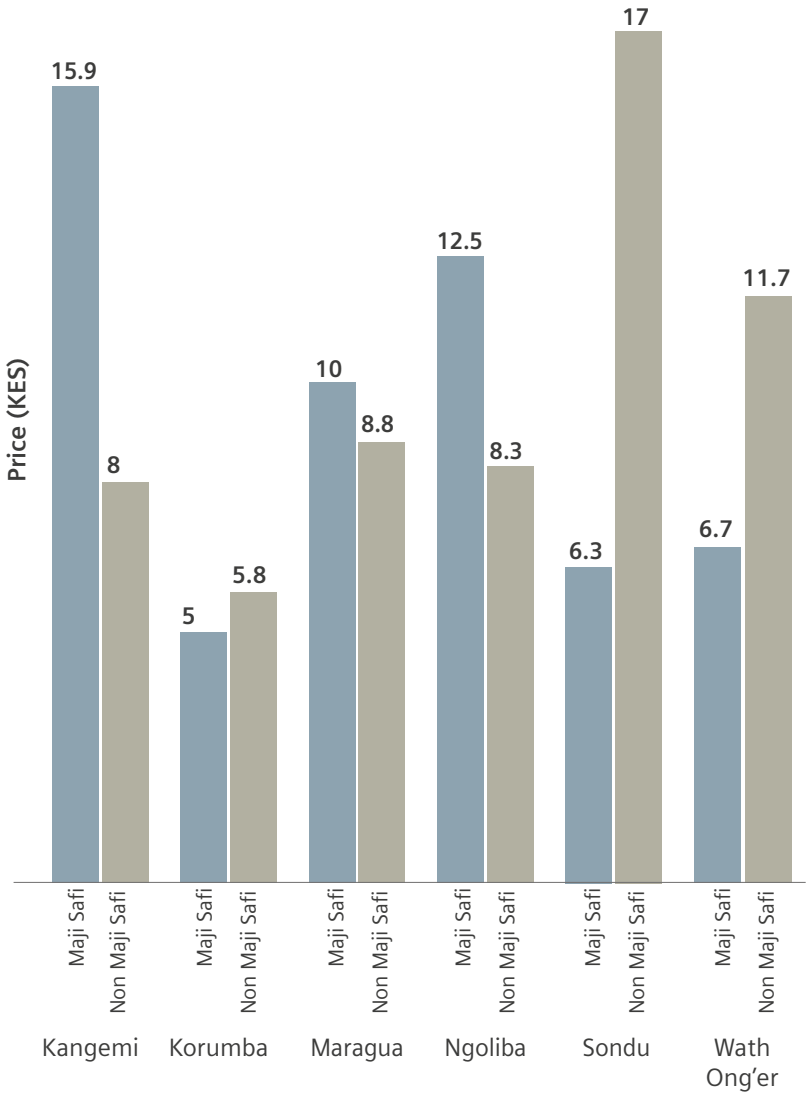
Figure 21:
Maji Safi households satisfaction with amount of water received



3.4.3 Affordability

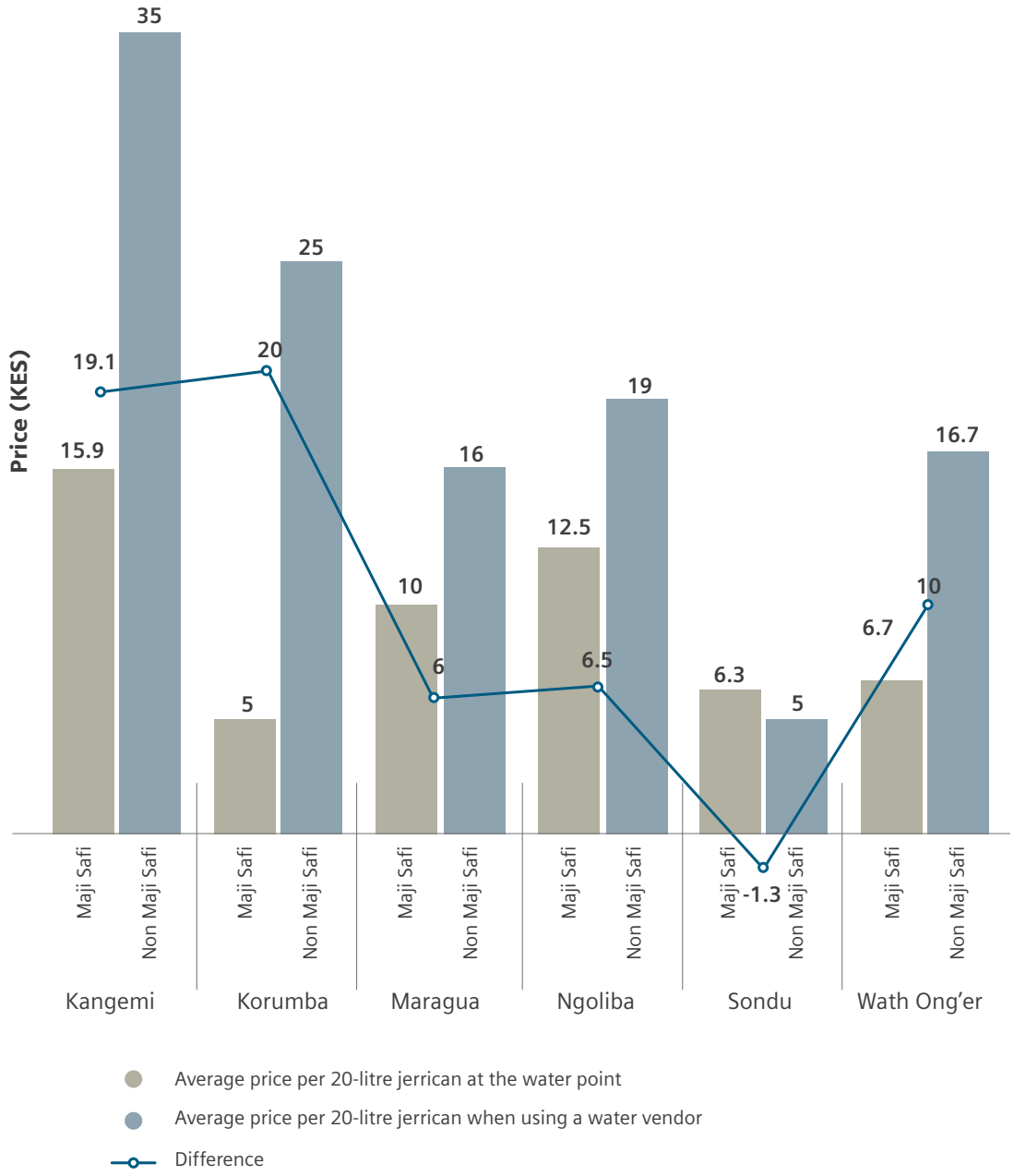
Households in Kangemi reportedly incur the highest average price per 20-litre jerrican at KES 15.9, followed by Ngoliba at KES 12.5 at the household level. Despite the high price in Kangemi, 64.6% of Maji Safi households are satisfied with the price. The kiosk operator at Kangemi reported that they have tried to address the price concerns with no success. This is because the kiosk mostly relies on sales from water vendors who can afford to purchase at the prevailing rate compared to households. On the other hand, 29.4% of respondents in Ngoliba expressed dissatisfaction with the price of Maji Safi water. This could be attributed to the fact that Kangemi is in an informal settlement within an urban region where the cost of living is higher compared to Ngoliba which is in a rural area.

Figure 22:
Average price per 20-litre jerrican at household level



Across the six sites, the average price of non-Maji Safi water per 20-litre jerrican is lower than that of Maji Safi, except for Korumba, Sondu, and Wath Ong'er. The main sources of water for non-Maji Safi users where the price is lower than Maji Safi include Kangemi - public water supply system (96.1%); Maragua - public water supply system (73.3%); Ngoliba - rainwater harvesting (63.3%). In addition, the price of Maji Safi water sold by vendors is higher than at the water kiosk due to the incorporation of additional expenses such as transportation, cleaning of jerricans, and compensation for the vendor. Sondu is the only location where the price of water sold by the vendors is lower than at the kiosk. The majority of the water vendors are reported to be obtaining the water from the river at no cost which they then sell at a friendly price to the households.

Figure 23:
Comparison of average price of Maji Safi at the water point vs water vendor



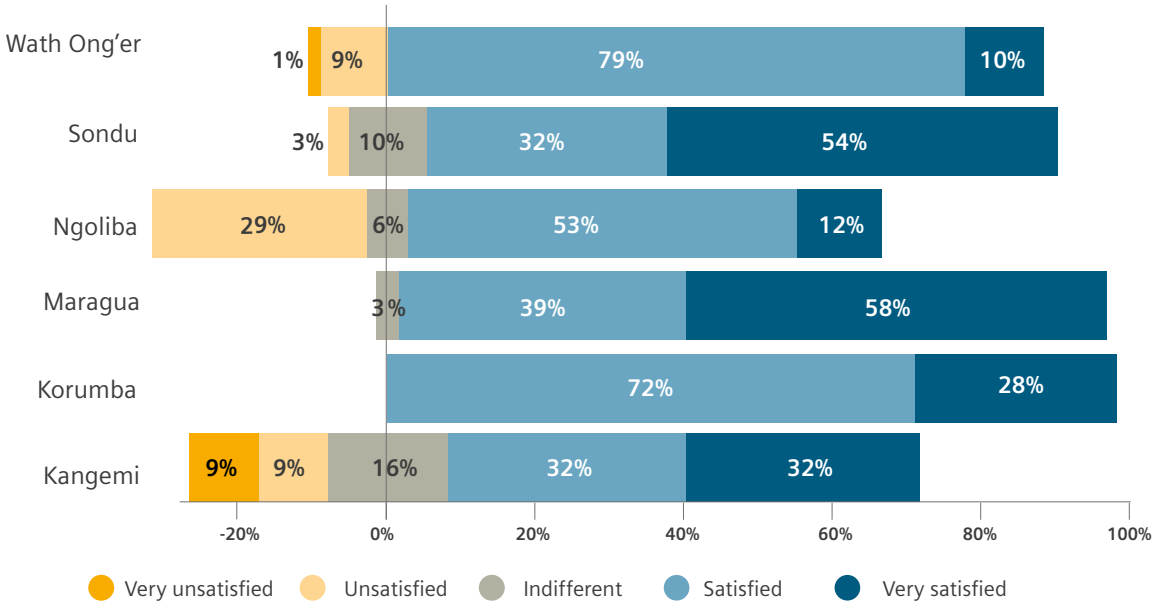
The average price of water per 20-litre jerrican across the Maji Safi and non-Maji Safi households is highlighted in **Table 6**. For Kangemi, the average cost of a 20-litre jerrican constitutes water obtained by the households either directly from the Maji Safi kiosks or through the water vendors. As indicated in the table below, and cognizant that the households may obtain water either directly or through the water vendors, the median price is the true reflection of the cost of water at the kiosks.

Table 6:
Household average price of water per 20-litre jerrican[35]

Kiosk	Average price per 20-litre jerrican at the Water point (KES) - Maji Safi	Median price per 20-litre jerrican at the water point (KES) - Maji Safi	Average price per 20-litre jerrican at the water point (KES) - non-Maji Safi[36]	Median price per 20-litre jerrican at the water point (KES) non-Maji Safi
Kangemi	15.9	5.0	8.0	5.0
Korumba	5.0	5.0	5.8	5.0
Maragua	10.0	10.0	8.8	7.5
Ngoliba	12.5	10.0	15.6	15.0
Sondu	6.3	5.0	17.0	5.0
Wath Ong'er	6.7	5.0	11.7	10.0

Figure 24 highlights the satisfaction rate for Maji Safi users on the price of water per 20-litre jerrican.

Figure 24:
Satisfaction with the price of water among Maji Safi households



35. The average prices at household level do not reflect the cost of a 20-litre jerrican at the kiosks as consumers obtain water either directly from the kiosks or through vendors. The median prices reflects the exact price at the point of collection is most kiosks.

36. As reported by consumers who do not obtain water from the Maji Safi kiosks

By considering the water burden, which is the ratio of water cost to household income[37], we measure the affordability of Maji Safi water across the six locations. The water burden across households is determined by assessing the parameters outlined in **Table 7**. While users in Korumba are generally satisfied with the price of water, they have the highest water burden as their incomes reportedly cannot cover all their needs.

Table 7:
Determining the water burden across households

#	Parameter	Data sources	Relevance
1	Expenditure on water	Household surveys	These variables comprise the inputs to the formula calculating the household water burden
2	Household income		
3	Affordability threshold	United Nations	This is the threshold level above which water levels are categorized as unaffordable.

The water burden is calculated as follows:

$$\text{Water burden (\%)} = \frac{\text{Monthly expenditure on water}}{\text{Monthly household income}} * 100$$

To estimate the water burden, we consider the average monthly household income range where most respondents in that area fall. For example, 77% of Maji Safi users in Kangemi earn between KES 10,000 and 30,000. The midpoint of this range is assumed as the average to establish an indicator of the water burden. Although this method does not account for other income bands, it provides a glimpse of the burden based on most respondents.

37. Read, J., Attal, N., Betanzo, E., Harrison, R., Stoltenberg, A. (2022). *Water Service Affordability in Michigan: A Statewide Assessment. University of Michigan Water Center, Graham Sustainability Institute*

The UN recommends that water costs should not exceed 3 – 5% of household income.[38] Therefore, in this study, the households were categorized as follows indicated in **Table 8**.

Table 8:
Determining the water burden across the Maji Safi users

Kiosk	Household source of water	Average monthly expenditure on water (KES)	Average household income	Water burden (%)
Kangemi	Maji Safi	452.6	20,000	2.3%
Korumba	Maji Safi	701.7	5,000	14.0%
Maragua	Maji Safi	796.2	20,000	3.9%
Ngoliba	Maji Safi	1673.7	20,000	8.4%
Sondu	Maji Safi	610.8	20,000	3.1%
Wath Ong'er	Maji Safi	555.1	20,000	2.8%
Rank				
Criteria	Affordable	Slightly unaffordable	Unaffordable	
Range	0 – 3%	3 – 5%	≥5%	

Based on these assumptions, the water burden increases when the amount spent on water per month is high, yet the income remains unchanged. The high water burden in Korumba could be attributed to the fact that the respondents recorded the highest percentage of users with an average monthly income of below KES 10,000 (62.0%). As such, this may impact their ability to purchase water from the Maji Safi kiosk. It is worth noting that respondents are often reluctant to disclose information on household incomes. Consequently, this poses a limitation on the accuracy of the water burden estimation, in case the respondents understated or overstated their income levels. The high monthly expenditure on water in Ngoliba can be attributed to the transportation costs incurred by the residents to obtain water from the kiosk which is located far from their households.

38. World Health Organization. (2021). *The measurement and monitoring of water supply, sanitation and hygiene (WASH) affordability: a missing element of monitoring of sustainable development goal (SDG) targets 6.1 and 6.2.*

3.5 Water quality

Water quality tests were conducted to analyze the chemical and microbiological parameters based on samples from the Maji Safi kiosks.

The records of water quality testing were reviewed to assess the frequency at which the kiosks carry out water testing and the associated results. We also compare the results available for 2017 and 2023 to identify any trends in water quality and establish if there has been an improvement or a decline. The latest available test results are from Korumba, Sondu, Maragua, and Wath Ong'er (2023), and Kangemi (2022). The latest available water quality test records for Ngoliba are from 2017.

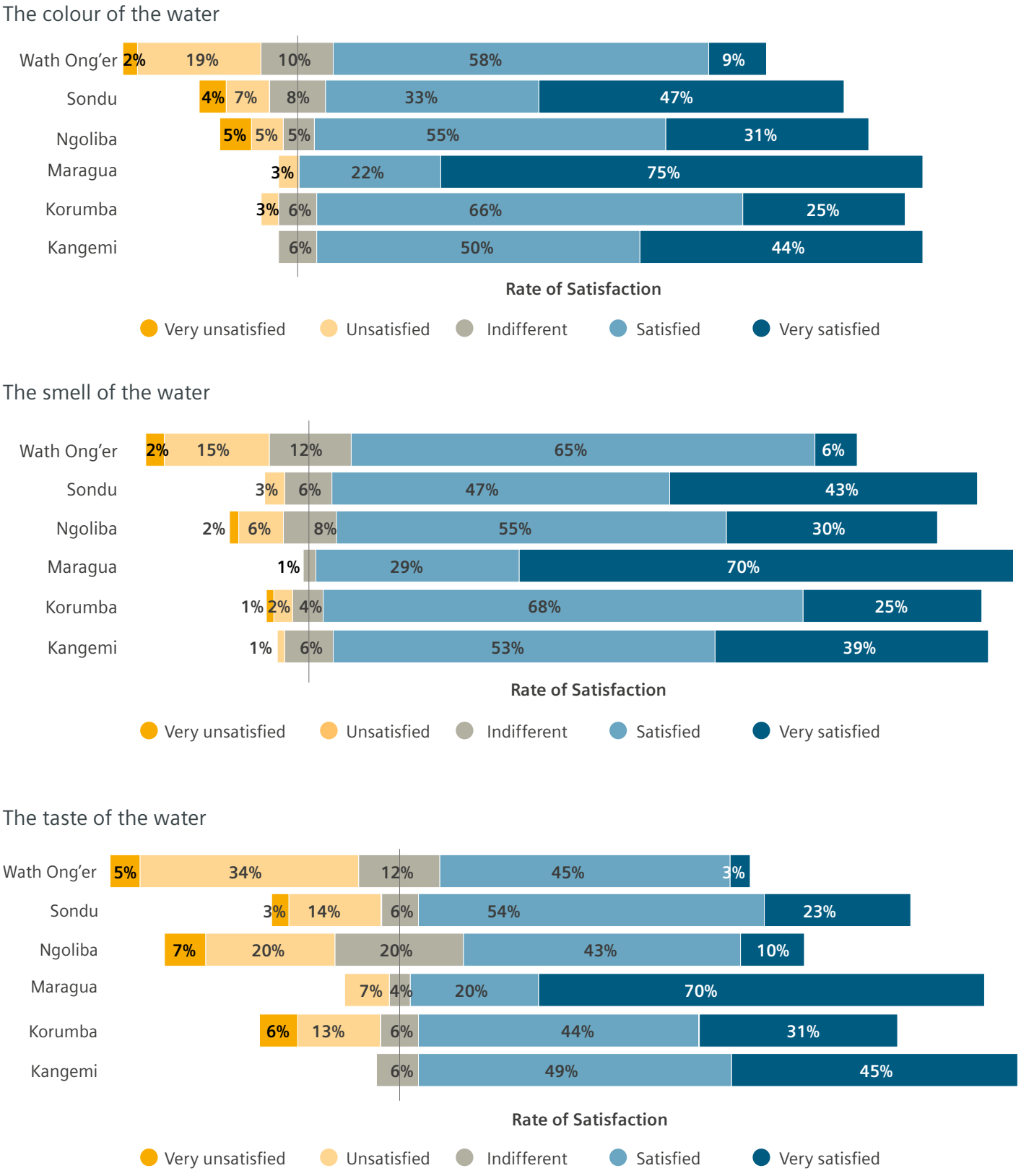
Water quality tests were conducted to analyze the chemical and microbiological parameters based on samples from the Maji Safi kiosks. From the test results, we establish that before the water undergoes filtration using the SkyHydrant Technology installed in the kiosks, there is the presence of either coliforms or e-coli bacteria or both. In the case of Kangemi, Maragua, and Sondu where the presence of coliforms was detected in the filtered water, the cause was linked to poor cleaning of the filters and water storage tanks. As such, recommendations were provided on the regular cleaning of the tanks and filters using chlorine.

Table 9:
Water quality testing frequency for Maji Safi kiosks

Kiosk	Does the kiosk carry out regular water testing? (Y/N) If yes, how often?	When was the last test done?	Does the kiosk have a record of the water quality report (Y/N)	Water quality test results available for which year?
Kangemi	Yes, twice a year	2022	Yes	2022, 2021, 2017
Ngoliba	Yes, every two months	2017	Yes	2017
Maragua	Yes, annually	2023	Yes	2023, 2017
Korumba	Yes, every few months	2023	Yes	2023, 2017
Sondu	Yes, annually	2023	Yes	2023, 2017
Wath Ong'er	Yes	2023	Yes	2023, 2017[39]

39. Year when the pre-test for water was done at Wath Ong'er.

Figure 25:
Water quality satisfaction rate for Maji Safi users



To determine how the water quality within the kiosks compares to the national and global standards, we compare the results against the Kenya Bureau of Standards (KEBS) water quality standards and those of the World Health Organization (WHO).

The relevant parameters and associated standards are summarized in **Table 10** below.

Table 10:
Maji Safi water quality performance against KEBS and WHO standards

Parameters	KEBS (KS-1:2007 standards)	WHO standards	Kangemi			Ngoliba	Maragua		Korumba		Sondu			Wath Ong'er	
Date of last test			**(23/06/2017)**	**(25/10/2021)**	**(25/10/2022)**	**(30/08/2017)**	**(07/06/2017)**	**(04/09/2023)**	**(12/06/201 7)**	**(05/08/23)**	**(13/06/17)**	**(16/10/2022)**	**(28/10/2023)**	**(28/08/2017[40])**	**(09/08/2023)**
pH	6.5 – 8.5	6.5 – 8.5	7.2	7.1		7.2-7.6	7.8	7.6	7.5	6.92	8.1	8.2	-	7.67	7.34
Color	Max 15	Max 15	-	-		-	-	7.5	0	-	4.0	-	-	1239	-
Turbidity	Max 5	Max 5	-	-		-	-	3.5	0.8	1.48	0.7	1.16	-	162	1.23
Conductivity	-	Max 2500	-	66		-	-	60	363	352	89.3	1103	-	115.4	152.1
Iron	Max 0.3	Max 0.3	-	0.1		-	-	-	0.1	0.01	0.1	0.01	-	2.7	0.03
Total hard-ness	Max 300	Max 500	23-7d	16		23-14d	4-7d	26	3.3	20.7	5.0	1.48	-	14.0	52.0
Calcium hardness	-	Max 500	-	-		-	-	-	0	12.4	1.4	1.26	-	7.992	36.0
Total alka-linity	-	Max 500	-	12		-	-	24	139	139	48.2	57	-	42.2	77.8
Chloride	Max 250	Max 250	0	8.0		0	0	1.0	-	-	-	0.82	-	3.0	-
Fluoride	Max 1.5	Max 1.5	-	0.1		-	-	0.2	0.2	0.07	1.6	0.01	-	0.449	0.16
Nitrate	Max 10	Max 10	0	1.9		10-25	10	1.3	0.2	-	0.1	0.42	-	0	-
Total sus-pended solids	-	-	-			-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	-	-	-			-	-	-	-	-	-	-	-	-	-
Total dis-solved solids	Max 1000	Max 1500	-	41		-	-	37	240	232	59.1	-	-	57.7	100
Total coli-forms	0	0	-	-	0	-	-	-	42.0-130.9	3	65.7-150	-	0	-	6
Escherichia Coli	0	0	113	-	0	133	223	-	-	0	3.0-3.1	-	0	-	0

Key

Acceptable levels	
Unacceptable levels	

40. Year when the pre-test for water was done at Wath Ong'er

Comparing the water quality test results for each kiosk, we deduce that the Maji Safi water quality is acceptable across most of the parameters. However, the presence of coliforms and e-coli in the samples tested renders the water unsafe for human consumption unless treated appropriately. Additionally, the latest test from Wath Ong'er in 2023 indicates the presence of coliforms in the water sample, rendering it unfit for consumption. Discussions with the Siemens Stiftung team indicate that the coliforms are likely from the storage devices rather than a failure of the technology. The standard practice for the team on the ground is to carry out a cleaning of tanks after the results are out, unfortunately, they do not do follow-up tests to check the quality. The main limitation here is the cost of the water quality tests. In Korumba, although there is a decline in the total coliforms found in the water sample (2017 versus 2023), there is still a significant presence, rendering it unsafe. On the other hand, there was a significant improvement in Sondu from 2017 to 2023 where the presence of coliforms and e-coli was reduced to 0, which is the acceptable standard for safe human consumption. However, the presence of fluoride in the Sondu water sample is slightly above the cut-off for acceptable fluoride levels.

3.6 Water supply and demand

Table 11 below summarizes the main and alternative sources of water for each kiosk, how often they receive water from the source, the types of customers served, and number of customers served daily.

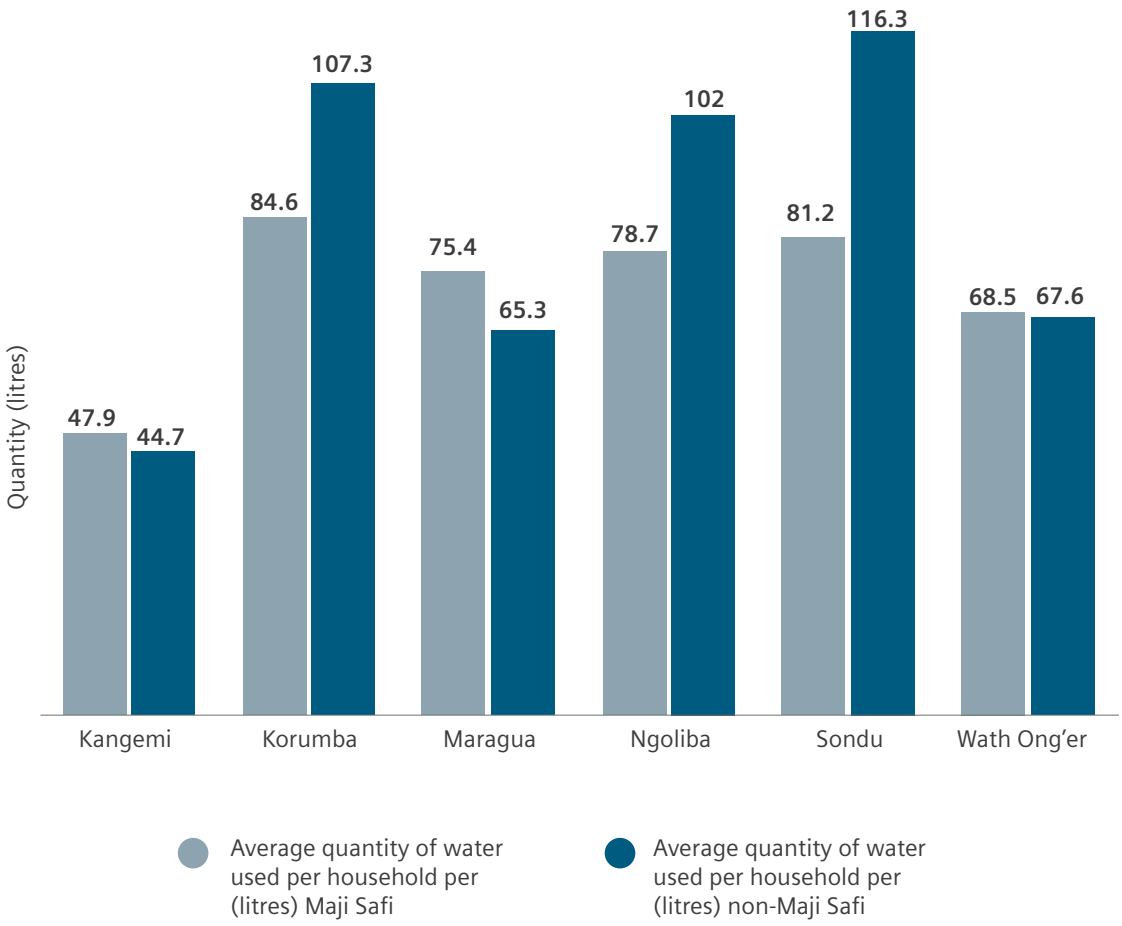
Table 11:
Water supplied by Maji Safi kiosks across the six sites

Kiosk	Water source	How often the kiosk receives water from the source	Types of customers served by the kiosk	Approximate number of customers served by the kiosk daily
Kangemi	Main – Nairobi water Alternative - borehole	Nairobi water three times a week but borehole water is consistently available	• Water vendors • Households	50 per day but most are water vendors who have many containers and come several times a day. In the dry season around 100 people
Maragua	Murang'a South Water and Sanitation Company (MUWASCO)	-	• Water vendors • Households • Market vendors • Restaurants • Schools	200 per day in the dry season and 100 in the wet season
Ngoliba	Thika river	During periods of low demand, they pump water from the river once a week and thrice when there is high demand	• Water vendors • Households	50-100 customers daily depending on the season
Sondu	River	Pump water daily during the dry season and once a week in the wet season	• Households	Approximately 100 customers daily in the dry season and 15 during the wet season
Korumba	Borehole	Obtain their water daily	• Households	Approximately 200 customers daily
Wath Ong'er	River Kuja	Pump water daily	• Households • Hotels • Restaurants • Water vendors	Approximately 200 customers daily

In Kangemi, they used to harvest rainwater but stopped due to rusting of the iron sheets which would have an impact on the quality of the water. Some of the vendors purchase up to 30 20-litre jerricans of water and visit the kiosk more than once a day. In Maragua, the kiosk sells water to market vendors, water vendors, restaurants, and some schools. The peak hours for customers fetching water from the kiosk are morning, noon, and evening hours. The average volume of water sold per day is 3,000-4,000 litres.

