Delivering safely-managed water to schools in Kenya

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