The operating hours for the Sondu kiosk also shift depending on the season to facilitate customer demand. In the wet season, they operate for 8 hours, and 15 hours in the dry season. The peak hours of operation include early morning and mid-afternoon. The Korumba kiosk serves customers for 12.5 hours daily with the peak hours in the early morning and late evening. The ATM system in the Wath Ong'er and Ngoliba kiosks allows customers with tokens to access the kiosk 24 hours a day, but those who do not have one have to wait for the operator. On the consumer demand side, the figure below summarizes the average quantities used per household per day and compares that of Maji Safi and Non-Maji Safi users.

Figure 26:
Average quantity of water consumed per household per day



3.7 Non-revenue water

The three main components of non-revenue water are physical (real) losses due to leakages from parts of the system, commercial (apparent) losses caused by illegal connections, and unbilled authorized consumption such as water used by the utility for operational purposes and free provision to certain customer groups.

The Kenya Water Services Regulatory Board (WASREB) considers non-revenue water as a significant indicator for measuring the operational efficiency of water service providers (WSPs). Non-revenue water refers to the difference between the volume of water produced and put into the distribution systems and the actual volume billed to the consumers. The three main components of non-revenue water are physical (real) losses due to leakages from parts of the system, commercial (apparent) losses caused by illegal connections, and unbilled authorized consumption such as water used by the utility for operational purposes and free provision to certain customer groups.[41]

To establish the kiosk non-revenue water, which encompasses the percentage amount of water not billed against the total amount of water produced for sale[42], we employed the formula below. Available data from the sales and volume of water across each kiosk was utilized for this assessment.

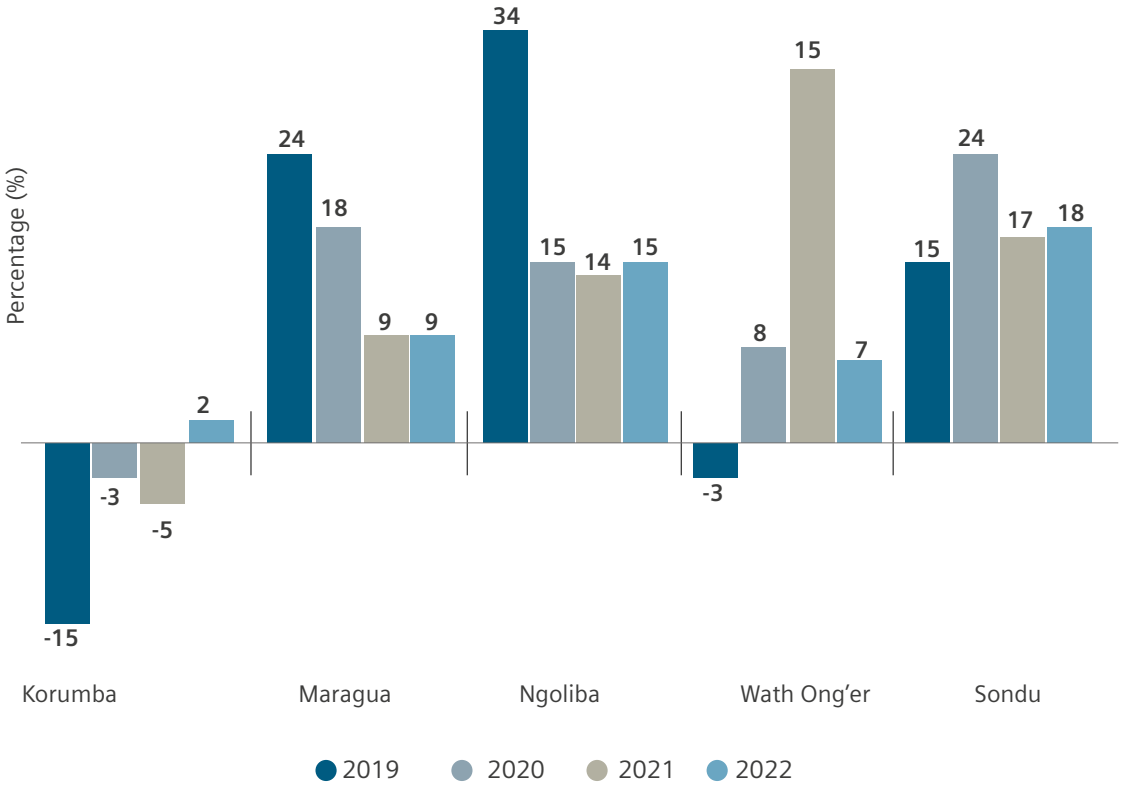
$$\text{Non Revenue Water (\%)} = \frac{\text{(Expected Sales based on Litres Sold - Actual Sales)}}{\text{Expected Sales based on Litres Sold}} * 100$$

NRW for Kangemi kiosk was not computed due to data gaps on the volume of water sold and lack of record keeping to differentiate the sales from borehole (KES 5 per 20-litre jerrican) and Nairobi Water (KES 30 per 20-litre jerrican). Across the five kiosks, Korumba has a negative NRW percentage from 2019 to 2021, with the figure increasing to 2% in 2022. The study attributes this to the available records that although, Ngoliba experienced the highest NRW in 2019 at 34%, it has progressively reduced NRW over the years. The case is similar for Maragua which has seen a consistent reduction in NRW. On the other hand, the NRW performance in Sondu stands out with a range of between 15% - 24% across the 4 years under review.

41. WASREB (2020). *Causes of Non-Revenue Water*. https://wasreb.go.ke/causes-of-non-revenue-water/#:~:text=WASREB%E2%80%99s%20acceptable%20level%20is%2020%25.%20Non-Revenue%20Water%20is,both%20commercial%20%28apparent%29%20losses%20and%20physical%20%28real%29%20losses.

42. WASREB https://wasreb.go.ke/causes-of-non-revenue-water/#:~:text=WASREB%E2%80%99s%20acceptable%20level%20is%2020%25.%20Non-Revenue%20Water%20is,both%20commercial%20%28apparent%29%20losses%20and%20physical%20%28real%29%20losses.

Figure 27
Maji Safi kiosks non-revenue water (%)



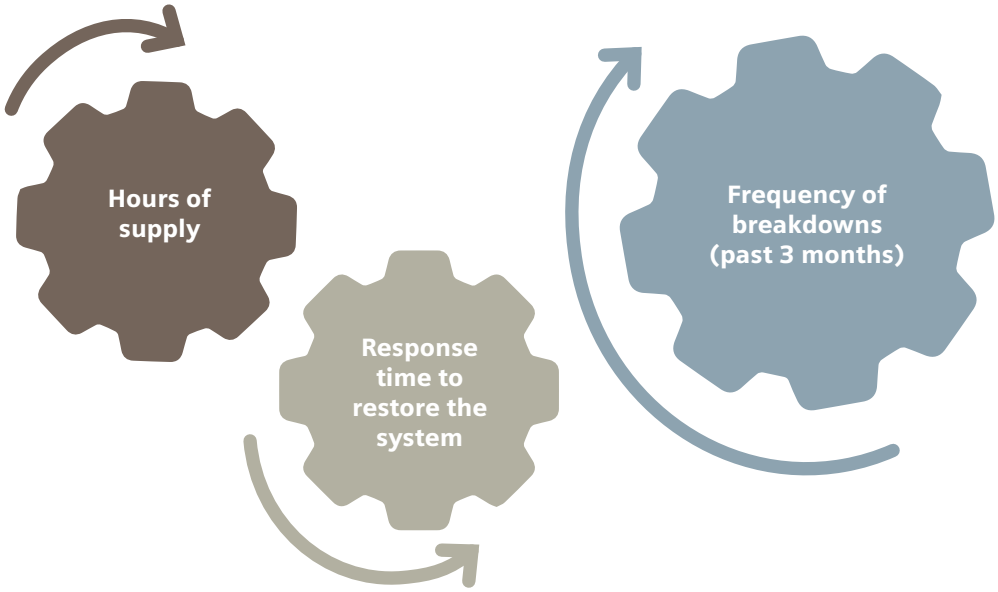
Two of the kiosks, Kangemi and Ngoliba, are located within a resource center and health center respectively. Clean and filtered water from the Maji Safi kiosks is provided for use within these premises at no cost and the records for the volume of water consumed are not tracked. This presents a gap in the overall analysis of the NRW for these kiosks. This volume of water is NRW as it could otherwise have been sold to earn revenues for the kiosk.

WASREB provides benchmarks for NRW levels as follows: under 20% - good; 20-25% - acceptable; over 25% - not acceptable. The sector benchmark of NRW performance by Kenyan WSPs is thus regarded as 20%. Although Maji Safi kiosks do not fall under the umbrella of water utilities regulated by WASREB, it provides a basis for comparing the performance of the water kiosks on this parameter. On this basis, when considering the average NRW percentage across the 4 years, all kiosks fall within the acceptable range of 20%, with Ngoliba falling right on the threshold at 20% as it provides water to the health facility at no cost.

3.8
Reliability water service provision in Kenya

This assessment employs three main parameters to determine the reliability of the water kiosk. These include hours of supply, reported frequency of breakdowns in the past three months, and response time taken to restore the system in case of a breakdown. The satisfaction of water users is also highlighted to bring out their perspective on the kiosk operations. These elements are summarized in **Table 12**.

Figure 28:
Parameters for assessing reliability



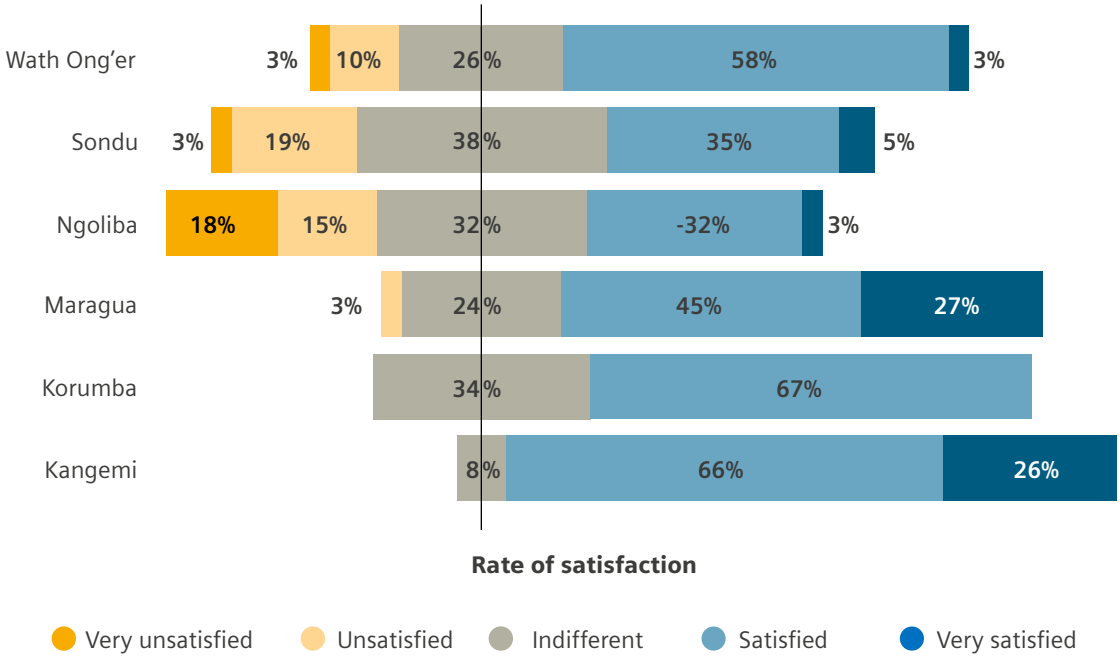
Wath Ong'er, Maragua, and Ngoliba have water ATM systems that enable token holders to access water 24 hours a day. However, those without access to these tokens are limited to accessing the kiosk during normal operating hours. As such, the average operating hours recorded for these kiosks are inclusive of these respondents. Maragua (30.3%) and Wath Ong'er (29.9%) had the highest percentage of respondents reporting a breakdown of the water kiosk system in the past three months. Sondu users reported the highest average response time for the restoration of the kiosk system in case of a breakdown at 15 days. This could be attributed to the fact that they do not have any internal maintenance personnel and upon the breakdown of the pump, it has to be transported to Kisumu for repairs. In cases where they do not have sufficient funds to pay for the transport and repairs, the downtime is prolonged.

Table 12:
Kiosk operating hours, frequency of breakdowns, and average response time

Maji Safi kiosk	Average kiosk operating hours	% of respondents who reported a system breakdown in the past 3 months	Months reported to have frequent breakdowns (Top 3)	Average time taken to restore the system in case of a breakdown (Days)
Kangemi	11.6	0	None	0
Maragua	10.3	30.3	Jan, May, Aug	2.4
Ngoliba	10.7	11.8	Oct	5.5
Sondu	10.7	24.3	Mar, Apr, Jun	15
Korumba	11.3	16.7	May, Jun, Sep	2
Wath Ong'er	12.4	29.9	Mar, Aug, Sep	3.6

The figure below provides an overview of the consumer's satisfaction with the response time taken by the respective kiosks to restore the system in case of a breakdown. Ngoliba has the highest dissatisfaction rate at 33%, followed by Sondu (22%) and then Wath Ong'er (13%). These three kiosks have the highest recorded average response times to restore the system in case of a breakdown. As such, the dissatisfaction rate corresponds with these records. Kangemi (92.0%), Maragua (72.0%) and Korumba (67.0%) kiosk users are generally satisfied with the time taken.

Figure 29:
Satisfaction of Maji Safi users with time taken to restore water in case of interruptions



3.9 Operation and maintenance

3.9.1 Kiosk infrastructure

The water kiosk's physical components should be able to withstand natural and human-induced stresses, including wear and tear, extreme weather events, and changing water quality. Data obtained from the observation checklists indicates that the kiosk infrastructure appears well maintained across all water kiosks. Findings show that all storage systems are functional in all six kiosks, and filtration systems are well maintained. In addition, all water tanks are fully covered. The findings also show that across all kiosks, the water storage systems are finished off correctly to prevent any form of run-off from getting into the system across all six kiosks.

3.9.2 General maintenance and repairs

On maintenance and repairs, all kiosks appear well maintained. Maintenance records are available for all six kiosks. KII data revealed that all kiosks apart from the Kangemi, spend a portion of their finances on maintenance and repairs. In Kangemi, the kiosk owner stated, *"Siemens Stiftung repairs and maintains the water kiosk. We, however, had a breakdown on the borehole and had to use KSH 85,000/= from the kiosk for the repairs. Davis & Shirtliff did the repairs"* {KII- kiosk owner}. Well-maintained infrastructure ensures these kiosks' continuous and efficient functioning, preventing breakdowns and disruptions in water supply. It also guarantees the long-term availability of safe and clean drinking water for communities in need.

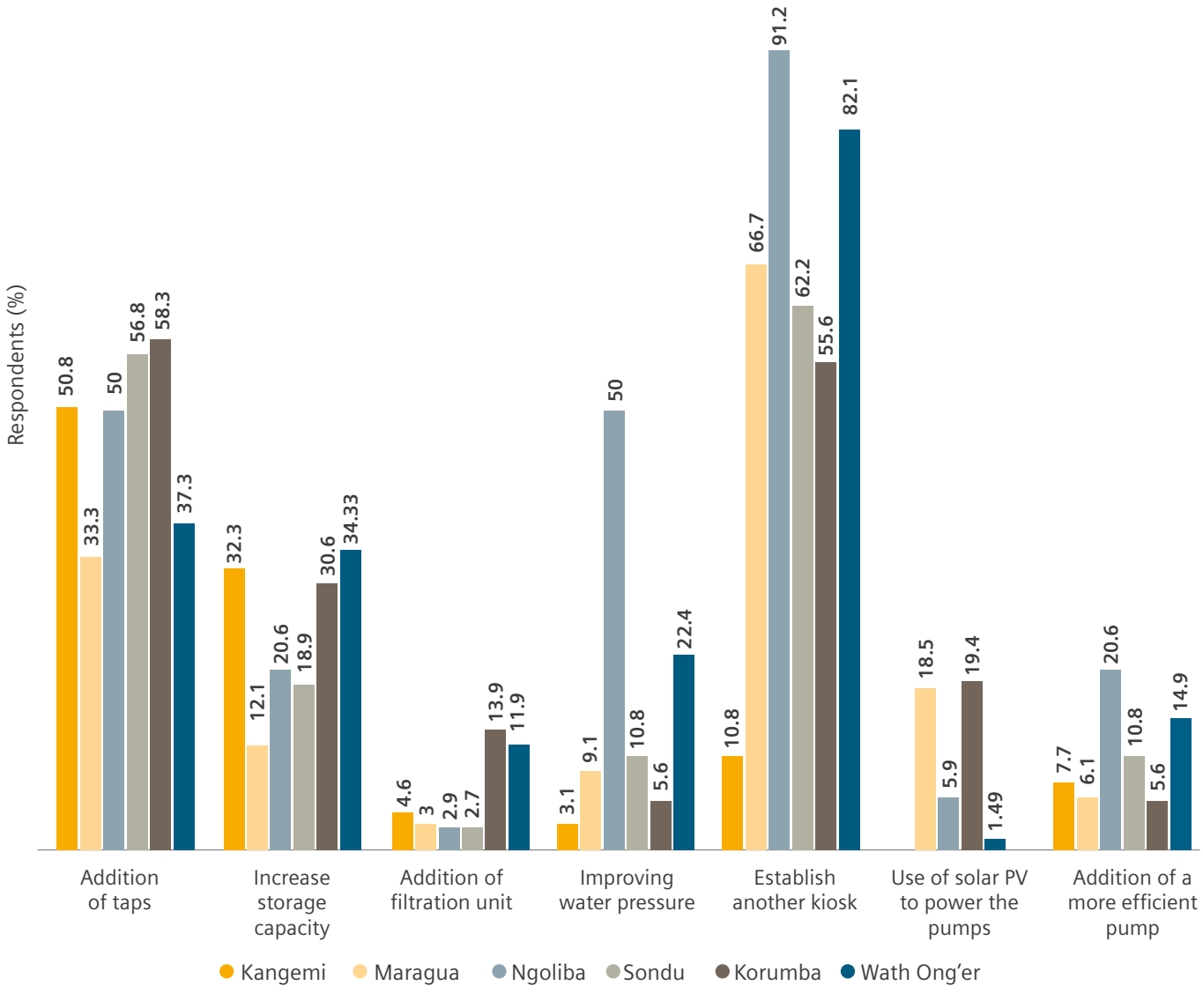
3.9.3 Cleanliness

Water kiosks' cleanliness directly impacts public health and consumer well-being. Clean water kiosks ensure that the dispensed water remains safe for consumption, free from contaminants, and devoid of harmful pathogens. Maintaining cleanliness at these kiosks safeguards against waterborne diseases and fosters trust among the community members who rely on them for their daily water needs. Data obtained through the observation checklists shows that the kiosk environment is cleaned daily across all water kiosks and the filtration system is also cleaned daily apart from one kiosk (Kangemi). Storage tanks are cleaned across all water kiosks but with differing frequencies and the pipes used to serve the customers are also adequately cleaned. The interior and exterior of the water kiosks were properly maintained, owing to the daily cleaning taking place in the various water kiosks.

3.10 Suggestions to improve the operation of Maji Safi kiosks

It is evident that the establishment of another Maji Safi kiosk in each location, excluding Kangemi, is a top priority among the Maji Safi respondents. This finding is consistent with the satisfaction assessment undertaken where many Maji Safi users, especially in Ngoliba, were dissatisfied with the distance and time taken to reach the kiosk. The other two priority areas for Maji Safi users are the addition of more taps and increased storage capacity. In Kangemi, where only 10.8% think establishing another kiosk would be beneficial, most of the respondents prioritize the addition of more taps (50.8%) and increased storage capacity (32.3%). The least concerns across the six Maji Safi kiosk users are the addition of a filtration unit, the use of solar PV to power the pumps, and the addition of a more efficient pump.

Figure 30:
Suggestions from Maji Safi users to improve Maji Safi operations



3.11
Technical performance of the SWE kiosks

To assess the overall technical viability of each water kiosk, we developed a scoring system as shown in **Table 13**. Indicators such as the water filtration unit maintenance frequency, water quality, water kiosk reliability, presence of alternative water sources, hours of supply, accessibility of the kiosk, and non-revenue water (%) are assessed. Points are allocated to each indicator based on a weighting criterion derived from the priorities of the Maji Safi users. The indicators with higher weighting include water quality, reliability, and accessibility. The individual performance of the water kiosk is ranked as highly, moderately, and not technically viable. Data from the observation checklists, household, business, and water vendor surveys, and key informant interviews with the water operator and kiosk management were used in evaluating the six kiosks.

Table 13:
Scoring criteria to determine the technical viability of the water kiosks

Indicator	Score	Performance	Points allocated
Frequency of maintenance of water filtration unit	Daily	Good	2
	Weekly	Moderate	1
	Monthly	Poor	0
Water quality	-	Good	4
	-	Moderate	2
	-	Poor	0
Reliability of water source	Highly reliable	Highly reliable	4
	Reliable	Reliable	2
	Unreliable	Unreliable	0
Alternative water source	Alternative source	Yes	2
	Alternative source	No	1
Hours of supply	>12 hours	Good	2
	7-12 hours	Moderate	1
	<7 hours	Poor	0
Accessibility of the source	<30 minutes for a round trip to collect water	Good	4
	=30 minutes for a round trip to collect water	Moderate	2
	>30 minutes for a round trip to collect water	Poor	1
Non-revenue water (%)	Below 20%	Good	2
	20%	Moderate	1
	Above 20%	Poor	0
Total maximum points - 20	High technical viability: scores 14-20		
Total medium score - 13	Moderate technical viability: scores 7-13		
Total minimum score - 6	Low technical viability: scores 1-6		

In **Table 14** below, we highlight the technical performance of the six kiosks under assessment.

Table 14:
Technical viability rating for the Maji Safi kiosks

Kiosk	Frequency of maintenance	Water quality	Reliability	Alternative water sources	Hours of supply	Accessibility	Non-revenue water (%)	Overall rating
Kangemi	2	4	3	2	2	3	2	17
Maragua	2	4	3	1	1	1	2	14
Wath Ong'er	2	3	3	1	3	1	2	15
Korumba	2	3	3	1	1	1	2	13
Ngoliba	2	3	3	1	2	1	1	13
Sondu	2	3	3	1	2	1	2	14

From these ratings, all kiosks fall within the moderate to high technical viability range. All the kiosks are ranked as highly viable except Korumba and Ngoliba which fall under the moderate category. Although recent water quality reports are not available for Maragua, Ngoliba, and Sondu, we establish their performance based on the customer satisfaction assessment undertaken as part of the survey. Some of the considerations that Maji Safi kiosks can consider to improve their technical performance include:

- **Establishing alternative methods to enhance the dependability of their water supply.** This could involve exploring options like establishing additional water sources, such as a borehole, or obtaining water from the local water utility.

- **Initiating measures to tame non-revenue water** that results in reduced revenues for water that they otherwise would have sold to consumers.

- To enhance their performance on the water quality parameter, **kiosks should carry out regular water testing and keep a record of these reports**.

- Improving the time taken to restore water services in case of a breakdown is also a key consideration for improved performance. **The water users' satisfaction with the reliability of the water kiosk operations significantly impacts its technical viability**.

- In cases of dissatisfaction with water quality among consumers, **the kiosks should consider establishing their transportation value chain** to guarantee the use of clean jerricans and safe handling of the resource during transit to the consumers. This would also contribute to controlled transportation costs that reduce the burden incurred by consumers, for whom transport being expensive is a consideration when selecting whether to use Maji Safi for all their needs.

By adopting these measures, water kiosks can contribute to making clean, safe water more accessible and affordable, thereby lessening the water burden on the community.

Table 15:
Kiosk-specific interventions to improve their technical viability

Kiosk	Establishing additional kiosk(s)	Addressing causes of NRW	Regular water testing and record keeping of results	Improving time taken to restore water services	Establishment of transportation value chain
Kangemi		✓	✓		✓
Maragua	✓		✓		✓
Wath Ong'er	✓			✓	✓
Korumba	✓				✓
Ngoliba	✓	✓	✓	✓	✓
Sondu	✓	✓	✓	✓	✓

4.
Financial performance of the water kiosk

4.1
Overview and context

The SWE model provides a potential market opportunity to serve 3.86 billion unserved and underserved persons globally.

The Safe Water Enterprises (SWE) use **market approaches to deliver high-quality water** treated at the point of consumption. Often, these solutions offer the full range of services across the value chain – from extraction, treatment, and payment collection.[40] In the context of middle- and low-income countries, these enterprises are referred to as Water ATMs which provide affordable safe drinking water.[41] The SWE model provides a potential market opportunity to serve 3.86 billion unserved and underserved persons globally.

In this chapter, we discuss and highlight the financial performance of the six water kiosks under evaluation. To achieve this, we assess their revenues, costs, net financial benefits, customer growth, water demand, and some non-financial factors to determine their viability. The assessment is based on the methods described in **Annex 3** and the financial records provided.

40 ibid
41 Safe Water Network (2023). *Sustainable Enterprises for water and health financial and operational performance of safe water enterprises in India.*

4.2
SWE project actors implementation cost

The key implementing entities identified in the set-up of the kiosks can be categorized into three as outlined below:

i) **Asset developers** (financing the infrastructure through capital investments training, managing entities, and carrying out WASH Hygiene Training),

ii) **The network operators** (operating and maintaining the systems through revenue collection and servicing the infrastructure – entities managing the systems CBO, Healthcare centre, and NGO), and,

iii) **The regulator** (acting to ensure that rules and guidelines for water service provision are adhered to)

In **Annex 2**, we present a summary list of kiosks established by Siemens Stiftung in Kenya. A breakdown of the total project investment costs is indicated in **Table 16** below.

Table 16:
Breakdown of total budgetary costs for SWE implementation across East Africa

No	Activity	Total (EUR)
1	Kiosk construction	**52,800**
2	Monitoring software	**1,200**
3	Piping/pumps, containers, water tests, chlorine solution	**15,336**
4	Total	**69,336**

4.3 Revenue analysis

The financial sustainability of SWEs is critical to unlock the potential of offering safe water at scale, especially in low-income areas.

4.3.1 Historical revenue trends

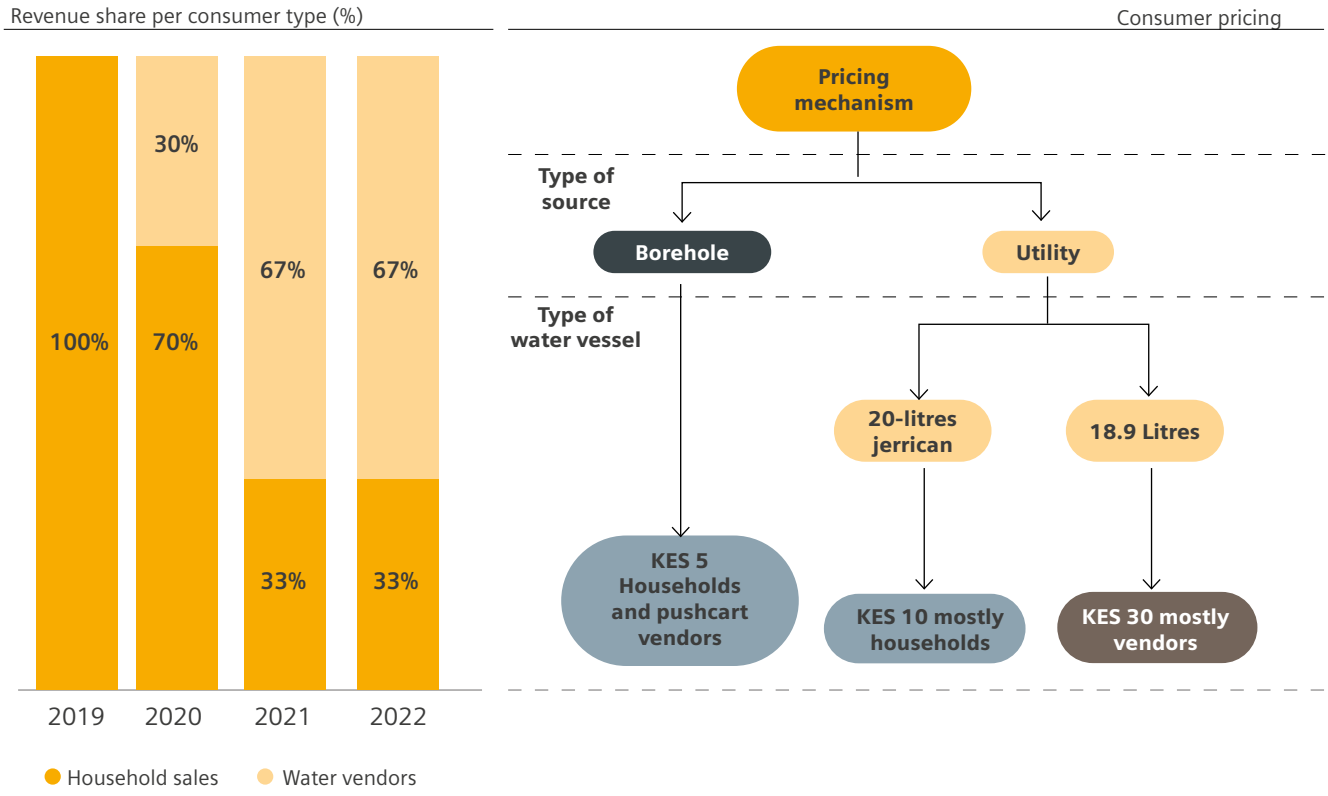
As of 2022, at least three kiosks - Kangemi, Wath Ong'er, and Maragua had sales volumes of above KES 500,000 while Ngoliba, Sondu, and Korumba sales volumes ranged between KES 150,000 – KES 300,000 (**Figure 31**).

Figure 31:
Revenue trends: yearly revenues, annual growth rate, and the compounded annual growth rate of the SWE kiosks

Over three years, most of the SWEs indicated revenue growth, regardless of the setting. Kangemi and Maragua SWEs had a year-on-year increase in their revenue streams with a compounded annual growth rate of 28% and 20%. Wath Ong'er, Ngoliba, and Sondu had a CAGR of 9%, 3%, and 15%, respectively - with fluctuations in their year-on-year revenue, all notably higher than the industry CAGR indicated by the water utilities (2.9%). With a CAGR of - 4%, Korumba SWE struggled to grow its revenues between 2019 and 2022. Moreover, Wath Ong'er has consistently been able to pay for the loan borrowed to install the water ATM and the land upon which the kiosk is constructed from the revenues collected.

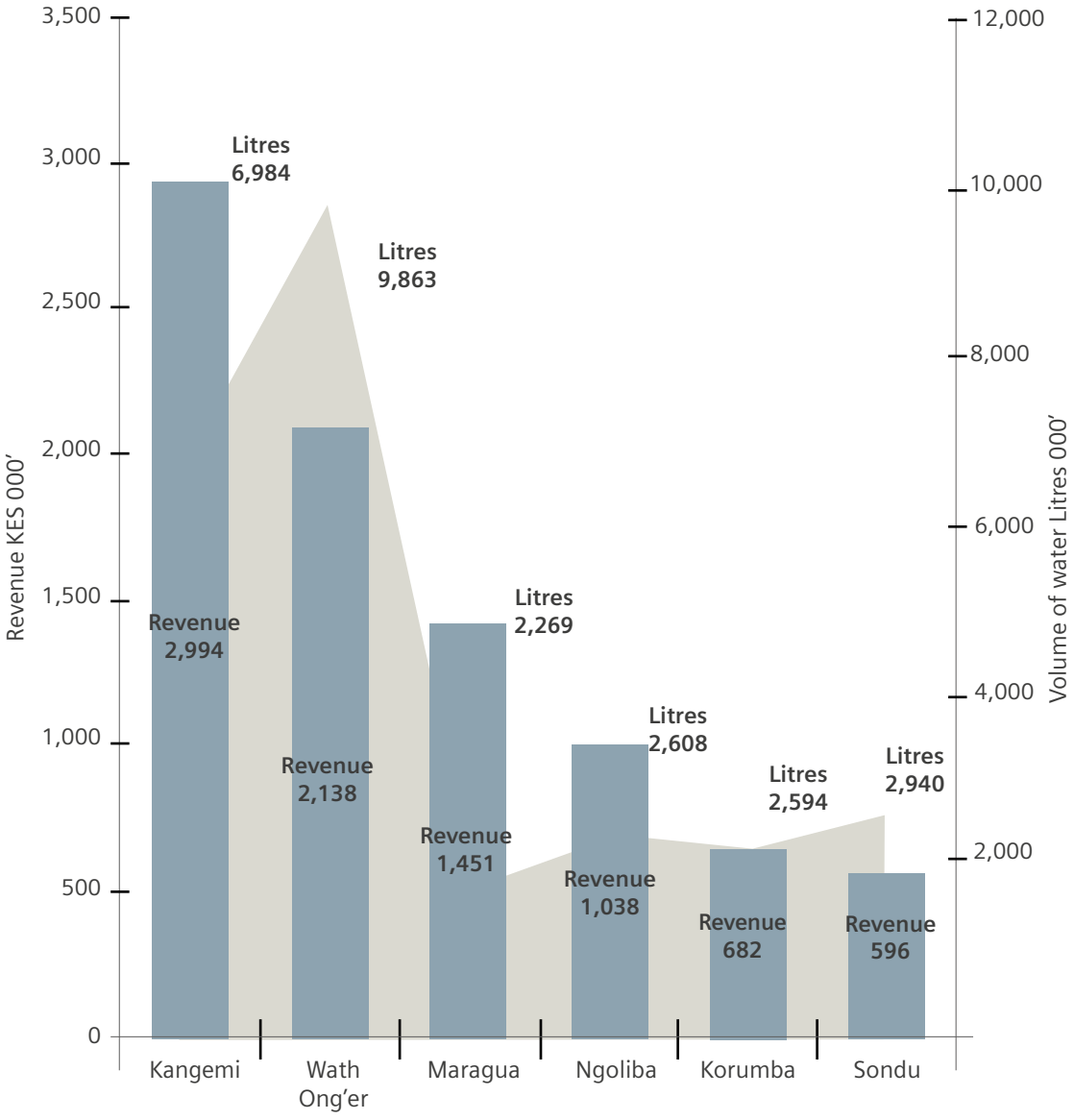
The most consequential driver of revenue growth is a market approach that targets distinct customer groups. Kangemi SWE kiosk, which doubled its revenue stream between the years of 2019 and 2022 has a differentiated pricing mechanism for customer groups. In 2020, when the kiosk started separately tracking sales to vendors and households, the revenue share split was 30% to 70%, respectively. By the end of 2022, the revenue from water vendor sales had increased to account for 67% compared to 33% from households (**Figure 32**). By offering safe water refills, the kiosk leverages drinking water demand from the middle class through the water vendors. The latter group purchases the same unit of water at a higher price. Therefore, the increase in sales is correlated to the pricing of the water rather than an absolute increase in the volumes of water sold as shown in the figure below.

Figure 32:
Revenue trends: Yearly revenues, annual growth rate, and the compounded annual growth rate of the SWE kiosks



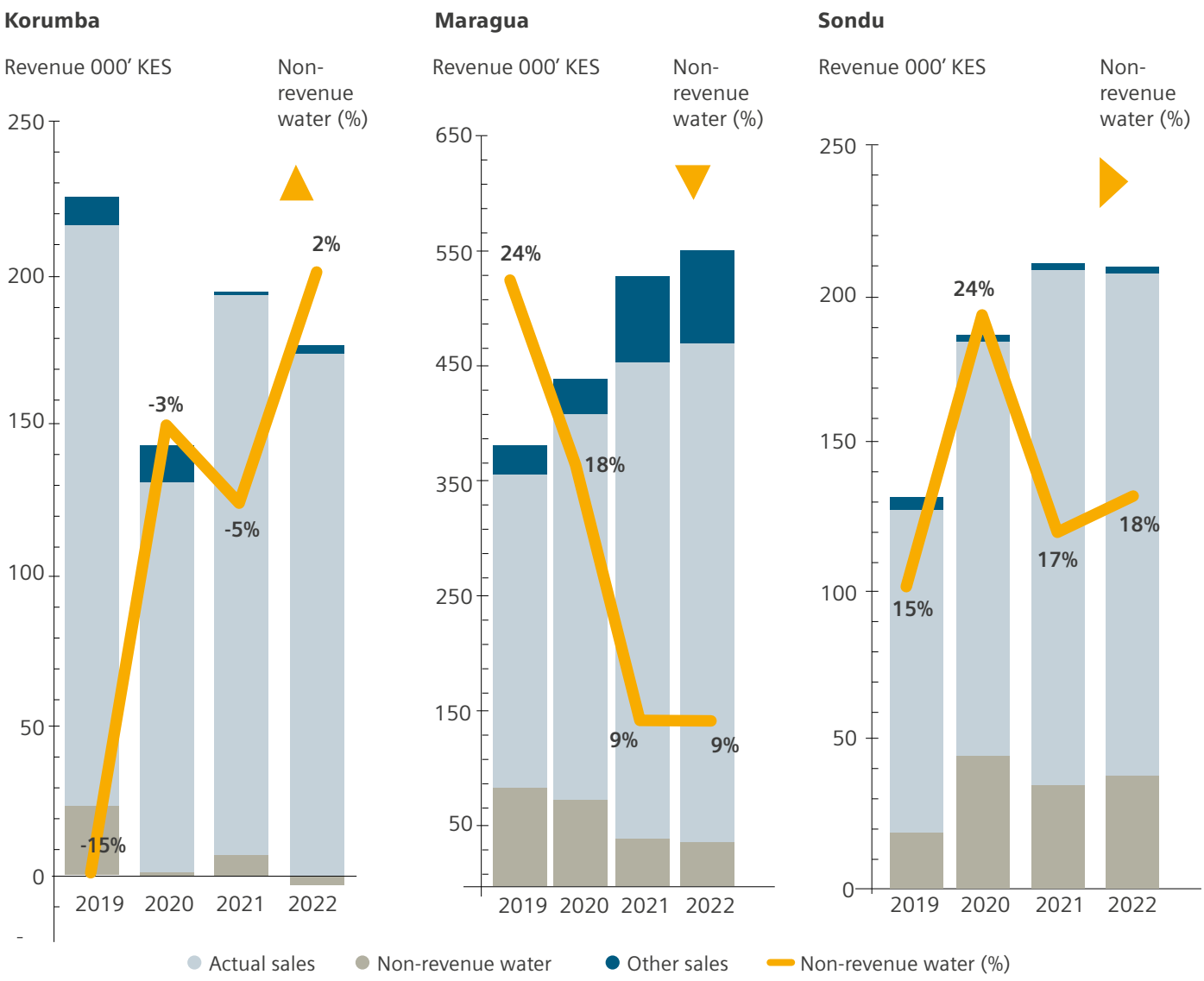
For kiosks of a similar production capacity and base charge fee, non-revenue water reduces the revenue potential of the SWEs. Sondu, Korumba, and Wath Ong'er SWEs charge a fee of KES 5 per 20-litre jerrican while Maragua and Ngoliba charge KES 10 per 20-litre jerrican. Maragua and Ngoliba SWE cumulative production capacity ranges from 2,269,000 litres to 2,608,000 litres respectively (**Figure 33**). However, the revenue from water sales is about KES 1,451,000 (Maragua) compared to KES 1,038,000 (Ngoliba). Conversations with the operators at Ngoliba indicate that part of the non-revenue water (20%) supplements the hospital water supply and is used for cooking. The same phenomenon is observed for Korumba and Sondu, with the former indicating higher revenue (0% non-revenue water) compared to Sondu (19% non-revenue). The cause of the latter is unclear but could be attributed to the absence of an automated system (Water ATM) that would enable the tracking of sales and volume sold.

Figure 33:
Comparing the cumulative revenue and cumulative volumes of water sold from kiosks with a similar production capacity and base charge. Non-revenue water is observed to affect the revenue potential of Ngoliba and Sondu



Where a differentiated pricing mechanism is not employed, both reducing non-revenue water and the right alternative source of revenue will critically grow revenues. This assertion arises from reviewing the revenue growth drivers for Maragua, Sondu, and Korumba SWE kiosks including the number of customers, reliability of kiosks, number of operating hours, and kiosks efficiency. Maragua SWE sequentially reduced non-revenue water from 24% (2019) to 9% (2022). Complementing the kiosk's water sales revenue is a public restroom and the selling of jerricans. Revenues from the latter doubled from 8% in 2019 to 16% in 2022. Although Sondu SWE also has a public restroom, the impact of the sales from that activity is less pronounced indicating that the location of the restroom is key. Conversations with the kiosk operator reveal that the public restroom has challenges that include vandalization and breakdowns. Maragua's SWE is in the middle of the town center next to a designated marketplace and a public transportation stage. In the case of Korumba – nonrevenue water is low, the decline in revenue is directly driven by a drop in the revenues from the alternative source of revenue (**Figure 34**).

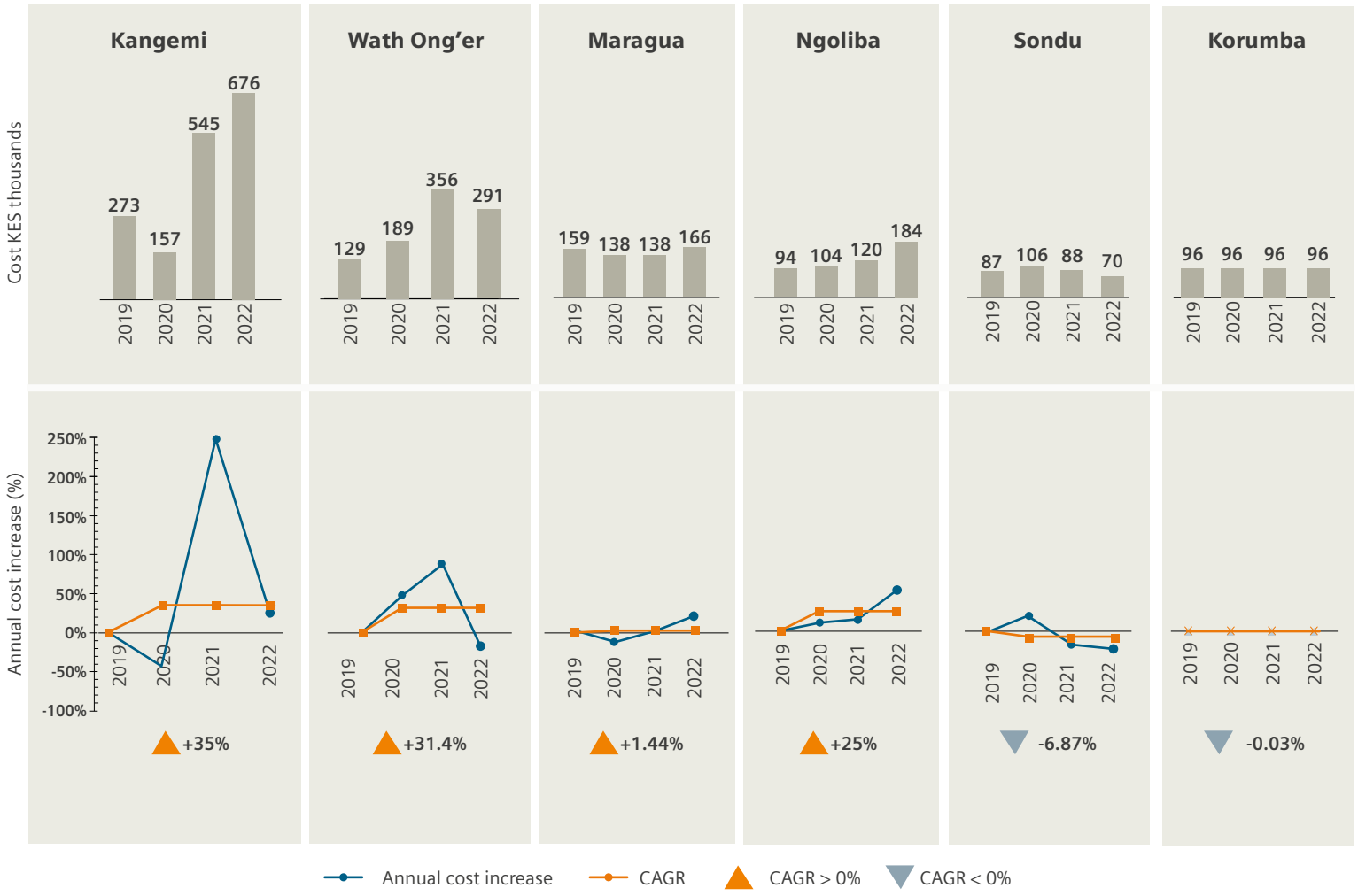
Figure 34:
Driving revenue growth through increasing sales revenue from alternative sources and decreasing non-revenue water. A comparison of Korumba, Maragua, and Sondu SWE kiosks.



4.4 Cost analysis

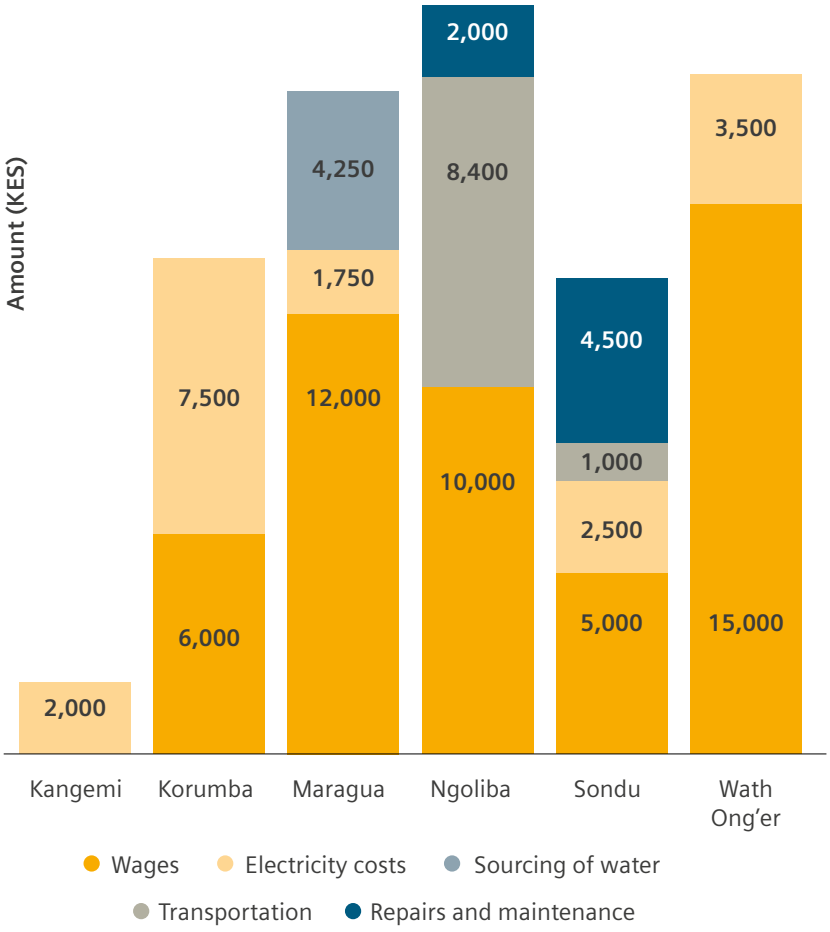
The SWE costs were noted to increase in four of the six kiosks. Kangemi, Wath Ong'er, and Ngoliba had a CAGR of +35%, + 31.4%, and 25% respectively. Maragua and Sondu SWEs managed to keep the cost increases to a minimum at a CAGR of +1.44% and -6.87%, respectively despite increasing the volumes of water sold. Kangemi SWE experienced a sharp increase in costs from Y2020 to Y2021 (250% increase). The monthly data provided does not provide the breakdown per expense item. However, discussions with the kiosk operators indicate that due to the unreliable supply of bulk water, the kiosk purchases water through Nairobi Water's Water Trucks (10,000 liters/ KES 6,000). Where the supply is stable, the SWE usually supplements bulk water through the purchase a weekly purchase of 10,000 liters. When the supply is low, the frequency increases to 3 – 5 purchases/week which is a considerable expense to keep up with the demand from their users.

Figure 35:
Cost trends: Yearly Costs, Annual Growth Rate, and the Compounded Annual Growth Rate of the SWE Kiosks.



Except for Kangemi, the kiosks, and the main expense classes are homogeneous and primarily related to the operations across the SWEs. The breakdown of the expenses incurred by all or some of the kiosks is indicated below[45]. Wages and electricity bills account for the larger expense share across the kiosks. In addition to these, Wath Ong'er is in the process of repaying a loan for infrastructural developments through revenue sales. They took on debt for capital infrastructure and have successfully completed the repayments for the KES 500,000. The payment of the land upon which the kiosk is built is nearly complete with KES 20,000 remaining as of December 2023.

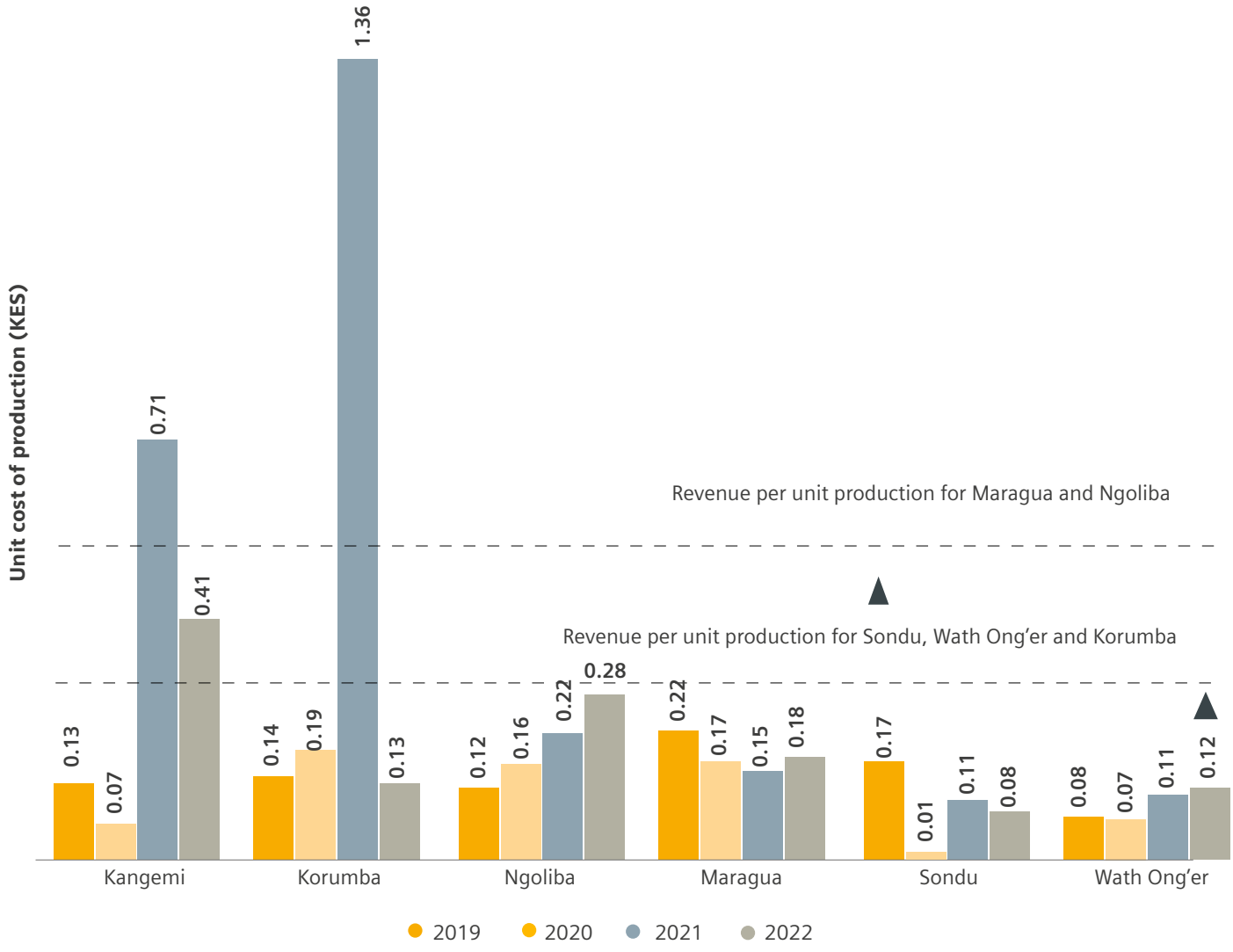
Figure 36:
The approximate costs incurred per month based on the KII responses from the operators



45 The kiosks did not have records of all the costs incurred hence the disparity in Figure 35.

To eliminate the need for external financing for operational costs, the kiosks will need to set their tariffs on cost-based pricing, i.e., a pricing strategy that will allow the kiosks to cover their expenses for their production capacity. This study reviews the cost of unit production (cost in KES/litre) against the revenue of unit production to ascertain the adequacy of the tariffs adopted (**Figure 37**). Maragua, Wath Ong'er, Sondu, and Ngoliba SWEs have consistently kept their cost of production lower than the revenue. Comparing SWEs with the same base charge, Maragua SWE margins of revenue to cost are more than 2x over the four years while Ngoliba SWE margins are slowly eroding as the cost of production continues to increase. The margins are slightly lower than 2x. Wath Ong'er and Sondu SWE margins are also 2x more. Korumba's margins have fluctuated from year to year. The margin of revenue to cost per unit of production was less than 1 for 2021. Implying that the volumes of water produced in that year were low, while the costs remained the same. The same phenomenon was observed for Kangemi, where the cost of production was high in 2021 due to a drop in the volume of litres sold.

Figure 37:
Comparison of cost and revenue per unit production (KES/litre)



Although the tariffs seem to provide adequate cost coverage, Kangemi and Korumba's fluctuations highlight the need to develop elaborate cost-effective coping strategies for when production is low. These may include introducing additional water storage to ensure a base supply that can allow sufficient revenue collection to cover the usual times of the water supply system. For longer times – lower production than normal, the kiosks will need to be aware of where they can easily reduce their costs.

It is important to note that to be fully independent of external financing, the SWE tariffs will need to be set based on full-cost recovery for providing the service including the operating costs, capital costs, and administrative/regulatory costs[46].

46. WASREB (2019). Tariff Guidelines. https://wasreb.go.ke/downloads/Tariff%20guidelines.pdf

4.5
Cost benefit analysis

Regardless of the setting, cumulatively each of the kiosks posted a positive net cash balance as indicated in **Figure 38**.

Figure 38:
Comparison of revenue, expenses, and net balance across the SWE models.

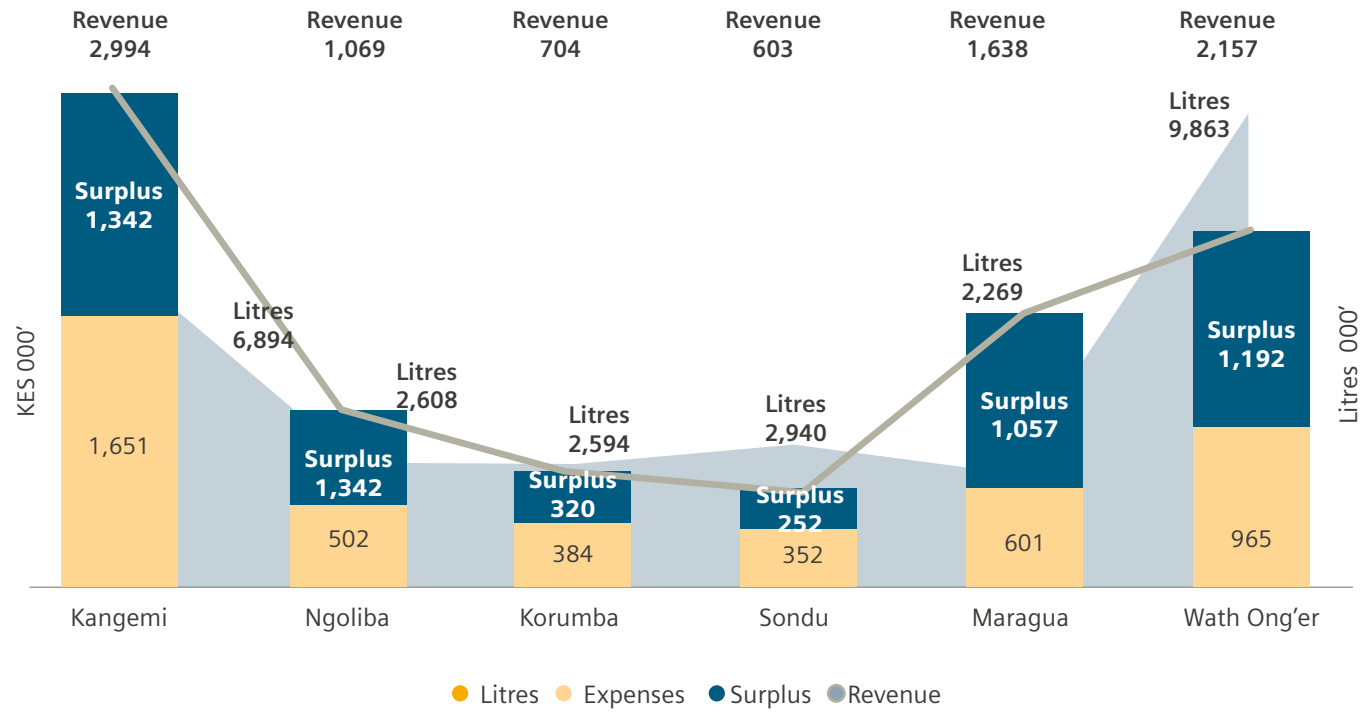
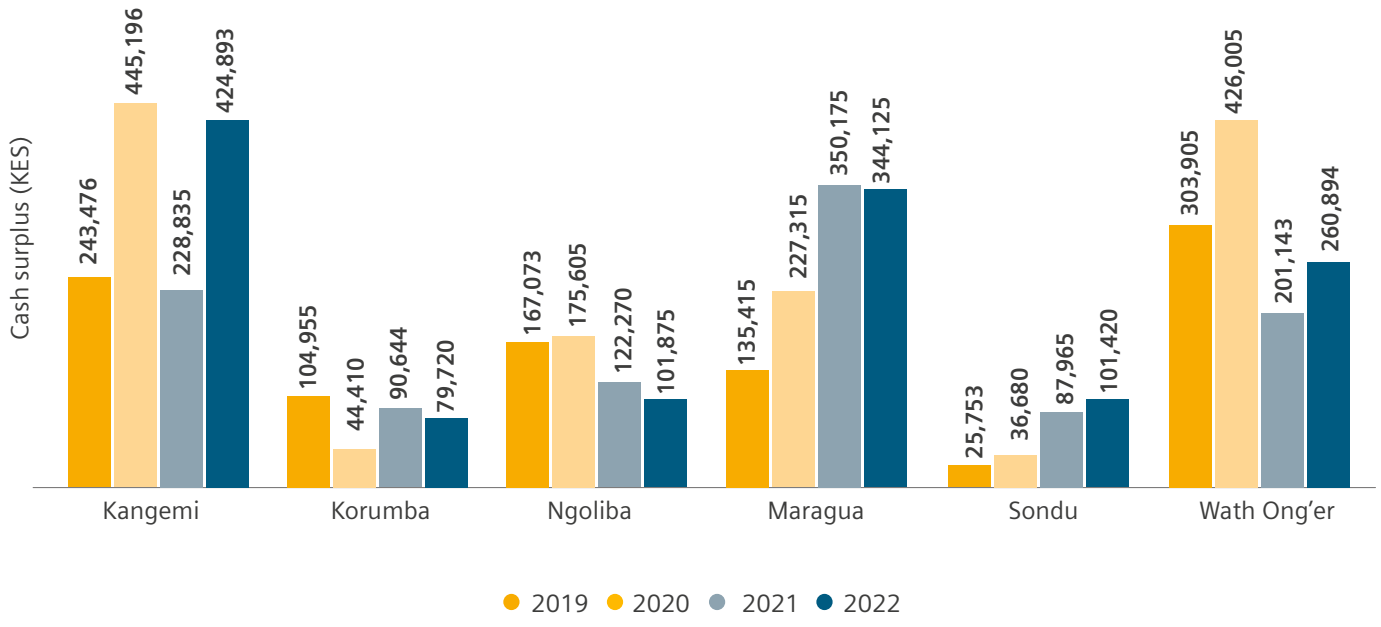
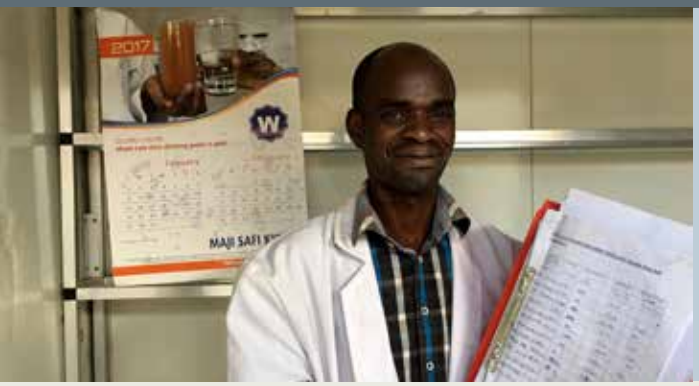


Figure 39:
Year-on-year cash surplus per kiosk

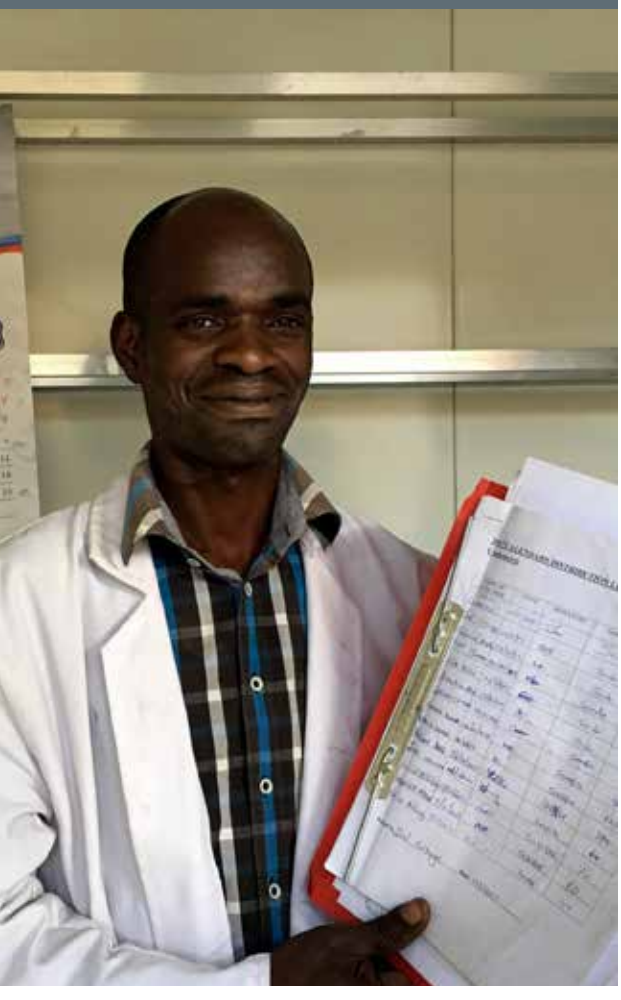


5.
Sustainability and scalability of the kiosks



5.1
Overview and context

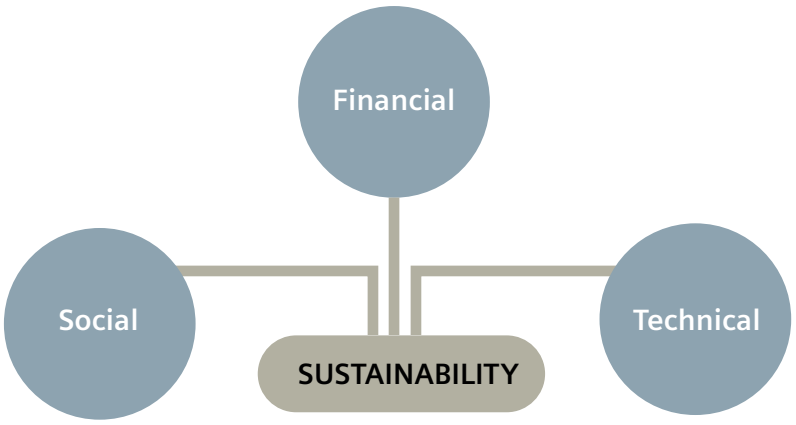
Sustainable water kiosks must generate enough revenue to cover their operational costs, maintenance, and potential expansion.



The sustainability of a water kiosk is crucial in informing its ability to scale. For example, sustainable water kiosks must generate enough revenue to cover their operational costs, maintenance, and potential expansion**.** A well-designed revenue model ensures that the kiosk can sustain itself without relying solely on external funding. To scale, a kiosk needs to demonstrate its ability to become financially self-sufficient or attract investors and donors interested in supporting its growth. Sustainability and scalability are not dichotomous variables. To be able to scale, the kiosk must reflect its ability to be sustainable.

The sustainability assessment of the six kiosks involved evaluating their ability to meet current needs without compromising the ability of future generations to meet their own needs. In defining the sustainability of the water kiosks, distinct dimensions have been considered: **social sustainability, financial sustainability, and technical sustainability**.

Figure 40:
Dimensions of sustainability



5.2 Sustainability of the SWE kiosks

5.2.1 Social sustainability

Social sustainability in the context of this study refers to the ability of the water kiosk's operations and services to meet the present and future needs of the community it serves while promoting social well-being, equity, and resilience. Several factors could negatively or positively affect the social sustainability of the kiosk. This includes the operational management and ownership structures, customer perception, and enterprise development (business establishments e.g. water vending) as a resultant impact of the water kiosk.

Table 17:
Social sustainability findings

#	Factor/indicator	Description	Social sustainability impacts/findings
1	Operational management and ownership	All water kiosks, apart from the Ngoliba and Kangemi kiosks, are owned and run by community-based organizations (CBOs).	• There are some considerable benefits to decentralized systems being owned and run by CBOs, however, there are also proportionate demerits. • In a key informant interview carried out with members of the CBO in Maragua, it was reported that the former chairperson was responsible for embezzling funds from the kiosk.
2	Local employment and economic benefits	Socially sustainable water kiosks may create job opportunities and business growth within the community, contributing to local economic development; this can enhance the social fabric of the area and improve livelihoods.	• Data obtained from the survey carried out with water vendors indicated that 70.37% of water vendors highlight that the Maji Safi kiosk has helped them in growing their businesses, compared to 28.63% who indicated that the kiosks have not had any influence in them scaling their businesses. • In addition, 38% of water vendors attributed their profits to the water kiosks.
3	Customer perception	Customer perception plays a crucial role in the success of businesses in today's competitive market.	• Purchasing decisions are influenced by multiple factors, including social, cultural, personal, and psychological aspects. Affordability was one of the variables used to gauge consumer perception towards the water kiosks. • Maji Safi kiosk consumers were very satisfied and satisfied with the price of water charged at the kiosk. Across all kiosks, 53.40 % of consumers were satisfied with the price of water charged.

5.2.2 Financial sustainability of the SWE kiosks

To ensure the kiosks are financially sustainable, their revenues must be adequate to meet their current operational expenditures as well as a reserve for emergency expenses. Moreover, by design, as a social enterprise, it is envisioned that the kiosks would have alternative revenue sources from running social enterprises. From the findings, the kiosks either have an alternative revenue source in the form of a restroom accessible by the community at a fee or planning to set up a business venture as an alternative.

In the Maragua market kiosk, there is already a restroom accessible at a fee, and Wath Ong'er currently offers phone-charging services and has also ventured into poultry farming and the establishment of tree nurseries. Based on the findings highlighted in **Figure 49**, each of the kiosks posted a positive net cash balance indicating that they are financially sustainable.

5.2.3 Technical sustainability of the SWE kiosks

In the context of this study, we define technical sustainability as the long-term ability of the kiosk's infrastructure and operational systems to provide clean and safe drinking water and ensure continued functionality effectively and efficiently. Factors used to assess the technical sustainability of the water kiosks include kiosk infrastructure maintenance, general maintenance and repairs, and cleanliness.

Table 18 below indicates the parameters used in determining the technical and environmental sustainability of the kiosks.

Table 18:
Technical and environmental sustainability rating for each water kiosk

Kiosk	Frequency of maintenance	Water quality[47]	Reliability of water source	Alternative water sources	Hours of supply	Accessibility[48]	Non-revenue water (%)	Overall rating
Kangemi	1	4	2	2	2	3	2	16
Maragua	2	4	2	1	1	1	2	13
Wath Ong'er	2	2	3	1	2	1	2	13
Korumba	2	2	2	1	1	1	2	11
Ngoliba	1	3	3	1	2	1	1	12
Sondu	2	3	2	1	2	1	2	13

Total maximum points - 20	Highly environmentally and technically sustainable water kiosks: scores 14-20
Total medium score - 13	Moderately environmentally and technically sustainable water kiosk: scores 7-13
Total minimum score - 6	Not Environmental and technical sustainable water kiosk: scores 1-6

47 Based on the test results provided and observation.

48 Accessibility encompasses distance to the water point, time spent to get to the water point and fetch water, and the quantity of water that households can fetch.

From this analysis, all the water kiosks are technically and environmentally sustainable with only Korumba and Ngoliba ranked as moderately sustainable and the rest of the kiosks highly sustainable. Although recent water quality reports were not provided for Maragua, Ngoliba, and Sondu, we establish their performance based on the customer satisfaction assessment undertaken as part of the survey. The moderately sustainable kiosks should consider alternative methods to enhance the dependability of their water supply. This could involve exploring options such as establishing additional water sources, like a borehole, or obtaining water from the local water utility. **Table 19** highlights some of the possible suggestions for addressing accessibility challenges, especially for rural kiosks.

Table 19:
Suggested improvements in addressing accessibility challenges

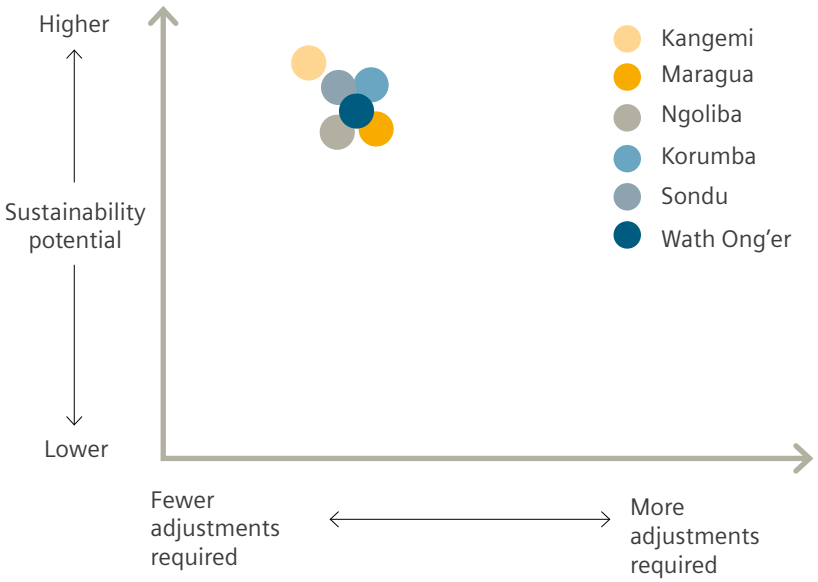
Suggestion	Implementation strategy
Location change	When looking to expand the kiosk operations, the kiosk could choose strategic locations for water kiosks that are easily accessible to the target customer base. Consider proximity to residential areas, schools, markets, and public transportation hubs.
Queue management	The kiosks could implement an organized queuing system, such as designated waiting areas or queue numbers, to prevent long lines and minimize waiting times, and with time, the kiosk could look to integrate digital software that could inform customers of wait times.
Increase in dispensing/ collection points	The kiosks could increase the number of water-dispensing points (taps or machines) to serve more customers simultaneously and ensure staff are in multiple stations during peak hours to reduce wait times.
Prepayment options	The kiosks could seek to offer prepayment options, such as smart cards to reduce transaction times and streamline the payment process.
Extended operating hours	The kiosks should consider extending the operating hours of the water kiosk, especially during peak demand times, to spread out the customer flow and reduce congestion.

5.2.4 Sustainability potential of the SWE kiosks

Figure 41 presents the sustainability potential of the six kiosks assessed. The sustainability levels of all water kiosks are ranked in **Table 18**. From the figure below, we can establish that all the kiosks are presently sustainable based on the three dimensions but will require a few or minor adjustments to ensure long-term sustainability. These adjustments range from increasing hours of supply to improving accessibility and improving the reliability of the water source. It will be important to assess the potential of the kiosks to maintain consistency two to three years after the handover.

Since the kiosks are mostly community-managed (decentralized management), the social sustainability aspect scores high with customers always looking forward to the clean water from the kiosks.[49] The only dimension that will require adjustment is the financial aspect; the collection and handling of revenues derived from the kiosks would determine for how long the kiosks can remain active and consistent in their operations. Moreover, with climate variability, water production is affected, hence the kiosks will have to establish coping mechanisms to be able to produce enough water that meets the customers' demand and maintain consistent revenue flows. Consequently, the kiosks may consider a partnership with the county governments and get capital subsidies or operational finance support as a sustainability option.[50]

Figure 41:
Sustainability ranking of each water kiosk



49 Cherunya, P. C., Janezic, C., & Leuchner, M. (2015). Sustainable Supply of Safe Drinking Water for Underserved Households in Kenya: Investigating the Viability of Decentralized Solutions. Water 2015, Vol. 7, Pages 5437-5457, 7(10), 5437–5457. https://doi.org/10.3390/W7105437

50 Bhatnagar, N., Lampert, S., Goyal, V., Mehta, R., Rai, R., & Chandrasekhar, A. (2017). The Untapped Potential of Decentralized Solutions to Provide Safe, Sustainable Drinking Water at Large Scale The State of the Safe Water Enterprises Market. January.

5.3 Scalability of the SWE kiosks

Scalability involves the capacity to expand or adapt the water kiosk infrastructure, services, and resources to meet the growing needs of the community it serves.

Scalability involves the capacity to expand or adapt the water kiosk infrastructure, services, and resources to meet the growing needs of the community it serves. The more scalable the kiosk is, the more likely it is for it to address the increased customer demand while maintaining consistent water quality, accessibility, and affordability. While sustainability will ensure adequate water, scalability would depend on the revenue growth trends. For example, a positive net revenue would indicate a potential to scale while a negative net revenue may well indicate the potential of the kiosk to run down.

From this study, most respondents, especially those residing far from the kiosks expressed the need to have an alternative kiosk nearby. The kiosks can scale in two main ways:

i. Constructing alternative kiosks to address the customer needs and increase customer growth, and

ii. Establishing a distribution system through piping.

To meet the cost of either constructing a new kiosk or establishing a distribution system, a significant financial investment would be required. If the current revenues cannot meet the cost of scaling up, the kiosks may require external support. To establish the sustainability potential of the kiosks, we look at the financial, technical, and social standing respectively position. In **Table 20**, we highlight the summary of the findings based on the current state of the kiosks. Other factors such as the availability of alternatives were also considered in establishing the scalability potential of the kiosks. For example, in Kangemi, consumers have multiple options to access water at no cost, however, the quality of Maji Safi kiosk water supersedes that of the alternative sources.

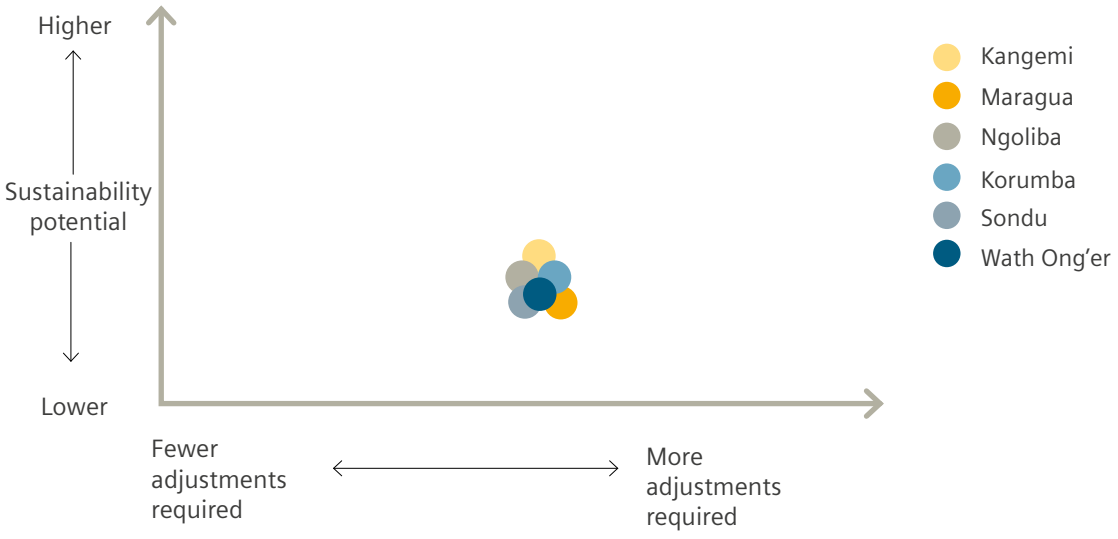
Table 20:
Scalability parameters

#	Kiosk	Social standing	Financial standing	Technical standing	Scalability potential
1	Kangemi	Good	Good	Good	Minimal
2	Maragua	Good	Good	Good	Minimal
3	Wath Ong'er	Good	Good	Good	Minimal
4	Korumba	Good	Satisfactory	Good	Minimal
5	Ngoliba	Good	Good	Good	Minimal
6	Sondu	Good	Satisfactory	Good	Minimal

None of the kiosks, in their current state, can scale their operations; enhance production capacity, set up satellite and or alternative kiosks, and supply water to high-water consumption facilities consistently. Based on this assessment, the SWE kiosks will require partnerships with institutions that can offer financial and technical assistance. For example, having a routine technician dedicated to the kiosks would assist in reducing losses that occur during breakdowns as such can be fixed in time. Additionally, all the kiosks currently incur considerable amounts of non-revenue water that can be converted into revenues.

One of the ways to scale is to seek financial aid; this can come from either donor partners or banking institutions. In Kenya, multiple financial and micro-financial institutions offer credits for water-related projects. However, accessing credit would require good financial standing, the ability to forecast revenue growth trends, and consistent records. From the assessment, most of the kiosks still require training on bookkeeping and financial management making them currently 'not ready'. Operating a water kiosk involves various costs. Failing to allocate resources for essential aspects can lead to financial instability and, ultimately, operational failure. Without a well-structured budget, the kiosks may find themselves struggling to cover their basic expenses, compromising the quality of their services, and invariably affecting the ability of the business to scale. This evaluation, therefore, concludes that the six SWE kiosks currently have a low potential to scale as illustrated in **Figure 42** below.

Figure 42:
Scalability potential of the SWE kiosks



A case study in Uganda[51] highlights that climate vulnerabilities may not have significance in the ability of the kiosks to scale due to weak management and pump breakdowns. The latter directly affects the ability of the kiosks to function and for the kiosks to be able to scale up, the technical and operational management has to be given priority. In Rwanda, intermittent water supply, high production cost, price sensitivity, and consumer demand affect both the sustainability and scalability of the decentralized kiosks.[52] Therefore, it is only when the kiosks have the capacity to address their customer demand issues, production capacity, and water supply challenges that they can be deemed to be ready to scale. Additionally, MajiPlus recognizes that kiosks can maximize their revenues and improve self-sufficiency through innovations like the use of water ATMs[53], however, this may not be enough to enable scale-up, hence the need for partner organizations and donors who can fund operational components to ensure sustainability and scalability.

51 Bouman, L., & Eawag, R. M. (2022). Business Case Study : *GDM Water Kiosks in Eastern Uganda. 41(July), 0–23.*

52 Huttinger, A., Brunson, L., Moe, C. L., Roha, K., Ngirimpuhwe, P., Mfura, L., Kayigamba, F., Ciza, P., & Dreibelbis, R. (2017). *Small Water Enterprise in Rural Rwanda: Business Development and Year-One Performance Evaluation of Nine Water Kiosks at Health Care Facilities. International Journal of Environmental Research and Public Health, 14(12).* https://doi.org/10.3390/IJERPH14121584

53 MajiPlus. (2021). *Accelerating Rural Water Access with MajiPlus featuring the TokenTap.* https://www.projectmaji.org/post/accelerating-rural-water-access-with-majiplus-featuring-the-tokentap

6.
Social and health impacts of the SWE project

6.1
Overview and context

Decentralized water systems can enhance social equity by reducing disparities in access to clean water, particularly in marginalized communities.

Decentralized water systems can enhance social equity by reducing disparities in access to clean water, particularly in marginalized communities[54]. Further, they promote local water resource ownership and management, fostering community empowerment[55]. This approach also promotes social equity by ensuring that marginalized populations have access to clean water, bridging the gap between urban and rural areas and reducing water-related inequalities.

Access to clean water through a water kiosk can profoundly impact a community's health: reportedly, clean and safe drinking water has been associated with numerous health benefits, including a reduction in waterborne diseases like diarrhea, which remains a leading cause of morbidity and mortality worldwide[56]. Additionally, safe water plays a crucial role in preventing other water-related illnesses, such as cholera and typhoid fever[57]. The availability of safe water also supports overall well-being by promoting proper hydration and facilitating good hygiene practices[58].

In this chapter, we highlight the consumer perception of the significance of the existence of water kiosks in both households and businesses including water vendors that benefit from it.

54 Bakker, K., & Kooy, M. (2003). "*Splintered networks: The colonial and contemporary waters of Jakarta.*" *Geoforum, 34(3), 203-219*

55 Budds, J., & Hinojosa, L. (2012). *"Restructuring and rescaling water governance in mining contexts: The co-production of waterscapes in Peru." Water Alternatives,* 5(1), 119-137.

56 Prüss-Ustün, A., Bartram, J., Clasen, T., Colford, J. M., Cumming, O., Curtis, V., ... & Cairncross, S. (2019). *Burden of disease from inadequate water, sanitation and hygiene for selected adverse health outcomes: An updated analysis with a focus on low- and middle-income countries. International Journal of Hygiene and Environmental Health,* 222(5), 765-777.

57 Bartram, J., & Cairncross, S. (2010). *Hygiene, sanitation, and water: forgotten foundations of health.* PLoS Medicine, 7(11), e1000367.

58 Clasen, T., Pruss-Ustun, A., Mathers, C. D., Cumming, O., Cairncross, S., & Colford Jr, J. M. (2015). *Estimating the impact of unsafe water, sanitation and hygiene on the global burden of disease: evolving and alternative methods. Tropical Medicine & International Health,* 20(6), 758-764.

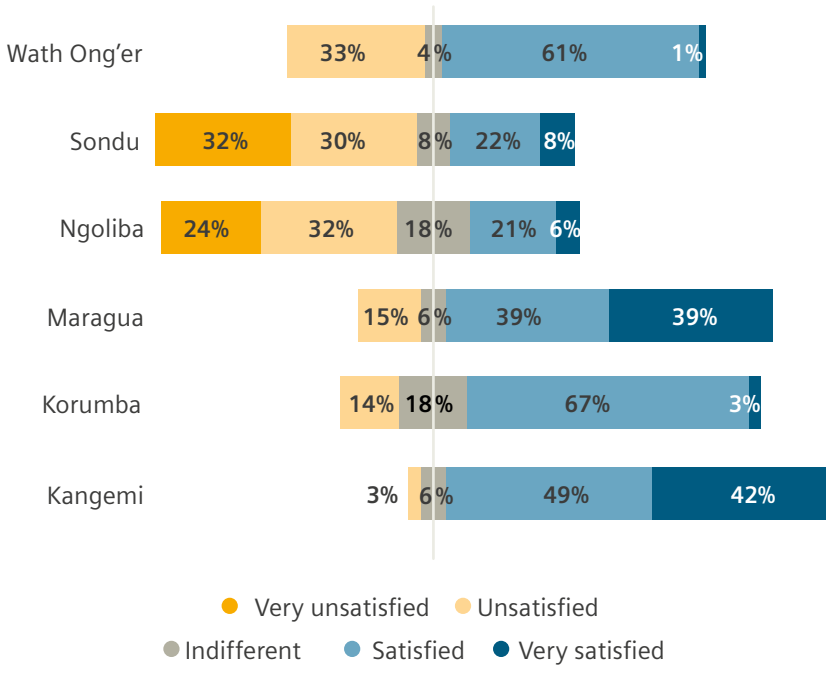
6.2 The social impact of SWE kiosks

Data obtained from the household surveys and key informant interviews show significant social impacts arising from the water kiosks. To establish the social impacts, we evaluated key aspects including: **reduced waiting times, time taken to walk to the kiosk, and the rise in business establishments.**

6.2.1 Reduced waiting times

These statistics reflect variations in queuing time satisfaction across different regions. While some kiosks report high satisfaction with queuing time, others face challenges. The majority of Maji Safi users experienced minimal wait times, with an average wait of 5 minutes or less. In Maragua, for example, 39.39% of Maji Safi users reported being very satisfied, and 39.36% reported being satisfied. This is also seen in Migori, with 61.19% being satisfied with the time it takes them to queue. With an average distance of only 200 meters to the kiosk, it offers convenience, contributing to the 90% satisfaction rate among users. Water kiosks with low satisfaction rates include Ngoliba, with 23.53% of users being very unsatisfied and 32.35% of users being satisfied. In Sondu, 32.43% of users reported being very unsatisfied, and 29.73% reported being unsatisfied.

Figure 43:
Time taken queuing satisfaction rates



Shorter waiting times and distances free up valuable time for individuals, especially women and children, who often bear the responsibility of collecting water. This extra time can be used for education, income-generating activities, or spending quality time with family, contributing to overall well-being. Reduced waiting times alleviate the burden on individuals, particularly women and children, who often spend significant portions of their day collecting water. This, in turn, empowers them to engage in other productive activities, such as education and income-generating work, thereby contributing to poverty alleviation and economic development[59]. Additionally, shorter queues can enhance community cohesion by reducing tensions and conflicts that may arise during long waiting periods[60]. Thus, by easing access to clean water, shorter queuing times at water kiosks contribute to communities' overall well-being and development, particularly in regions facing water scarcity challenges.

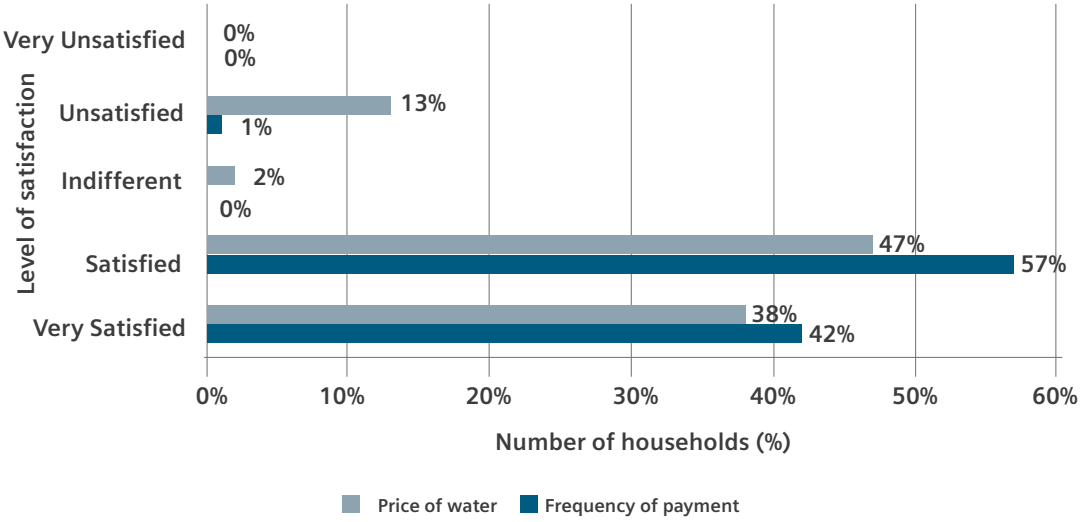
6.2.2 Rise businesses establishments

The specific business establishments supported by the water kiosks vary across the kiosks. While some kiosks mention direct support to water vendors or the emergence of community resource centers and libraries, others focus on the indirect economic benefits of providing the community safe and affordable drinking water. For example, in Ngoliba, the water provided by the kiosks has led to the emergence of small businesses such as butcheries, saloons, and restaurants. According to data obtained from the businesses, we can establish that most businesses are either very satisfied or satisfied with the price of water charged by the Maji Safi kiosks (37.74% & 47.17%, respectively) as shown below. Furthermore, out of the 27 vendors interviewed, 70.37% of vendors indicated that water obtained from the kiosk has helped them grow their businesses whilst 29.63% indicated the kiosks did not contribute to their growth.

59 Sangamithra, G., Magesh, N. S., & Mohan, V. R. (2018). *Impact of water kiosk on women's daily chores and their livelihood: A case study from Cuddalore District, Tamil Nadu, India. Environment, Development and Sustainability,* 20(2), 667-685.

60 Kjellén, M., & McGranahan, G. (2006). *Informal water vendors and the urban poor. IWA Publishing.*

Figure 44:
Payment and tariffs satisfaction rates



The equitable pricing at water kiosks has the capacity not only to encourage entrepreneurship and business expansion but also to bolster the community's general welfare and prosperity through job creation and the promotion of economic growth. This notion is evidenced by a study by Smith et al (2019) highlighting how exorbitant water prices charged by decentralized water systems can disproportionately burden small and medium-sized enterprises, hindering their growth and profitability[61]. In addition, the expansion of water vending businesses through kiosks plays a pivotal role in achieving both social and economic advancements in communities, making it an essential aspect of contemporary entrepreneurship.

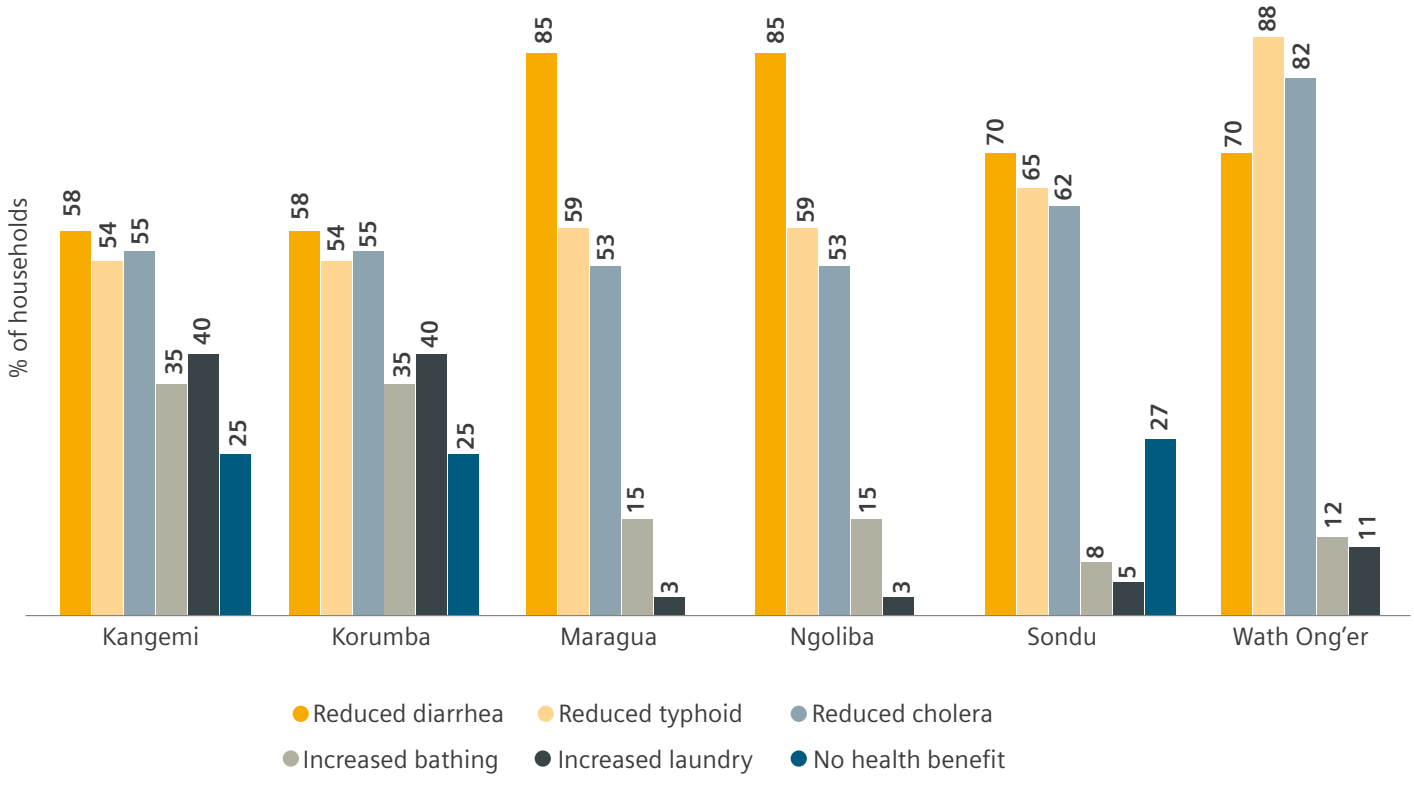
61 Smith, J., Brown, C., & Harris, L. (2019). *Water Poverty and the Burden of a Water and Sanitation Service in the Rural Developing World. International Journal of Environmental Research and Public Health*, 16 (16), 2842.w

6.3 The health impact of SWE kiosks

6.3.1 Prevalence of waterborne diseases

Across regions, users report a reduction in waterborne diseases, with over 90% of respondents rating the water as clean and safe. These kiosks contribute to lower incidences of illnesses like diarrhea and cholera. Improved water quality, regular testing, and hygiene promotion enhance health outcomes. From the figure below, we can establish that across all water kiosks, households reported reduced waterborne diseases such as diarrhea and typhoid, with Maragua and Ngoliba Maji Safi water users reporting larger health benefits that have resulted due to water usage from the kiosk. In addition, we can also note Maji Safi kiosk users interviewed in Korumba, and Kangemi have reported no health benefits associated with the kiosk.

Figure 45:
Health benefits across the six kiosks



Water kiosks are crucial in improving public health by providing access to clean and safe drinking water in many communities, particularly in regions with limited access to clean water sources. According to a study by Howard et al (2019), access to clean water through water kiosks significantly reduces the incidence of waterborne diseases such as diarrhea, cholera, and typhoid. These kiosks employ water treatment technologies that effectively remove contaminants and pathogens, ensuring that the water distributed is safe for consumption[62]. Furthermore, a study by Mukherjee et al (2018) highlights that water kiosks can decrease infant mortality rates by providing mothers with a reliable source of clean water for formula preparation and hygiene practices. Additionally, the convenience of water kiosks reduces the need for individuals to rely on untreated or contaminated water sources, thus reducing the burden of water-related illnesses in these communities[63].

6.3.2 Improved hygiene standards

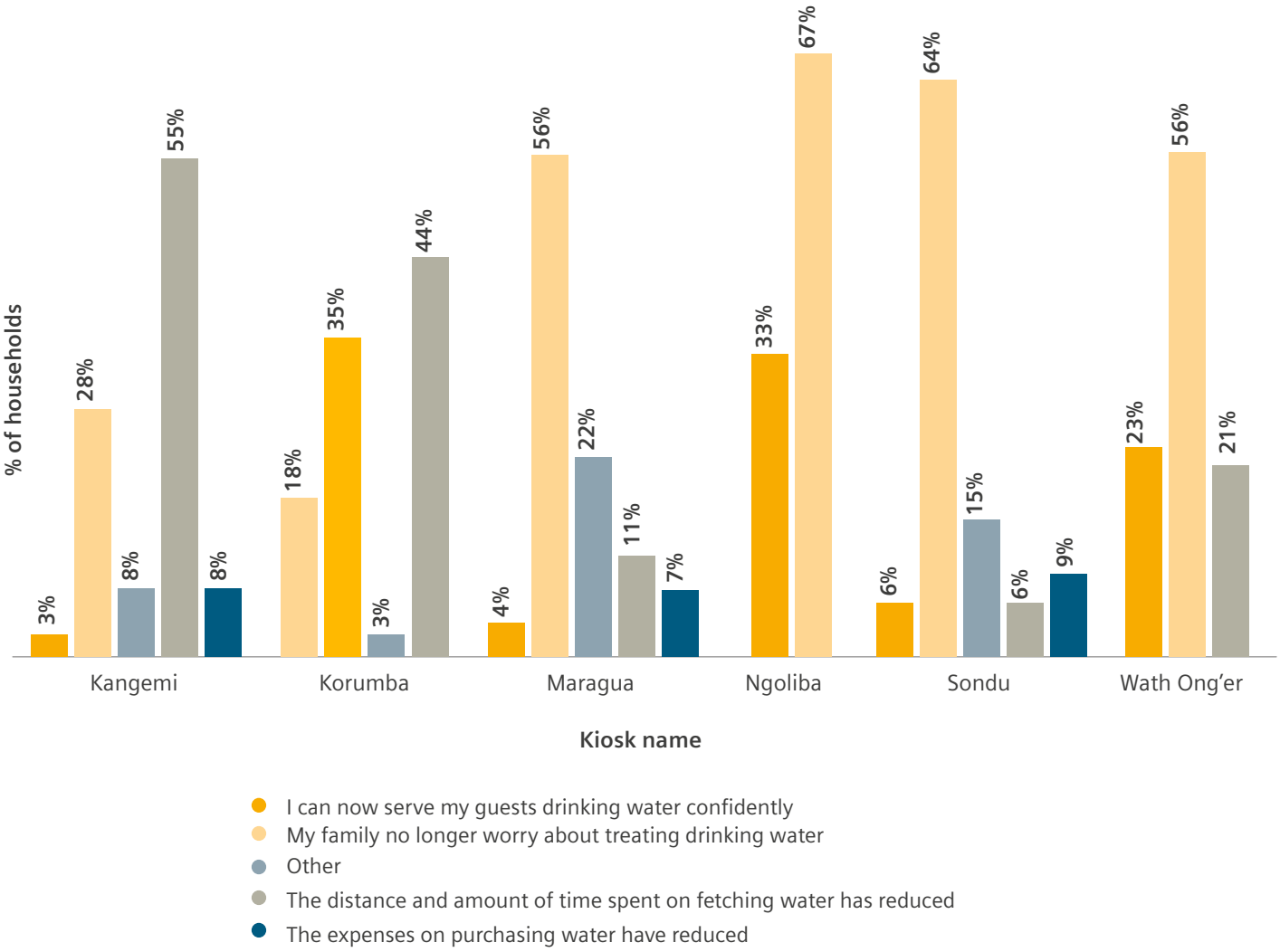
Data obtained from the household survey showed that over 50% of the households across all the water kiosks do not have to worry about water treatment because of the quality of water provided by the kiosks. Across all the kiosks, the households reported that they could now serve their guests drinking water without having concerns about its quality (**Figure 46**). This positive response shows that the kiosks are offering safe water and have the interest of the community members at heart. This finding is supported by academic literature as a study by Whittington et al (1991) highlighted the proliferation of trusted water kiosks in low-income urban areas has significantly reduced the need for individual water treatment practices, such as boiling or using chlorine tablets, which are often inconsistent and burdensome[64].

62 Howard, G., Bartram, J., & Fewtrell, L. (2019). *Systematic review of health risks associated with consumption of unprocessed or inadequately treated water. Environmental Health Perspectives,* 127(6), 066001.

63 Mukherjee, A., Roy, S., Das, D. K., & Biswas, D. (2018). *Water kiosks: A sustainable approach for safe drinking water supply in urban slums of India. Journal of Water, Sanitation, and Hygiene for Development,* 8(2), 342-351.

64 Whittington, D., Lauria, D. T., & Mu, X. (1991). *A study of water vending and willingness to pay for water in Onitsha, Nigeria.* World Bank Policy Research Working Paper No. 4859.

Figure 46:
Positive experiences reported by households



7.
Lessons learned and success indicators

7.1
Overview and context

To determine the potential of the safe water kiosks to scale and be sustainable in the long run, it is imperative to identify key lessons and success factors. It is from the lessons and success factors that the management of these kiosks can identify areas to improve on and those to maintain. Our interaction with different stakeholders and the project beneficiaries (consumers) points to a very impactful project, albeit with some lessons that could be picked for future projects. Consequently, we provide some of the lessons picked during the evaluation of the performance of the kiosk and the success factors.

7.2 Success indicators

Access to safe water not only contributes to better health but also spurs community growth in many aspects. For rural and underserved communities where access to safe water is limited due to the multiplicity of unsafe water sources, the Safe Water Kiosks can be seen as a game changer, and Maji Safi is a popular phrase. The following are some of the success factors identified during the project evaluation.

7.2.1 Improved quality water access

The interaction with Maji Safi Water consumers reveals that customers are confident about the water they consume. *"...I no longer have to worry about treating or boiling drinking water, Maji Safi has been of great help"* – Maji Safi kiosk user. Access to unsafe water sources forced a majority of the rural communities to either treat or boil water for drinking, however, things changed when the kiosks were installed as they no longer had to worry about access to clean and safe drinking water.

Further, with the majority of the water kiosks having water ATMs, the customers could access the water at any time. Similar initiatives by other agencies like Oxfam[65] suggest that the use of electronic service-based systems ensures the sustainability of these systems especially in rural areas with no or limited piped connections.

Figure 47:
Maji Safi kiosks users queuing for safe drinking water at Ngoliba kiosk – Kiambu County

65 Goodrich, I., & Ogamba, S. (n.d.). Sustainable Solutions to Water Supply in Kenya. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwix4b2M9v-EAxU1Q_EDHdgADOIQFnoECA4QAQ&url=https%3A%2F%2Foxfamilibrary.openrepository.com%2Fbitstream%2F10546%2F620300%2F1%2Fcs-sustainable-water-kenya-100717-en.pdf&usg=AOvVaw1kmXhHP4Kt_JTr_NanfuJH&opi=89978449

7.2.2 Shorter waiting time and distances

Before the establishment of the kiosks, most households would walk longer distances to fetch water, but this changed when the kiosks were commissioned for operations. This was particularly the case for women and school-going children, who had to rise early, walk longer distances, and in some instances wait and queue for water. As a result, some of the children would be late for school and face punishment.

The safe water kiosks have made it easy for both women and school-going children. Women now have more time at their disposal for other household tasks, while children no longer have to worry about school punishment for arriving late, and more time is available to play and do homework. *"..my kids now have more time to play and finish their homework, as I attend to other household chores"* – reports a household from Sondu Kiosk.

7.2.3 Entrepreneurial mindset and income generation opportunities

By design, the safe water kiosks were tailored as social enterprises that support entrepreneurial growth. In most of the kiosks, they have established business ventures which range from community toilets, and poultry farming to retail shops. In Maragua, for example, the kiosk is generating revenues from a toilet, and a retail shop that they own.

The availability of safe water kiosks has attracted business opportunities. Areas that are far from the kiosks are reached by the water vendors, as a result, the growth of the water vending business has been witnessed across all the kiosks evaluated. *"... from the water vending business, I have been able to take my son through high school and now enrolled for college studies"* – reports Mary, a water vendor at Wath Ong'er.

7.2.4 Reduced waterborne diseases and improved hygiene

For most of the rural kiosks, the motivation for setup was to increase access to safe water and reduce the prevalence of waterborne diseases like cholera and diarrhea. An interview with a health officer at Wath Ong'er indicated that there were reduced cases of diarrhea and cholera in the community thanks to the Maji Safi kiosk. Moreover, the consumers also report reduced cases of diarrhea, especially in children owing to the use of clean and safe water from the kiosk.

7.3 Lessons learned

This section details key lessons learned from the evaluation of the kiosks as well as key learnings from similar or related projects.

7.3.1 Efficient water provision requires reliable technology

The technology employed by Siemens Stiftung is highly cost-effective. The SkyJuice Foundation's filter technology is well-suited for groundwater and river water. It can produce up to 10,000 litres of clean water per day for around 1,000 families. The SkyHydrant can be used for up to 10 years with minimal maintenance. The majority of the kiosks have rivers and boreholes as their main and alternative water sources, the technology was well-suited and responded to the needs of the rural and underserved communities. **Figure 47** shows the filtration system used in one of the SWE kiosks under evaluation. As opposed to other technologies that use multiple purification[66,67] methods to ensure safe water provision, the SkyHydrant filtration is more efficient, reliable, and cost-effective. It has 10,000 hair-thin fiber membranes against bacteria and viruses.

It is reported that most rural communities in Sub-Saharan Africa may not have adequate access to electricity[68]. However, they receive abundant solar irradiation which can be utilized as a source of energy. Consequently, a technology that enhances water production by utilizing solar energy would be ideal for these areas.

Figure 48:
An image of the Sky Hydrant filtration system at Korumba kiosk - Kisumu County

66 Maniam, G., Ain Zakaria, N., Peng Leo, C., Vassilev, V., Banahene Blay, K., Behzadian, K., Eong Poh, P., Hartmann, T., Editor, A., Wright, N., Editor, S., & Jepson, W. (2022). *An assessment of technological development and applications of decentralized water reuse: A critical review and conceptual framework.* Wiley Interdisciplinary Reviews: Water, 9 (3), e1588. https://doi.org/10.1002/WAT2.1588

67 Peter-Varbanets, M., Zurbrügg, C., Swartz, C., & Pronk, W. (2009). *Decentralized systems for potable water and the potential of membrane technology.* Water Research, 43 (2), 245–265. https://doi.org/10.1016/j.watres.2008.10.030

68 REAL-Water. (2022). *Technological Innovations for Rural Water Supply in Low-Resource Settings. United States Agency for International Development (USAID) Rural Evidence and Learning for Water Project.* Available at: https://www.globalwaters.org/sites/default/files/4dec_technological_innovations.pdf

7.3.2
Revenues generated from the kiosk may only ensure sustainability but not scalability of the kiosks

The safe water kiosks incur operational and management costs monthly due to the growing demand for clean water. To meet this demand, the kiosks would need to enhance their production capacity which translates to huge financial investments. It is evident that for most of the kiosks, the revenues generated if properly managed, can ensure the kiosks meet their operational and management costs. However, the kiosks will have little to no money available to scale up; setting up additional kiosks, including satellite kiosks, and enhancing production and storage capacity. *"...we are looking to set up satellite kiosks in Nyakweri and Osiri, but this would require us to seek financial assistance as our current revenues are inadequate to support this initiative"* – reports an informant from Wath Ong'er, Migori County. In essence, the kiosk would need to explore alternative revenue sources, or obtain loans and donor support to scale and meet the growing demand for clean and safe water. Further, it would be useful to explore the extent to which the water kiosks can run comfortably with their current revenues, as this is an area that is yet to be explored[69].

7.3.3
Adequate and continued stakeholder engagement is instrumental for the decentralized systems

In implementing the Safe Water Enterprise (SWE) kiosk project, Siemens Stiftung and its partner organization Skyjuice Foundation embraced partnerships with the local CBOs, Counties, Non-Governmental Organizations (NGOs), and implementing partners like KWAHO and SWAP Kenya. From the onset, Siemens Stiftung ensured that the establishment of the kiosks was a community idea. This ensured that the communities owned the project and processes for their success. Different actors were engaged for different purposes: the Public Health Officers (PHOs) and Community Health Volunteers (CHVs) were engaged at the county level alongside KWAHO and SWAP Kenya to assist in capacity building and awareness creation on the use of safe water and hygiene promotion at the community level.

Throughout the project implementation, these actors promoted better hygiene practices. To ensure periodical water testing as required by regulations[70], Siemens Stiftung has been supporting all the kiosks; in Western Kenya, SWAP Kenya has been instrumental in conducting the water tests. Moreover, technicians have always been a call away in the event the system encounters technical challenges.

69 Huttinger, A., Brunson, L., Moe, C. L., Roha, K., Ngirimpuhwe, P., Mfura, L., Kayigamba, F., Ciza, P., & Dreibelbis, R. (2017). Small Water Enterprise in Rural Rwanda: Business Development and Year-One Performance Evaluation of Nine Water Kiosks at Health Care Facilities. International Journal of Environmental Research and Public Health, 14(12). https://doi.org/10.3390/IJERPH14121584

70 WASREB. (2019). Sanitation Services in Rural and Underserved Areas in Kenya Guideline Water Services for All for Provision of Water and Sanitation Services.

7.3.4 Ultimately, the kiosks can only project what they can track

Our interactions with the management of these kiosks reveal limited or inadequate knowledge of bookkeeping. The classification of revenues, and recording keeping still require guidance, training and capacity building. As the majority of the kiosks would require financial assistance to be able to scale up, clear records would be necessary to access credit. There is a clear absence of consistent records from the perusal of the documents presented. While the water ATMs proved useful in tracking sales and volumes of water sold, other expenses, and revenues had no clear and consistent records.

7.3.5 The Safe Water Enterprise (SWE) project mirrors other projects across the region

From the implementation approach to kiosk operations, the SWE project has major similarities with similar or related projects implemented by different actors. All the actors listed in **Table 21** recognized the need for clean and safe water for underserved communities, especially in rural areas. While the entrepreneurial approach by Siemens Stiftung mirrors the Aqua for All work with women enterprises in Senegal and Burkina Faso, other systems did not take a similar approach with a focus mainly on service provision.

Unlimited water access is evident across the selected case studies except one where that is not specified. In most of the systems reviewed, the implementing agency and partners have worked towards providing customers with smart cards, and or water cards that allow them to access water 24/7. Oxfam reports that the integration of the automated system (ATM) has seen water utilities in Wajir County, Kenya record a 400 percent rise in water revenues, and increase transparency[71]. According to UNICEF – with the smart water kiosks, costs on wages have been reduced as the kiosks do not require an attendant to operate as the system is monitored remotely and they can identify maintenance needs in real-time.

The system setup is almost identical with water being pumped from the source to an overhead tank(s), filtered through a membrane system, and then supplied to the customers from the kiosks. Water quality remains essential and the UNICEF smart kiosks have adopted monthly collection and testing of samples. While there are no records on the frequency of tests from the other cases reviewed, the Siemens Stiftung's SWE kiosks test water at least annually. According to World Vision, their system tracks water usage and payments and allows them to quickly identify needed repairs. Such is useful in ensuring timely maintenance and kiosk efficiency albeit with a high capital expenditure that the evaluated SWE kiosks may not afford.

65 Goodrich, I., & Ogamba, S. (n.d.). Sustainable Solutions to Water Supply in Kenya. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwix4b2M9v-EAxU1Q_EDHdgADOIQFnoECA4QAQ&url=https%3A%2F%2Foxfamilibrary.openrepository.com%2Fbitstream%2F10546%2F620300%2F1%2Fcs-sustainable-water-kenya-100717-en.pdf&usg=AOvVaw1kmXhHP4Kt_JTr_NanfuJH&opi=89978449

Figure 49:
Preview of the kiosk systems by World Vision and Siemens Stiftung

AQTap Water Kiosk by World Vision

Maji Safi Kiosk by SIEMENS Stiftung

Table 21:
Select case studies of related or similar projects

#	Item	Implementing entity			
		Aqua for All [72,73]	**World Vision** [74]	**Oxfam**[75]	**UNICEF**[76]
1	Name of project	Supporting safe water enterprise Oshun in Senegal and Burkina Faso	Automated water kiosks - AQtap water ATM	Sustainable WASH in fragile contexts (SWIFT)	Smart water kiosk
2	Implementation approach	Targeting women enterprises Implemented in partnership with Oshun Senegal.	World Vision is engaging water committees to take ownership or run the kiosks. This is being implemented in partnership with Grundfos.	Oxfam is working with the private sector and devolved county governments to improve water access.	UNICEF partnered with the local government to build smart water kiosks.
3	Target area/ population	Rural	Rural	Rural, arid, and semi-arid lands	Rural
4	Country(ies)[77]	Senegal and Bukina Faso	Kenya, Zambia, Ghana, Rwanda, Ethiopia	Kenya, Democratic Republic of Congo	Mongolia
5	Project description and technology	Oshun Senegal offers filtered and disinfected drinking water through an innovative water kiosk franchise model. The water kiosks are connected to an application that monitors water supply and quality remotely.	Water is pumped up into an overhead storage tank and then the water flows through gravity to kiosks placed throughout the community including near households, in schools, and at healthcare facilities. Water usage and payments are tracked by the system allowing us to quickly identify potential needed repair.	Both water ATMs and solar pumping technologies address the sustainability of service provision by the water utilities. Solar energy is used for pumping water from the source to the storage tanks and dispensation units.	The smart water kiosk was designed using a shipping container and fitted with water purification filters installed inside the kiosk. The kiosk is equipped with sensors that monitor water quality and level, and a mobile payment system. Samples are taken and analyzed monthly by the provincial inspection agency.
6	Operating hours	Unspecified	24/7	24/7	24/7

72 Read more here: https://aquaforall.org/news/swe-support-oshun-senegal-and-burkina-faso/

73 Incofin. (2020). *Resilience of safe drinking water models in COVID-19 times - Incofin.* https://incofin.com/resilience-of-safe-drinking-water-models-in-covid-19-times/

74 Read more here: https://www.wvi.org/stories/clean-water/automated-water-kiosks-make-life-easier-and-safer-women-and-children

75 Goodrich, I., & Ogamba, S. (2018). *Sustainable Solutions to Water Supply in Kenya.* file:///G:/Mi unidad/Water Humanitarian context/cs-sustainable-water-kenya-100717-en.pdf

76 UNICEF. (2022). *' Smart ' water kiosks improve access to drinking water in rural Mongolia.* 1–8. Available at: https://clearinghouse.unicef.org/sites/ch/files/ch/sites-PD-WASH-WASH%20Knowledge%20unicef-FN2723%20Smart%20Water%20kiosks%20Mongolia-2.0.pdf

77 This is restricted to the countries where the case study has been derived from and not all the countries where the entity works in.

8.
General conclusion and recommendations

8.1 Overall project performance and general conclusion

The purpose of this assessment was to share key learnings of the SWE kiosks models. This was to be achieved by analyzing the technical and economic viability and potential social impacts. Specifically, Siemens Stiftung wanted to understand the extent to which the community-led SWE kiosks model has achieved technical and business performance, financial sustainability, scalability, and potential social impact.

Having conducted the research and identified best practices, success factors, challenges, and weaknesses, we make the following conclusion and recommendations.

The overall project performance is described and ranked as follows:

Table 22:
Overall rating of the SWE kiosk project

#	Criteria	Evaluation aspect	Provisions based on project documents	Findings	Rank
1	Relevance [78]	Validity of the project objectives	SWE operates as a social enterprise to provide clean and safe drinking water to the community members.	The **water access gap in rural and underserved communities requires urgent and immediate attention**. EED-A, therefore, finds the project objectives highly relevant.	
		Alignment of project outputs with the expected outcomes	The project's logical framework has detailed the Outcomes and Outputs . For example, Training on business opportunities around SWE provided an opportunity for water vendors and businesses to grow.	Having reviewed the project log frame/logical framework, linked to the findings, EED-A finds the **project outputs aligned to the expected outcomes** with businesses attributing part of their growth to the existence of the kiosk. Moreover, in Kangemi, sales to the water vendors command the highest share of total sales (**30% in 2019 to 67% in 2022**).	
		Alignment of the project outputs with the overall goal of the Siemens Stiftung [79]	Siemens Stiftung was established as an independent nonprofit foundation in 2008. It is committed to sustainable social development and focuses on access to essential services, connected societies and climate and sustainability.	EED-A finds the SWE project **aligned with the overall goal** of Siemens Stiftung. SWE is a water kiosk that is placed within the community to provide safe drinking water to the community members. It is operating as a social enterprise which means that the revenues are used to benefit the community. For example, part of the revenues have been used to establish a fish pond and poultry farm in Wath Ong'er.	
2	Sustainability[80]	The extent to which the project benefits would continue after the handover of the kiosks	The SWE project targeted: • Equitable access to affordable and clean water in local proximity for people in rural areas. • More jobs in rural areas • A good understanding of the necessity of hygiene by the community.	The customers are satisfied with access to clean and safe water and the health benefits that come with it. That, notwithstanding, EED-A finds that the kiosks would need to put more effort into ensuring these efforts are enjoyed post-handover. • A **significant financial investment** would be needed to scale up the kiosks to reach the target population especially the Wath Ong'er and Sondu kiosks. • There is a possibility that **some of the kiosks could run down in the long term** – In Ngoliba, the health center uses part of the revenues. • The water vendors still require more training on hygiene especially in handling water meant for drinking. **Only 37% of the water vendors clean the containers daily with 33% doing so weekly as 15% do not know whether they clean the containers.**	

78 SWE logical framework
79 SWE kiosks sustainability assessment
80 SWE problem analysis tree

#	Criteria	Evaluation aspect	Provisions based on project documents	Findings	Rank
		Factors influencing the achievement or non-achievement of project sustainability	Distance to the water source Inadequate awareness and technical capacity for safe water provision Increased demand for clean and safe water by rural communities Competition from similar projects/ Availability of alternatives	Having reviewed the project documents, EED-A finds factors either influencing the achievement or non-achievement of the project sustainability defined. However, the **lack of a tracking mechanism** for these factors may influence the sustainability of the project. **9 out of 16 sites** adequately picked up and were tracked by Siemens Stiftung and the rest were transferred to NGOs who run them without the assistance of Siemens Stiftung. In Kangemi, there are multiple projects with others providing free water – this may affect the sustainability of the kiosks as some customers would prefer the free water. Additionally, it is reported that the trend in **customer growth at Maragua has been declining** as there are alternatives; MUWASCO has already set up a public utility kiosk and more households are continually getting piped water connections.	
3	Impact [81]	The general result of the project	The SWE impact logic clearly defines the general result of the project; contributing to the achievement of SDG 6 on universal access to safe and adequate water	From the assessment. EED-A finds that, • More customers **continue to demand** clean water. • At least 50% of the consumers have reported **general satisfaction** with the kiosks and service provision. • The kiosk has facilitated the growth of businesses and **water vendors who can earn a living** from the distribution and selling of water.	
		The difference the SWE project has made to the local community[82]	Some of the differences the SWE project envisioned include; • The kiosk operators being able to operate the kiosks in a business-minded way to benefit the community • People being able to apply the instructions given during the health and hygiene training (e.g., washing hands and cleaning containers) • Increase productivity as more time is available for other tasks	Already Maragua kiosk is being operated alongside **small businesses** (*operating a sanitation facility – toilet*), and the Wath Ong'er kiosk has a poultry farm, customers can charge their phones from the kiosk at 10/- While the community has embraced handwashing, those who live far from the kiosks and use vendors have lamented that some vendors do not clean the jerricans. More than 60% of the kiosk users report having **more time to do other domestic duties** due to the availability of the kiosk.	
		Percentage of the population that has benefited from the project [82]	The population served. The number of households benefiting from the kiosk and the target area was defined	While the original population was originally defined, EED-A finds that a **mechanism to track the population that benefits from the kiosks was not defined.** This makes it difficult to explicitly report the percentage of the population that benefited or benefitted from the project.	
4	Coherence	Consistency of the SWE intervention with other interventions done by Siemens Stiftung	Siemens Stiftung is involved in the following areas; • Development of basic services, • Social entrepreneurship, • Promotion of education, and • Enhancement of culture.	Having reviewed the project documents and further interaction with the project implementation team, EED-A finds the SWE project consistent with other interventions the company does. Across Africa and globally, Siemens Stiftung projects aim to **enhance the livelihood prospects** of various communities. The provision of safe water is one aspect of enhancing livelihoods.	
		Linkage between the SWE kiosk model with other actors' interventions in the project sites	The SWE Kiosk model aims to enhance access to clean and safe drinking water in rural and underserved communities.	In 2023, the national and county governments signed a **Sh900 billion National Water and Sanitation Investment Financing Plan (NAWASIP)** to tackle ravaging drought. Further, the government aims at enhancing water access at household and community level. This study established that several other organizations are working to improve water access in rural and underserved communities. SNV Kenya is implementing a **Public-Private-Community-Partnership Model** to improve water access in the Arid and Semi-Arid Lands of Kenya.	

81 SWE impact logic (Presentation)

82 SWE logical framework

83 SWE kiosk sustainbility assessment

#	Criteria	Evaluation aspect	Provisions based on project documents	Findings	Rank
5	Effectiveness	The extent to which the project objectives were or would be achieved	The goal of the project was to ensure: • There is affordable access to clean water in local proximity for people in rural areas. • There are more jobs in rural areas • People have a good understanding of the necessity of hygiene	Based on the study findings, EED-A finds that the objectives have been achieved but not fully as there are factors that still limit the full achievement of the objectives. The kiosk operators would still need additional training on record-keeping. For Kangemi and Ngoliba kiosks, it would be useful to monitor the financial expenses, especially by the hosting institutions (the resource and health centers respectively). The continued use of the finances by the hosting institutions may limit the scalability of the kiosks and their ability to manifest as social enterprises.	
		Factors influencing the achievement of the set objectives	• Distance to the water source • Inadequate awareness and technical capacity for safe water provision • Increased demand for clean and safe water by rural communities • Competition from similar projects resp. availability of alternatives. • Finances including Capital Expenditure (CapEx)	Some of the kiosks like Wath Ong'er **still incur some capital expenditure** and would need more time for the objectives to be achieved.	
6	Efficiency	Cost-effectiveness of the activities implemented	The Siemens Stiftung team in partnership with SkyJuice Foundation implemented a cost-effective technology that was cognizant of the main water sources in the project sites. • **The SkyHydrant:** 10,000 hair-thin fiber membranes against bacteria and viruses. Capacity Building of communities on access to clean water, health and hygiene practices.	The technology employed by Siemens Stiftung is highly cost-effective: • The SkyJuice Foundation's **filter technology** is well-suited for groundwater and river water. It can produce up to 10,000 liters of clean water per day for around 1,000 families. The SkyHydrant can be used for up to 10 years with minimal maintenance. • **Partnerships** with the local CBOs, Counties, NGOs, and implementing partners like KWAHO and SWAP Kenya made the awareness creation and training cost-effective.	
		Timely achievement of the objectives	In most cases, it takes **two to three years** for a Safe Water Enterprise (SWE) to become financially independent and entirely owned and operated within a community[84]	The kiosks have been handed over 8 years from the time of establishment for most of the kiosks. However, since most of the kiosks fully kick-started their operations at least 3 years ago, EED-A still finds the project to have timely achieved its objectives. The achievement of the objectives at the community level may be gradual but **feasible eventually.**	
		Efficiency of the project compared to alternatives	Provision and clean and safe water for improved health and hygiene conditions in rural and underserved communities.	The communities from the project sites have **localized and embraced Maji Safi kiosks** as they provide water better than any other, making them more efficient, especially **for drinking water.**	

84 Source: https://www.siemens-stiftung.org/en/projects/safe-water-enterprises/

8.2 Conclusion

Based on key findings discussed in previous chapters, we conclude as follows:

The SWE kiosks have increased access to clean and safe drinking water for the respective communities in the six sites under assessment. Before the establishment of the Maji Safi kiosks, most households did not have adequate access to clean drinking water and sometimes opted for the available water because they lacked alternatives. Moreover, most users report reduced time in accessing water and availability of time to attend to other household chores.

All the kiosks have high financial sustainability potential. All the kiosks have the greatest potential to be financially sustainable with minimal adjustments needed. Their revenues are currently sufficient to meet the operational and management expenditures.

None of the kiosks can scale without external support. Scalability of the kiosks would require significant financial investments, but in their current state, the kiosks do not have enough surplus to cover the cost of scaling up: for example, setting up satellite kiosks. Moreover, it is not explicitly clear if the kiosks can comfortably run their operations in the longterm, though the handover has already happened two years ago. This is an area that could be assessed in two or three years.

The kiosks have influenced the establishment and growth of businesses and social amenities. In some of the kiosks, restrooms have been constructed to increase access to sanitation facilities; for example, in Maragua, a restroom has been constructed and users can access it at an affordable fee. Further, the number of water vendors obtaining and distributing water from the kiosks is on an upward trajectory. Some of the kiosks are also planning on venturing into other income-generating activities. To increase the kiosk's revenues and support the local community, Wath Ong'er kiosk has a poultry farm and working on rehabilitating the fish pond.

The technology used in designing the SWE kiosks model is cost-effective and replicable across other rural and underserved communities. The kiosk management and operators report minimum maintenance and simplified procedures for cleaning the filtration system. Moreover, the filter technology is well-suited for groundwater and river water and the filtration process requires no electricity. From the Ngoliba kiosk, some business people have expressed interest in developing similar kiosk designs and or replicating them in other areas.

There is potential to reduce the non-revenue water and increase revenues. All the kiosks recorded some level of non-revenue water that could be exploited to increase their financial performance.

The revenue water arises from multiple sources notably, water that is supplied at no cost to the host institutions especially for Kangemi and Ngoliba kiosks that supply the resource and health centers respectively. While this could be categorized as a social impact, the lack of data on how much is supplied to the institutions makes it difficult to quantify the level of impact.

Access to clean and safe drinking water has led to a reduction in cases of waterborne related illnesses like cholera and typhoid. The interactions with the health centers and households within the communities visited revealed that the number of reported cases of illnesses has been declining since the kiosks were established. Most of the households recognize the taste, color, and smell of the Maji Safi water, and use it primarily for drinking.

8.3 Recommendations

Based on the conclusions above, we recommend the following:

Training and capacity building – there is a greater need to capacity build the kiosk management and operators on fiscal management and maintenance practices. This would go a long way in influencing their potential to scale up and be sustainable. More specifically, it would be important to educate the management about revenue classification so they can get a sense of their financial sustainability. Well Aware[85] works with community water systems in East Africa to improve their technical and operational efficiency through training and capacity building. It therefore positions itself among other organizations as a potential partner for training and capacity building.

Partnership and collective action – for the kiosks to be scalable, there is a need for the local administrations especially the county government to support the community-based social enterprise models. Interest groups and other private sector actors could support the scaling up of this model to improve water access to the underserved communities where most of the public water utilities have limited coverage.

Adoption of a guaranteed service model to cover the operation and maintenance (O&M) needs. The evaluation has established that the majority of the kiosks especially those in rural areas struggle with their operation and maintenance needs due to inadequate technical capacity and the absence of a reliable technician. A guaranteed service model like that previously employed by Fundifix[86] in which the entity is granted a portion of the operating costs to cover infrastructural maintenance based on annual contractual agreements. This is similar to a Delegated Management Model (DMM) model[87] in which the kiosk would assign a number of its water service delivery functions (for example operations, maintenance, and or revenue collection) to an external party like FundiFix.

Rationalization of the tariffs – there is a disparity in water tariffs across the six kiosks. With the growing number of alternatives, especially for kiosks in the peri-urban areas, there is a threat of decreased customer growth. In Kangemi, most Maji Safi kiosks users have lamented the higher tariffs as a hindrance to accessing clean and safe drinking water.

Hygiene and sanitation awareness – based on the study findings, there is a positive correlation between the usage of Maji Safi and the decreased prevalence of waterborne diseases. Consequently, it would be important for the kiosk management to partner with local health centers, dispensaries and other interest groups to facilitate awareness creation on the importance of using safe water for drinking and improve their hygiene practices. This activity should also target the water vendors who distribute water to the households.

85 Read more here: https://wellawareworld.org/success-model/

86 Nyaga, C. (2020). *Maintenance Approaches to Improve the Sustainability of Rural Water Supplies.* University of Colorado Boulder.

87 WSTF. (2017). *Service Delivery Model Toolkit for Sustainable Water Supply.*

Annexes

Annex 1
List of key informants interviewed

Table 23:
List of key informants interviewed

#	Name of stakeholder engaged / interviewed	Affiliation	Position
1	Christine Meinhardt	Siemens Stiftung	Senior Project Manager
2	Rhett Butler	SkyJuice Foundation	CEO and Founder
3	Stephen Njuguna	Siemens Stiftung	Project Consultant (external)
4	Paul Mwariri	Siemens Stiftung	Project Consultant (external)
5	Petronilla Musonye	Kenya Water for Health Organization (KWAHO)	Project Officer for Health and Hygiene Training and Social Marketing
6	Linah Rugabelah	Kenya Water for Health Organization (KWAHO)	Project Manager
7	June Samo	Millenium Water Alliance (MWA)	Water Intervention Manager and Market Systems Development Specialist
8	Ida Githu	World Bank	Consultant
9	Alie Eleveld	Safe Water and AIDS Project (SWAP) Kenya	Technical Advisor
10	Eden Mati	Water & Sanitation for the Urban Poor (WSUP)	Country Manager
11	Isaac Gichuki	Murang'a County	Director County Water Department
12	Ann Kombija	Kisumu County	WASH Coordinator
13	Silvester Gumo	Migori County	Sub-county Water Officer
14	James Kimani Nduati	Maragua Kiosk - Murang'a	Kiosk Owner
15	Susan Wambui	Maragua Kiosk -Murang'a	Kiosk Operator
16	Paul Ouma Ogutu	Korumba Kiosk- Kisumu	Kiosk Owner
17	Latif Adha	Korumba Kiosk- Kisumu	Kiosk Operator
18	George Nyanji	Sondu Kiosk - Kisumu	Kiosk Owner
19	Joel Otieno Onyango	Sondu Kiosk - Kisumu	Kiosk Operator
20	Hezron Olem	Wath Ong'er Kiosk - Migori	CBO Secretary (LAVISO)
21	Joshua Ojwang'	Wath Ong'er Kiosk - Migori	CBO Vice Chairperson (LAVISO)
22	Margaret Ondoche	Wath Ong'er Kiosk - Migori	Kiosk Attendant
23	Moses Rangile	Wath Ong'er Kiosk - Migori	Clinical Officer - Wath Ong'er Dispensary
24	Kevin King'ori Mwangi	Ngoliba Kiosk - Kiambu	Health Facility Manager
25	Simon Ndere	Ngoliba Kiosk - Kiambu	Kiosk Operator
26	Esther Wanjiru Ndirangu	Kangemi Resource Centre - Nairobi	Kiosk Manager
27	Vincent Ogot	Kangemi Resource Centre - Nairobi	Kiosk Operator
28	Susan Murithi	Kangemi Resource Centre - Nairobi	Kiosk Attendant
29	Hilda Katunge Ngusya	Kangemi Resource Centre - Nairobi	Finance/ Admin manager
30	Joyce Atieno	Wath Ong'er –Migori	Technical personnel

Annex 2
Siemens Stiftung SWE project established in Kenya

Table 24:
SWE kiosk projects in Kenya

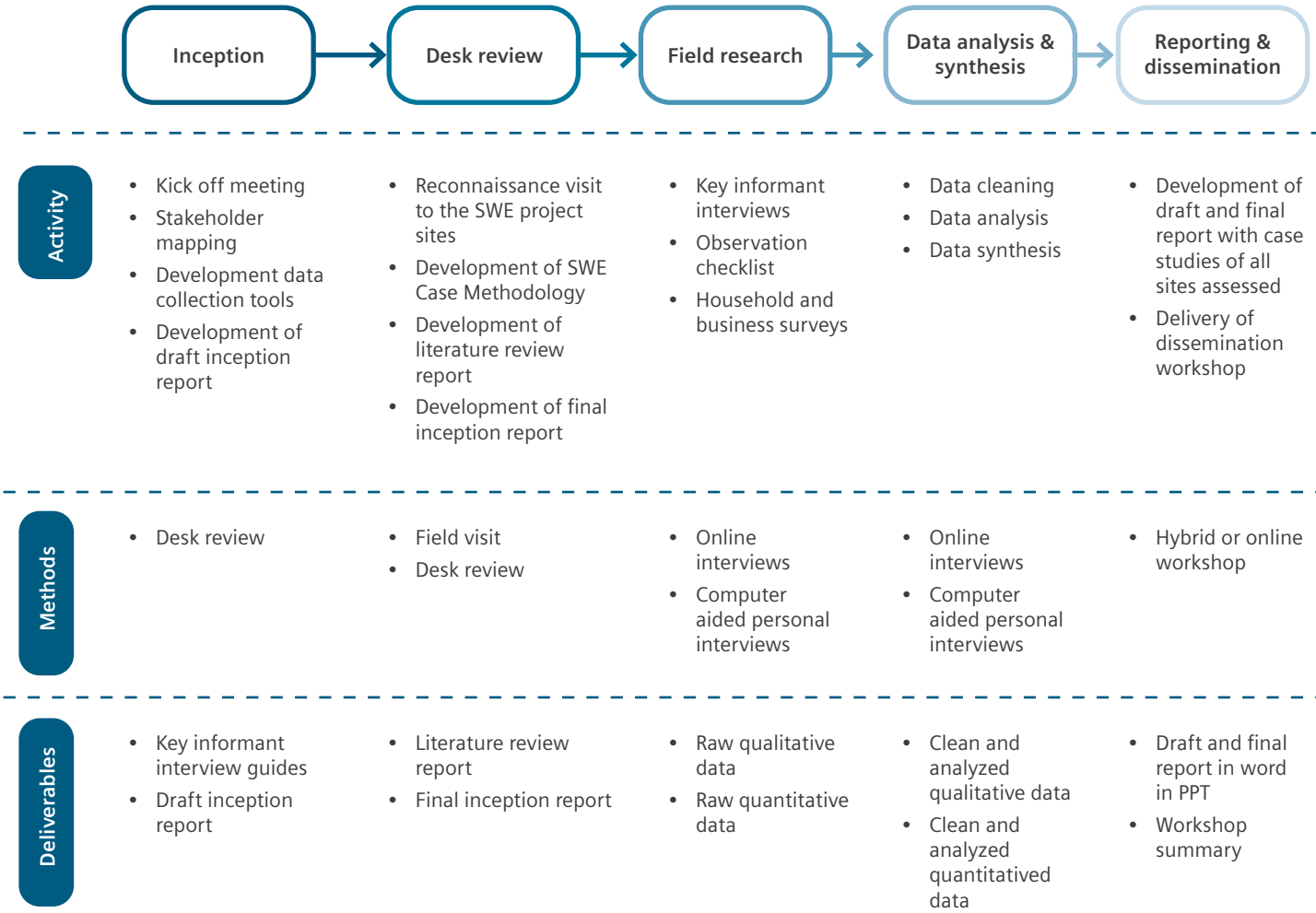
No.	Kiosk name	Location	Est.	Implementing Partner	Legal ownership
1	Watoto Wenye Nguvu	Kiambu County	2012	Global Nature Fund	Boarding school
2	Maragua Ridge	Muranga County	2012	Global Nature Fund	Health Center
3	Githembe	Muranga County	2013	Skyjuice/Pure Flow	CBO
4	Ngoliba	Kiambu County	2014	Skyjuice/Pure Flow	Health Center
5	Maragua Market	Muranga County	2014	Skyjuice/Pure Flow	WUA
6	Kangemi	Nairobi	2014	Skyjuice/Pure Flow	Resource Center
7	Kudho	Kisumu County	2014	SOS Childrens villages	Kudho PRY School
8	Soko Kogweno	Kisumu County	2014	SOS Childrens villages	CBO
9	Korumba	Kisumu County	2015	SOS Childrens villages	WUA
10	Kitui	Kitui County	2015	Amref	Amref Kenya
11	HowaMwana	Kwale County	2016	County Government	WUA
12	Vitsangalaweni	Kwale County	2017	County Government	WUA
13	Sondu	Kisumu County	2017	Safe Water and AIDS Project (SWAP)	WUA
14	Nyagoro	Homabay County	2017		Health Center
15	Tinderet	Nandi County	2017	Tachwasco	Tachwasco WSP
16	Wath Onger	Migori County	2019	Lake Victoria Aids Support Organization	WUA

Annex 3
Research methodology

Study approach

In response to the research objectives, six sequential steps were employed to conduct the research. These steps are highlighted below.

Figure 50:
Study approach



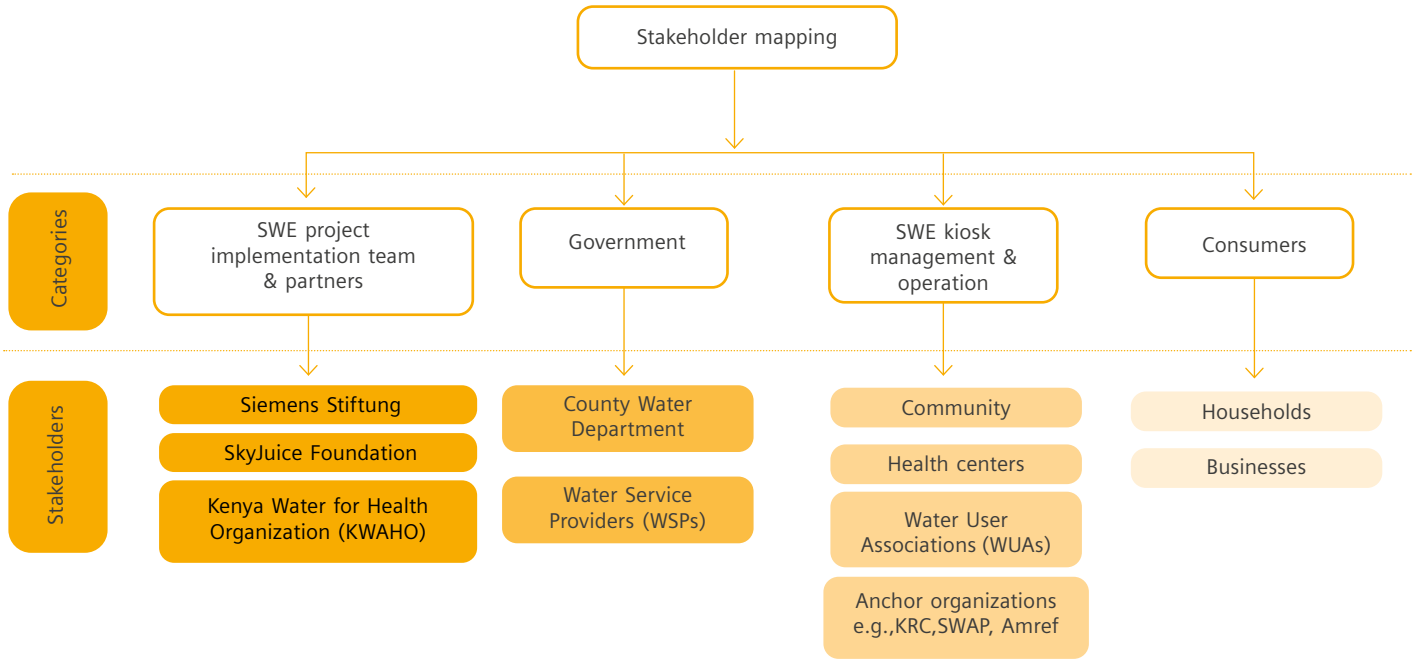
An inception meeting was held virtually on July 10, 2023, to clarify the objectives of the assignment and finalize contractual agreements. During the project inception, a number of activities were carried out that led to the drafting and submission of the draft and final inception report. The key activities carried out during the inception phase are highlighted below;

Figure 51:
Activities conducted during the inception phase

Stakeholder mapping

From conversations with Siemens Stiftung and the implementing teams on the ground, EED-A mapped the key stakeholders and project beneficiaries as indicated below:

Figure 52:
Stakeholder Mapping



Reconnaissance field visit

EED-A in consultation with the Siemens Stiftung team, carried out reconnaissance visits to the kiosks between July 24 and July 28, 2023. The two main aims of the visit were:

i. To introduce the consulting team to the community and create a rapport for the key informant interviews and surveys that were to be implemented.

ii. To request relevant technical and financial documentation that was to be used to undertake the evaluation.

Development of data collection tools

In preparation for the data collection exercise, a number of data collection tools were developed in response to the study objectives and stakeholders mapped. These have been summarized in the table below;

Table 25:
A list of data collection tools

#	Tool	Description
1	Key informant interview (KII) guides	Different KII guides were developed to reflect the key data points to be obtained from the categories of stakeholders. The aim of using these guides is to ensure that the discussions are structured and time-bound.
2	An observation checklist	The observation checklist was developed to guide the observation around the kiosk including the infrastructure in line with the technical parameters.
3	Survey questionnaires (*households', business' and water vendors' questionnaire*)	The survey questionnaires, which included qualitative and quantitative questions, were developed to reflect the expected data points, including themes that were explored during the feasibility phase of setting up the kiosks and the customer profiling exercises.

Further, in compliance with the laws governing research in Kenya, EED-A obtained a research permit from the National Commission for Science, Technology, and Innovation (NACOSTI). This permit was also used to seek county permits that were shared with local government administrators during data collection.

Desk review

Following the conclusion of the inception phase, a critical review of existing literature was conducted with a focus on social entrepreneurial business solutions and community-led approaches to bridge the water access gap. Specifically, the review aimed to unravel the efforts towards implementing community-led approaches to safe water provision through government or donor-led programs, the political or cultural enablers in these contexts, and the sources of financing/donor trends. Although the study focused mainly on the East African context owing to the SWE program scope, the review also analyzed similar initiatives in comparable contexts within Sub-Saharan Africa and emerging economies and Benin was used as a case study.

Based on the Terms of Reference, EED-A conducted an in-depth review of qualitative and quantitative data available on water kiosk models to identify gaps in the literature. Through these reviews, EED-A sought to determine the best practices, trends, and correlating factors for providing safe drinking water and the current opportunities and challenges.

Evaluation of technical viability

EED-A evaluated the technical viability of the water kiosks based on the technical key performance indicators (KPIs) outlined in terms of reference and the WASREB Guidelines on water vending in Kenya. The table below summarises some of these parameters and the data collection methods.

Table 26:
Technical Viability Assessment Parameters

#	Technical KPIs	Parameters assessed	Data collection method
1	Water filtration system	Reliability of the system	• KIIs with kiosk operators. • KIIs with the SWE project team.
		Performance of the filters and cost of filter replacements	
		Safe water supply in liters per day	
		Challenges in using the system by kiosk operators	
2	Water supply	Source of water	• KIIs with kiosk operators and WSPs.
		Reliability of water source(s) used	
		Kiosk hours of operation per day	
3	Demand for water by consumers	The average number of customers per day/month	• KIIs with kiosk operators. • Review of water sales records. • Surveys with consumers.
		Average consumption in liters per day/month	
		Common water uses among consumers	
4	Water quality	Water quality provision (results and frequency of water tests – covering Physical, Chemical, and Biological parameters)	• Review of water quality reports obtained from the water kiosks.
5	Kiosk infrastructure	Water source casing/cover	• Observation checklist
		Storage tank hygiene	
		Storage tank material and cover	
		The accuracy of the water meter	
		Performance of the valve and pressure adequacy	
		Kiosk and operator hygiene	
		Location of the water kiosk and proximity to animals	
		Cleanliness of the water pipes/systems used to fetch water by consumers; any leaks, bursts, or external contamination of the pipe and overall system	
		The presence of a lockable and secure door	
		Drainage within the kiosk and its surroundings	
6	Level of compliance	Use of approved water sources	• Review of water kiosk licenses and approvals. • Review of water quality reports. • Observation checklist.
		Licenses from water utility and public health unit	
		Regular water quality testing and reporting	
		Use of personal protective equipment (PPE) by kiosk operators	
		Use of approved water tariffs	
		Record keeping and reporting on sales, water outages, poor water quality, and any other incidences	
7	Legal ownership model	Ownership of the water kiosks and land on which It is constructed	• KIIs with kiosk operators. • KIIs with the SWE project team. • KIIs with county water department/WSPs.

Evaluation of financial viability

The evaluation of the financial viability of the kiosks followed key parameters adapted from various sources including the Siemens Stiftung business Key Performance Indicators (KPIs), the Water Sector Trust Service Delivery Model Toolkit for Sustainable Water Supply, and the Toolkit for Urban Water Supply Projects. The latter toolkit focuses on guiding principles and project planning for kiosk systems. The table below highlights these parameters and the associated data collection method that was employed to obtain the necessary data.

Table 27:
Financial viability assessment parameters

#	Business KPIs	Parameters assessed	Data collection method
1	System performance	• Sources of water • The volume of water produced • Water system loss • Population in the service area • Population served • Percentage population served	• KIIs with kiosk operators. • KIIs with the SWE project team. • KIIs with county water department/WSPs.
2	Service quality	• Average hours of supply • Number of complaints • Number of breakdowns (monthly) • Average response time	• KIIs with kiosk operators. • Surveys with consumers.
3	Operating and maintenance expenses	• Administrative costs • Salaries • Electricity consumption cost • Type, number, and cost of breakdowns • Type, number, and cost of repairs • Type, number, and cost of spare part replacements • Other expenses e.g., licenses • Total costs of operations	• Review of water kiosk records, bills, etc.
4	Revenues	• The average number of jerricans sold per day • Cost per jerrican • Number of days per month • Collection efficiency	• Review of water kiosk sales records.

Evaluation of social impact

The evaluation focused on assessing the parameters outlined in Siemens Stiftung's Theory of Change (ToC) on the social impact KPIs. These are summarized below.

Table 28:
Social impact assessment parameters for kiosk operators and consumers

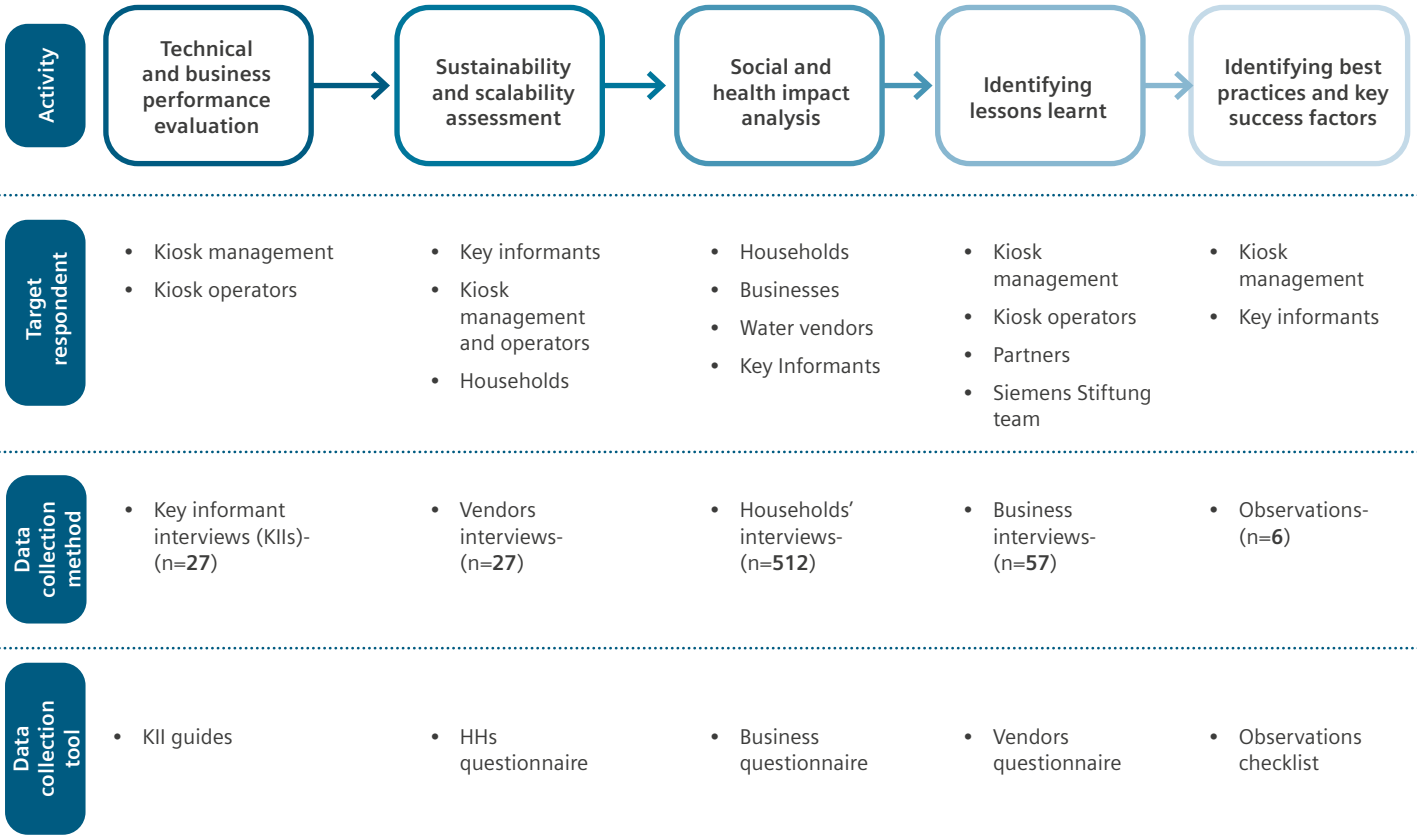
#	Social impact KPIs – kiosk operators	Parameters assessed	Data collection method
1	Satisfaction with kiosk management	Kiosk operations include: • training • consulting • sales and revenues • generated income (improved capacities and more income)	Key informant interviews with kiosk operators
2	Belief in own ability to operate and maintain the technology	Technical skills and know-how	Key informant interviews with kiosk operators
#	**Social impact KPIs - Consumers**	**Parameters assessed**	**Data collection method**
1	Satisfaction of customers and community members (especially women) with kiosk services	• Perceptions of Water Quality • Affordability • Availability • Distance • Trust (access to safe water)	Surveys and focus group discussions
2	Increased productivity because of time savings	The average time taken to collect water	Surveys and focus group discussions
3	Improved health and well-being	The former and current prevalence of waterborne diseases in the community	Surveys and focus group discussions
4	Economic impact on local businesses	• Number of businesses that have emerged because of water availability from the kiosk (where possible, names and types) • The kind of activities the businesses are engaged in • Nature of relationship with the kiosk • Percentage (%) of the growth attributed to the availability of the kiosk	Interview with kiosk management

Data collection

A mixed methodology approach was employed in obtaining the needed data for this study[88]. The table below represents a summary of the data collection methods and tools used in obtaining the needed data for this assessment.

88 No single method was used to collect the data required

Figure 53:
Summary of data collection methods used in this study



Key informant interviews (KIIs) and observations

Throughout the project implementation, key actors were engaged. These actors supported the project implementation either directly or indirectly. To understand the technical, and business performance, and identify best practices, success factors, and challenges and weaknesses of the kiosk model, EED-A engaged different actors mapped previously. Further, experts in the sector drawn from both public and private sectors were interviewed to help in understanding the sustainability and scalability of the decentralized kiosk models.

The informants were purposively selected. Most of the interviews especially with the county water officers, kiosks management, and operators were conducted in person. However, the project team, implementation partners, and key experts in the sector were conducted virtually, through Microsoft Teams, Zoom, and Google Meet, depending on the informant's preference. **Annex 1** presents a summary of the key informants interviewed during this study.

During the key informant interviews with the kiosk operators, EED-A observed the kiosk infrastructure and surrounding environment using the observation checklist. This exercise was aimed at among other things, assessing the potential of hazardous events occurring within a water kiosk vending system. An observation checklist was prepared to aid this activity.

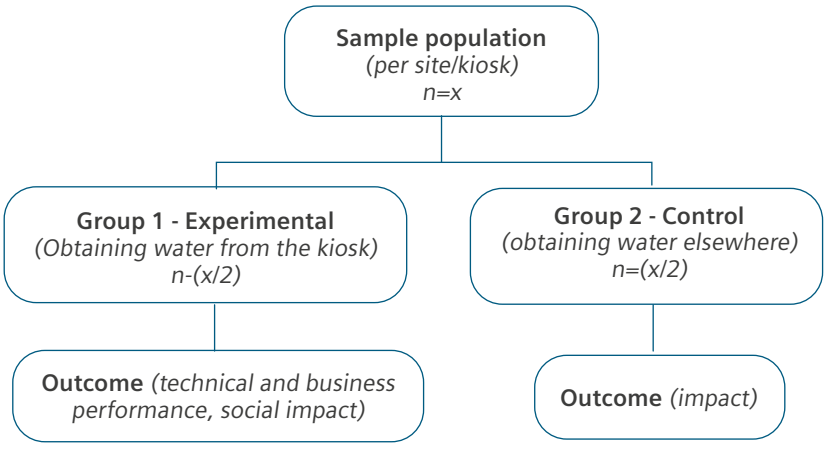
Households, businesses and water vendors' surveys

The surveys were tailored to obtain primary data. Before the data collection exercise, a study design was developed, the sample size was determined and distributed proportionately across the six kiosks, and the tools were coded. These have been discussed below:

i. Study design

Based on deliberations during the inception meeting and findings from the reconnaissance visits, the study employed a Randomized Control Trial (RCT) study design. Respondents were randomly allocated to either experimental or control groups to establish the viability of the decentralized kiosk models and their potential social impacts. An equal number of households were targeted from both the experimental group (*those that obtain water from the kiosk*) and the control group *(those that do not obtain water from the kiosk)*.

Figure 54:
A representation of the RCT study design



Where **n** represents the sample size calculated as indicated in the subsequent section.

ii. Sample size calculation

Upon deliberations and additional information obtained during the reconnaissance field visits, the sample size was decided on in light of two main considerations, i) representativeness and ii) the budget availability.

The six sites depict various dynamics in *lieu* of their settings (*peri-urban, rural, and urban informal settlements*). In consultation with the Siemens Stiftung team, EED-A opted to get a reliable, allowable number of at least 30 interviews.[89] Consequently, from each group, a minimum of 30 respondents were targeted giving a total sample size of 60 households per site (Total=360). However, due to the varying population density across the six sites, two sites were oversampled. Kangemi was oversampled by 20 and Wath Ong'er by 30. This gives a total sample size of **n= 460.**

The table below outlines the sample distribution across the six sites.

Table 29:
Sample distribution

#	County	Name of kiosk	Number of respondents	
			Experimental group	Control group
1	Nairobi	Kangemi resource center, Kangemi informal settlement	50	50
2	Murang'a	Maragua market	30	30
3	Kiambu	Ngoliba health centre	30	30
4	Kisumu	Korumba Community water project	30	30
5	Kisumu	Sondu water project	30	30
6	Migori	Wath Ong'er water project	60	60
	Total		230	230

In addition to the household surveys, 10 businesses that benefit directly from the Safe Water Enterprise program were interviewed. The water vendors were included as part of the business interviewees. The businesses to be interviewed were randomly selected onsite in consultation with kiosk management and operators. The table below highlights the categories of businesses that were targeted during this study.

Table 30:
A non-exhaustive list of businesses Interviewed

#	Description of sites
1	Retail shops that use water for cleaning
2	Water vendors (either using bikes, tuk-tuks, carts, etc.)
3	Hotels/Kibandaski/restaurant
4	Individual vendors especially those operating on market days in areas where the kiosks exist in a peri-urban area

89 Dalenius, T. (1964). William G. Cochran, *Sampling Techniques. The Annals of Mathematical Statistics,* 35(3), 1381-1382.

iii. Coding of household, business/vendors questionnaire, and observation checklist

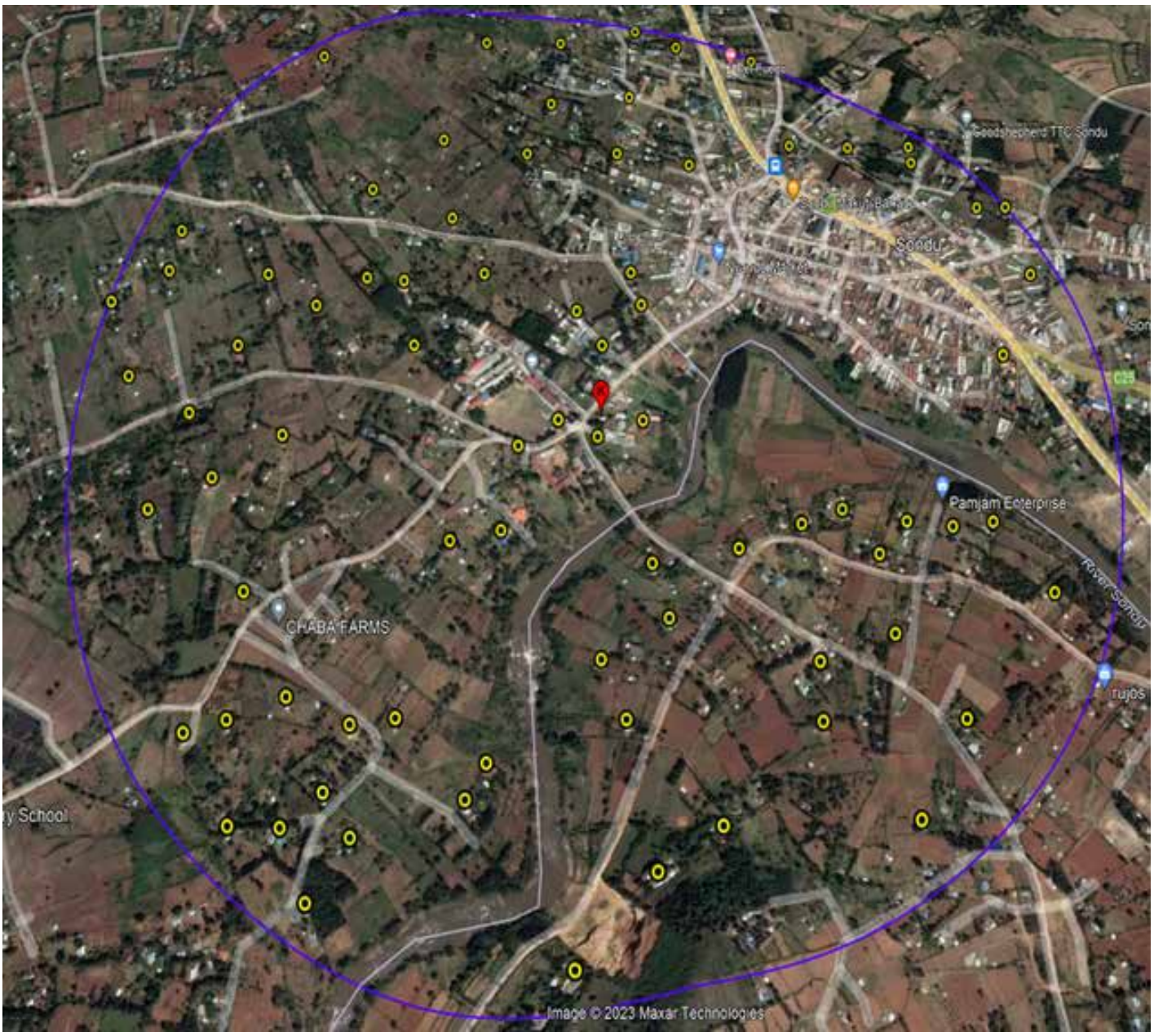
The household and business surveys were administered through computer aided personal interviewing (CAPI) using the ODK collect platform. The data collection tools were developed, reviewed, finalized, and coded in English. Further, minor modifications were made to the tool during the pre-test before the actual data collection began. The ODK Collect data platform was prepared for the real-time submission of data. All the questionnaires were uploaded onto Android-based tablets.

iv. Survey implementation

Each kiosk was built to serve the immediate population estimated in the feasibility studies. Using the household population density updated after the 2019 Kenya National and Housing Census and satellite imagery, EED-A mapped out the residential areas around the kiosks. A geospatial technique was employed to randomly identify households from these areas. The enumerators were taught to coordinate such that they interview at least 30 Maji Safi kiosk users (experimental group) and 30 non-users (control group) per site and oversample as guided in Kangemi and Wath Ong'er. This strategy meant that everyone in the area who was targeted by the kiosk had an equal chance of being part of the study.

These pre-selected households were pre-loaded onto the SW maps platform. SW Map is an Android-based geospatial application that allows real-time navigation using GPS and the Global Navigation Satellite System (GLONASS). EED-A has used this tool in multiple surveys in the past to help enumerators navigate their way within the enumeration areas. Each household was labeled with a unique number for ease of identification by the enumerators. A demonstration of SW maps is provided in the figure below. The red icon represents the location of the kiosk while the yellow icons represent the preselected households. Further, the blue line represents the boundary of the enumeration area.

Figure 55:
SWP map interface for the Sondu kiosk



Enumerators captured household geo-coordinates during the interview process using Survey CTO collect to an accuracy of between four and 12 meters. All enumerators were encouraged to aim for an accuracy of four meters. These geo-coordinates were compared against the pre-selected coordinates to ensure that enumerators visited the correct households. The verification process is conducted in real-time by the data verification team while the enumerators are in the field so that enumerators interviewing wrong households can be called and corrected.

v. Preparation of training manuals

The field data collection team included the enumerators and local supervisors working under the coordination and supervision of the core EED-A team. The EED supervisory team ensured that the target number of interviews was met within the stated timelines while maintaining the quality of the outputs. An enumerator and supervisor's training manual [90] was developed to guide the training, data collection, and quality control processes under this exercise.

Field data collection

The data collection exercise was conducted simultaneously across the six sites between **September 6th and 10th, 2023**. Various activities took place to enable the data collection. Among these were i) recruitment and training of the local supervisors and the enumerators, ii) pre-testing and finalizing the survey instruments, and iii) data collection and quality control process.

Figure 56:
Field data collection activities

- All enumerators (main and backup) were **recruited from the EED-A database** for each of the County kiosk sites.
- The enumerators were trained on the **objectives of the assignment, how to conduct the household surveys, the questions in the observation checklist, etiquette, and ethics of data collection, and emergency and quality control protocols.**

- The pretest was conducted outside the enumeration area.
- The pretesting of the data collection was conducted on the second day of fieldwork **(8/9/2023)**
- This exercise was used to gauge the flow of the questions and identify any outliers.
- Based on the findings from the pretest - **the tools were modified accordingly.**

- The data collection was conducted on the third and 4th day of fieldwork.
- During the same period, the EED-A team were able to conduct interviews with the kiosk management and operators.
- The EED-A also administered the observation checklist.
- Enumerators and supervisors were tasked to **interview households and conduct business interviews** respectively.

Data cleaning

Primary data was collected and transmitted electronically to the ODK Cloud server. These were then downloaded and cleaned before the commencement of the analysis. The cleaning process aimed to identify typos, outliers, incorrect inputs, omissions, data anonymization, translation, transcription, audio review, and transcript review in line with the nature of the data collected.

Qualitative data analysis

All the audio recordings and notes taken from the Key Informant Interviews (KIIs) were uploaded into a secure folder in preparation for the transcription process. Thereafter, a data analyst examined the KII guides and developed a Standard Operation Procedure (SOP) for the transcription of the audio. The transcripts were reviewed to ensure the quality standard of the transcription was met. Thereafter a master code/ codebook for analysis based on the themes subthemes was developed as highlighted below. The data was analyzed using NVivo software. This software is used to organize and analyze qualitative data to identify themes and uses visualization tools to uncover richer insights

Table 31:
Contents of the thematic analysis

#	Stakeholder	Thematic Areas
1	Kiosk operators and committees	Technical and business KPIs Social impact KPIs Best practices Success factors Challenges and weaknesses of the model Lessons learned and recommendations
2	County Water Department/ WSP representatives	Water access status Water service provision Water access challenges Plans and strategies
3	Project Implementation partners including KWAHO	Social Impact Social Innovation Best Practices Success Factors Challenges and weaknesses of the model Lessons learned and recommendations
4	SWE project implementation team (SkyJuice Foundation and Siemens Stiftung)	Project innovation Best practices and success factors Challenges and weaknesses of the model Lessons learned and recommendations
5	Subject matter authorities (experts and consultants)	Best practices and success factors Challenges and weaknesses of the model Lessons learned and recommendations

Quantitative data analysis

Quantitative data analysis was conducted mainly in Stata statistical software and was targeted at addressing the objectives of this study. Descriptive statistics and predictive models were deployed to extract more insights from the data. The categorical findings were presented in tables, charts, and graphs, while the numerical data was presented as mean, median, minimum, maximum, and standard deviation. The quantitative analysis involved assessing the financial records obtained from the field and some of the information obtained from the key informant interviews.

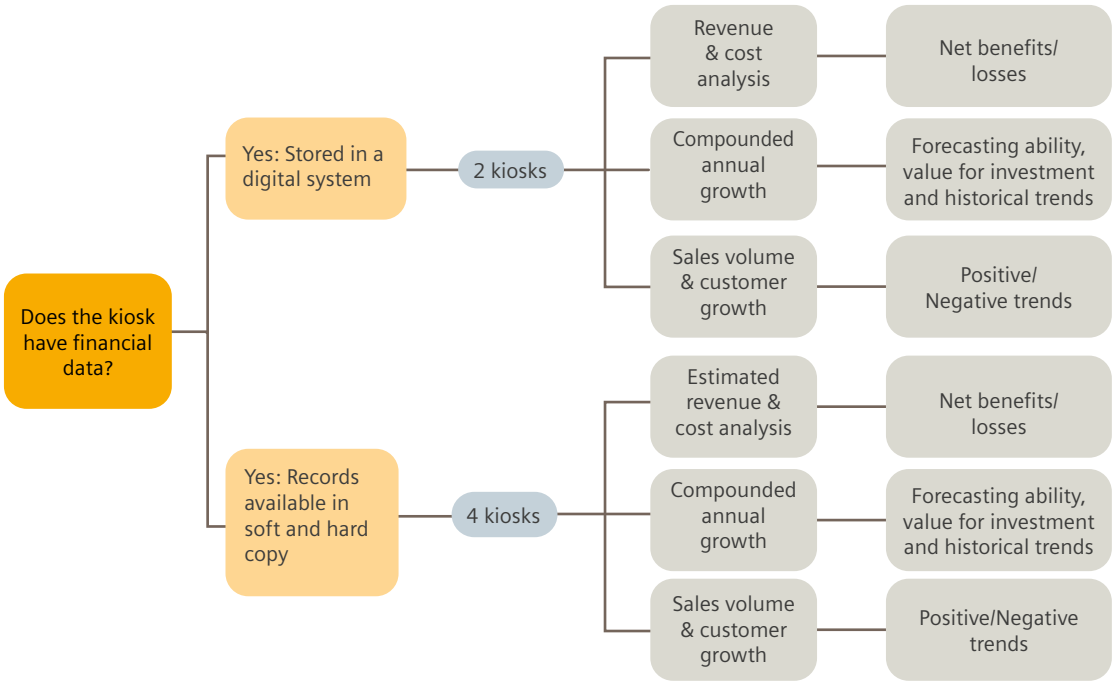
i. Determination of cost

A determination of the core costs needed to run the water kiosk with a special focus on operation and maintenance costs, was established. These costs included electricity or fuel, chemicals, materials, and overheads. In relation to the costs, the reserves mainly set aside for emergencies, capital expenditures, or other critical financial needs were reviewed.

ii. Determination of revenue

Both operating and non-operating revenue was established through interviewing the kiosk owners and operators. These included sales records and operation expenses incurred by the kiosk monthly. A decision tree was adopted to aid the financial analysis.

Figure 57:
A decision tree for the financial analysis



In addition, a demand analysis was conducted to determine: the quantity of water demanded, the quantity of water produced, the kiosk's production capacity, and the current pricing for the water being produced and sold. The demand analysis was enriched through the KIIs that sought to gain more insight into consumption levels, water usage, and capacity needs.

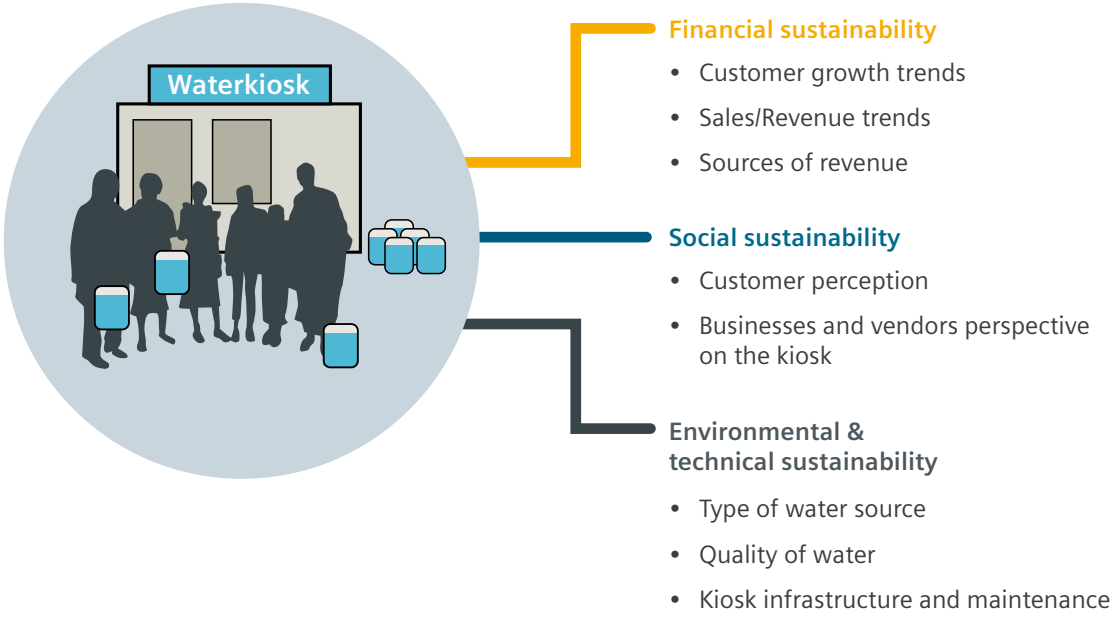
iii. Determination of the net financial benefits/surplus

Consideration, of whether the water kiosk was generating a financial benefit and surplus, was determined upon review of the sales records. A positive or surplus financial benefit meant that the water kiosk was generating revenues that were sufficient to cover the operation and maintenance expenses. A water system was considered self-sustaining if it was also able to cover all its capital expenditure requirements.

Determining scalability and sustainability of the kiosks

To determine scalability and sustainability, emphasis was laid on key variables whose outcome would inform the recommendations to the Siemens Stiftung. To further understand how sustainable, the kiosks are, the variables were classified to answer three main sustainability aspects. The aspects and respective variables are highlighted in **Figure 16** below.

Figure 58:
A decision tree for the financial analysis

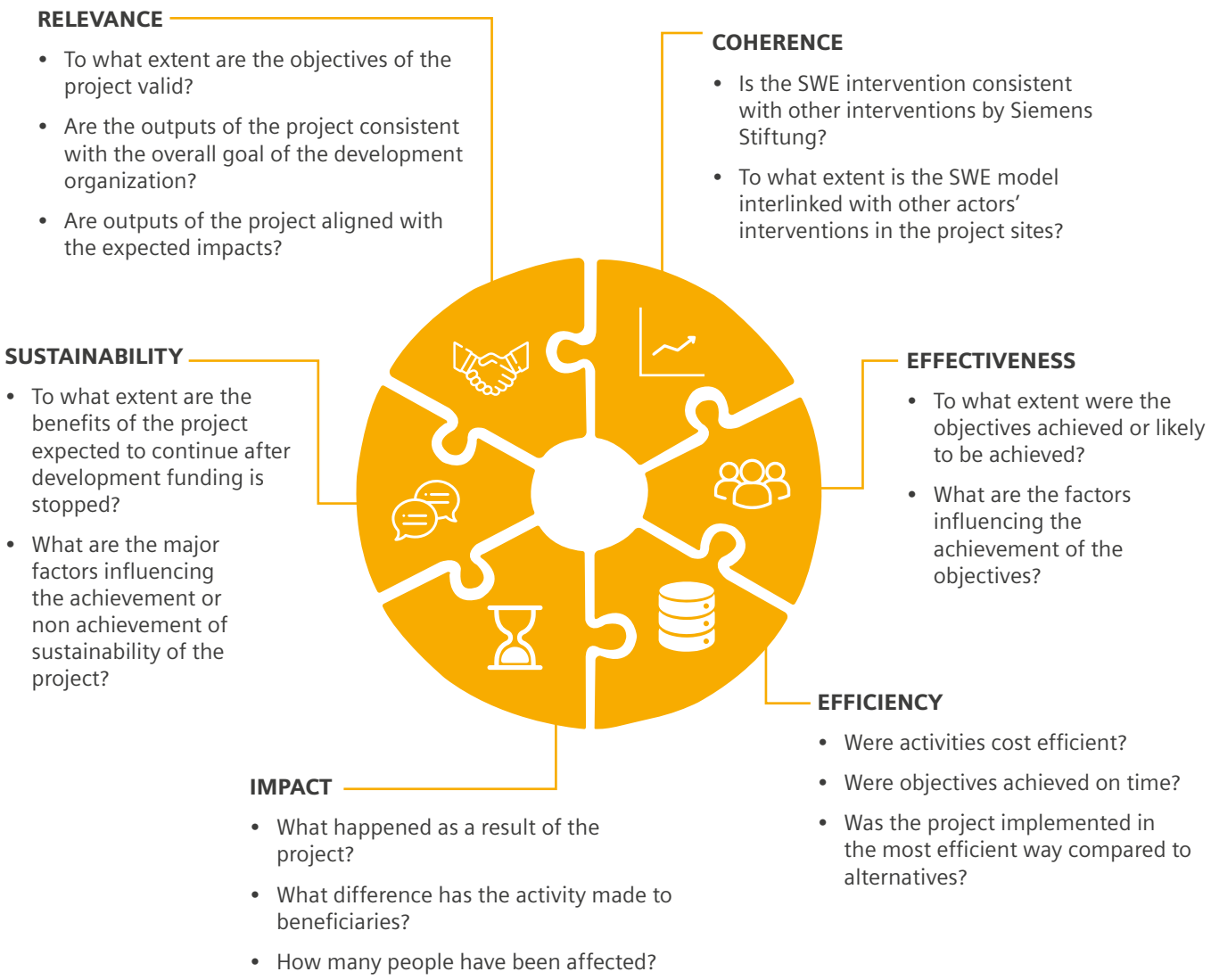


The sustainability indicators informed the scalability in three ways: the financial standing of the kiosks, customer growth trends, and the social standing of the kiosks based on customer perception.

Overall project performance analysis

In assessing the overall performance of the project, EED-A employed the Organisation for Economic Co-operation and Development (OECD) criteria for monitoring and evaluation. This entailed an assessment of the results achieved relative to the set targets in the project TOC log frame. The objective of the evaluation is to assess the project implementation successes and milestones by investigating the project's relevance, effectiveness, efficiency, sustainability, and impact drawn from the OECD criteria. These criteria are used to provide a framework for determining the merits of a policy, strategy, program, or project intervention.[91] The figure below highlights the six criteria and the sample aspects of evaluation customized to reflect the SWE project.

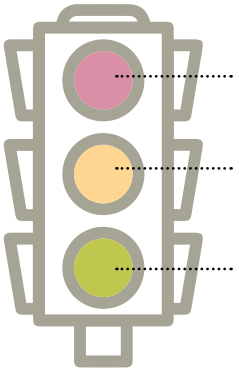
Figure 59:
Application of OECD Criteria to Synthesize Project Findings



91 OECD, (2023). *Evaluation Criteria*. Retrieved from https://www.oecd.org/dac/evaluation/daccriteriaforevaluatingdevelopmentassistance.htm#relevance-block

To conclude on the SWE project performance, a traffic light system was adopted to rate the water kiosk models' technical, financial, and social impact performance against the project targets, highlighting areas that require attention for future improvement. The figure below illustrates how this system was utilized to rate progress.

Figure 60:
Illustration of the RAG rating system



RED

Project targets not achieved

AMBER

Project targets partially achieved

GREEN

Project targets achieved

Annex 4
Individual kiosk profiles

A. Kangemi resource centre, Kangemi informal settlement, Nairobi County

Kangemi resource centre (KRC) is a two-person operation, with an operator and attendant manning the kiosk. The kiosk has four above-ground water tanks (one 4,000 litres and two 1,000 litres) dealing with Nairobi Water and two other above-ground tanks (5,000 litres) dealing with borehole water, as well as two underground tanks for borehole water (29,000 litres). The community primarily relies on water vendors, to supply water from their facilities. The cost of water is Ksh. 30 for Nairobi Water and Ksh. 5 for borehole water, paid in cash or via Mpesa. Maintenance for the units is done every three months.

Table 32:
Kangemi resource centre kiosk profile

Category	Description
Year of establishment	• Built in 2014 • Decals on Kiosk renewed in February 2022
Ownership structure	• Kangemi resource centre (KRC)
Implementing partners and roles	• KRC is responsible for day-to-day operations. • Siemens Stiftung consults on operations and maintenance, repairs, and provides technical support, if required. • SkyJuice Foundation provided the filtration system.
Main sources of water in the community	• Nairobi Water and Sewerage Company and a borehole
Location of the water kiosk	• Kangemi resource centre (KRC), Nairobi County, Kangemi Sub-County, Kangemi Location, Gichagi Sub-Location
Population of the surrounding community	• 11,472 households
Technical setup of the water kiosk	• KRC invested in storage tanks, and these tanks have a collective capacity of holding up to 50m3 of water. • The kiosk is equipped with a single ultrafiltration system, which can purify an average of 1m3 of water per hour.
Kiosk management	• The water kiosk is managed by KRC with overall oversight by a project manager. • The project manager is supported by an administrator/ accountant who handles financial and administrative aspects. • The day-to-day operations of the kiosk are supervised by one full-time kiosk operator. • The kiosk operator reports to both the project manager and the administrator/accountant, ensuring smooth coordination of activities.
Licenses/permits	• Holds a business license issued by Nairobi County Government. • Possesses a water abstraction permit granted by the Water Resource Authority (WRA). • Expected to sign a service provision agreement with Nairobi Water and Sanitation Company to authorize the sale and supply of water.

B. Ngoliba Health Centre, Kiambu County

This water kiosk is managed by one operator with six years of experience. Customers, including water vendors and community members, count between 50 to 100 per day. Water is sold at KES 10 per 20-litres jerrican, generating daily revenues ranging from KES 2000 to 2500. Payments are made in cash and Mpesa, with tokens generated by the operator. Additional income is generated from selling 20-litres water jerricans. There are occasional electricity outages, but a generator ensures water pumping for treatment during such times.

Table 33:
Ngoliba health centre kiosk profile

Category	Description
Year of establishment	• 2014 • Connected with a dedicated pipeline from Thika river in 2019
Ownership structure	• Owned by Ngoliba health centre
Implementing partners and roles	• Siemens Stiftung
Main sources of water in the community	• Thika river
Location of the water kiosk	• Thika East Sub-county, Ngoliba location in Ngoliba sub-location.
Population of the surrounding community	• 4,812 households
Technical setup of the water kiosk	• Raw water is sourced from the Thika River. • A 2km pipeline was installed in 2018 to transport the raw water from the river to the kiosk. • The kiosk is outfitted with two ultrafiltration systems known as sky hydrants. • These ultrafiltration systems can purify up to 1,500 liters of water per hour. • The kiosk has substantial storage capacity, including 11,000 liters of storage tanks for raw water. • Additionally, there are 6,000 liters of storage tanks dedicated to safe drinking water.
Kiosk management	• The kiosk is managed by a Board of Management (BOM). • The BOM also manages the hospital in the area. • Members of the BOM are elected by the community, representing various villages around Ngoliba. • The BOM consists of community representatives. • The chair of the BOM, along with the doctor in charge of the hospital, actively oversees the management of the kiosk. • The doctor in charge of the hospital also serves as the secretary to the BOM.
Licenses/permits	• N/A

C. Maragua market, Murang'a County

This water kiosk is managed by one main operator with two years of experience, assisted by a temporary worker who comes in on weekends. Customer numbers vary, around 200 during dry seasons and 100 during wet seasons per day. Water is sold at KES 10 per unit, with payment options including cash and Mpesa paybill. The kiosk generates revenue from water sales, operating a washroom, and selling water jerricans.

Table 34:
Maragua market kiosk profile

Category	Description
Year of establishment	• Built in 2014 • 2 Skyhydrant filters installed in 2014. • Both Filter Membranes replaced in Nov 2022
Ownership structure	• Started as a Community-Based Organization (CBO) with an 8-member committee. • Now operating as Korumba Water Association since 2023 • Committee leadership consists of a Chairman, Secretary, and Treasurer.
Implementing partners and roles	• Siemens Stiftung, KWAHO
Main sources of water in the community	• MUSWASCO
Location of the water kiosk	• Murang'a County, Maragwa Sub-County, Nginda Location in Rurago Sub-Location
Population of the surrounding community	• 3,344 households
Technical setup of the water kiosk	• The water kiosk is managed by a Community-Based Organization (CBO) consisting of 14 members. • The CBO elects officials to oversee the organization's management for a term of three years. • These officials typically include a chairman, secretary, and treasurer. • The day-to-day operations of the water kiosk are carried out by the kiosk operator. • The kiosk operator operates under the supervision and guidance of the CBO's executive committee.
Kiosk management	• SWAP up to 2018 then local CBO since
Licenses/permits	• N/A

D. Korumba, Kisumu County

This water kiosk is operated by a single individual with eight months of experience. The kiosk has five water tanks of various sizes and four pumps, all powered by Kenya Power and Lighting Company (KPLC) with a post-paid meter. Operating daily for 12.5 hours with service hours mainly in the early morning and late evening, the kiosk primarily serves students from RIAT College, with around 200 customers per day. Water is sold at KES 5 per unit and payments are made in cash.

Table 35:
Korumba kiosk profile

Category	Description
Year of establishment	• 2015
Ownership structure	• The water kiosk is owned by the Korumba Development Group, which operates as a Community-Based Organization (CBO). • The Korumba Development Group consists of 60 members who are part of the community
Implementing partners and roles	• Siemens Siftung, SOS CV-Kisumu, Kisumu County Government, KWAHO
Main sources of water in the community	• Korumba SWE
Location of the water kiosk	• Kisumu West Sub-county, East Kisumu Location, and Dago Sub-location
Population of the surrounding community	• 1,777 households
Technical setup of the water kiosk	• The kiosk is supplied with water from a borehole, initially drilled and equipped by the municipal council. • The borehole has been a reliable source of water for the community, except during drought seasons when it may not meet the demand. • To purify the borehole water, the kiosk is equipped with an ultrafiltration system, specifically the SkyHydrant system. • Storage capacity includes 14,000 liters of raw water and 6,000 liters of safe drinking water. • Customers collect water directly from the kiosk using jerricans. • A few water vendors also utilize the kiosk as a source for resale, typically using motorbikes for transportation.
Kiosk management	• Started as a Community-Based Organization (CBO) comprising 60 members; now registered as Korumba Water Users Association (KWUA) • 12 officials are elected to oversee CBO activities. • The executive committee is composed of a Chairman, Secretary, Treasurer, and Internal Auditor.
Licenses/permits	• The kiosk has a business license from the Kisumu County Government. • They possess a water abstraction permit issued by the Water Resource Authority (WRA). • They are seeking to sign a service provision agreement with Kisumu Water and Sanitation Company.

E. Sondu, Kisumu County

Operated by a single individual with two years of experience, this water kiosk sometimes needs assistance from the operator's wife. Operating daily in the dry season and weekly in the wet season, the kiosk serves the entire area due to inconsistent tap water supply. During the dry season, they cater to around 100 clients daily, dropping to 15 during the wet season. Water is sold at KES 5 per unit and payments are made in cash, though Mpesa is also accepted.

Table 36:
Sondu kiosk profile

Category	Description
Year of establishment	• 2017
Ownership structure	• Sondu Maji Safi CBO
Implementing partners and roles	• Siemens Stiftung, SWAP, KWAHO
Main sources of water in the community	• River Sondu, shallow wells, water kiosk by Nyanas WSP, Maji Safi Kiosk, and water harvesting
Location of the water kiosk	• Sondu town
Population of the surrounding community	• 2,846 households
Technical setup of the water kiosk	• Uses an electric pump • Has 1 ultrafiltration system (Skyhydrant) • Filtration capacity is about 700 liters per hour • Safe drinking water storage tank is 6,000 liters • Raw water storage tank is 5,000 liters
Kiosk management	• SWAP up to 2018 then local CBO since
Licenses/permits	• Business license from Kisumu County Government. • Water abstraction permit from the Water Resource Authority (WRA). • Sign a service provision agreement with Nyakach Water and Sanitation Company (Nyakach WSC) upon registration as a Water Users Association (WUA).

F. Wath Ong’er, Migori County

The water kiosk has been operated by two attendants since 2019, primarily responsible for issuing water and maintaining cleanliness. The two attendants alongside CBO members have received adequate training on kiosk operation and filtration technology, but not on business planning, budgeting, or customer relations. The main water source is river Kuja, with no alternative source. Regular water testing records are stored in the Water ATM documentation. The kiosk operates 24/7 for token holders, while non-token holders need to call for service. Customers include domestic and commercial users, with pricing at KES 5 per 20-litre jerrican.

Table 37:
Wath Ong'er kiosk profile

Category	Description
Year of establishment	• 2019
Ownership structure	• Is owned by the local CBO
Implementing partners and roles	• Siemens Stiftung and Lake Victoria Aids Support Organization (LAVISO), KWAHO
Main sources of water in the community	• River Kuja, rainwater harvesting, and shallow wells
Location of the water kiosk	• Nyatike Sub-county, God Bondo Lower Kanyarwanda Location in West Kanyarwanda Sub-location
Population of the surrounding community	• 1,828 households
Technical setup of the water kiosk	• An electric pump is used to transport the water to the kiosk, located approximately one kilometer away. • The kiosk is equipped with three ultrafiltration systems known as Skyhydrants. • These Skyhydrants collectively have a filtration capacity of approximately 2,100 litres per hour. • The kiosk has a raw water storage tank with a capacity of 11,000 litres. • Additionally, there is a storage tank for safe drinking water with a capacity of 6,000 litres.
Kiosk management	• Managed by the Lower Nyatike Water Users Association comprising 25 members
Licenses/permits	• Obtain a business license from the Migori County Government. • Secure a water abstraction permit from the Water Resource Authority (WRA).

ANNEX 5: HOUSEHOLD QUESTIONNAIRE
ANNEX 6: KEY INFORMANT INTERVIEW GUIDES
ANNEX 7: BUSINESS QUESTIONNAIRE
ANNEX 8: OBSERVATION CHECKLIST
ANNEX 9: DATA QUALITY CONTROL PROTOCOL
ANNEX 10: ENUMERATORS & SUPERVISORS' TRAINING MANUAL

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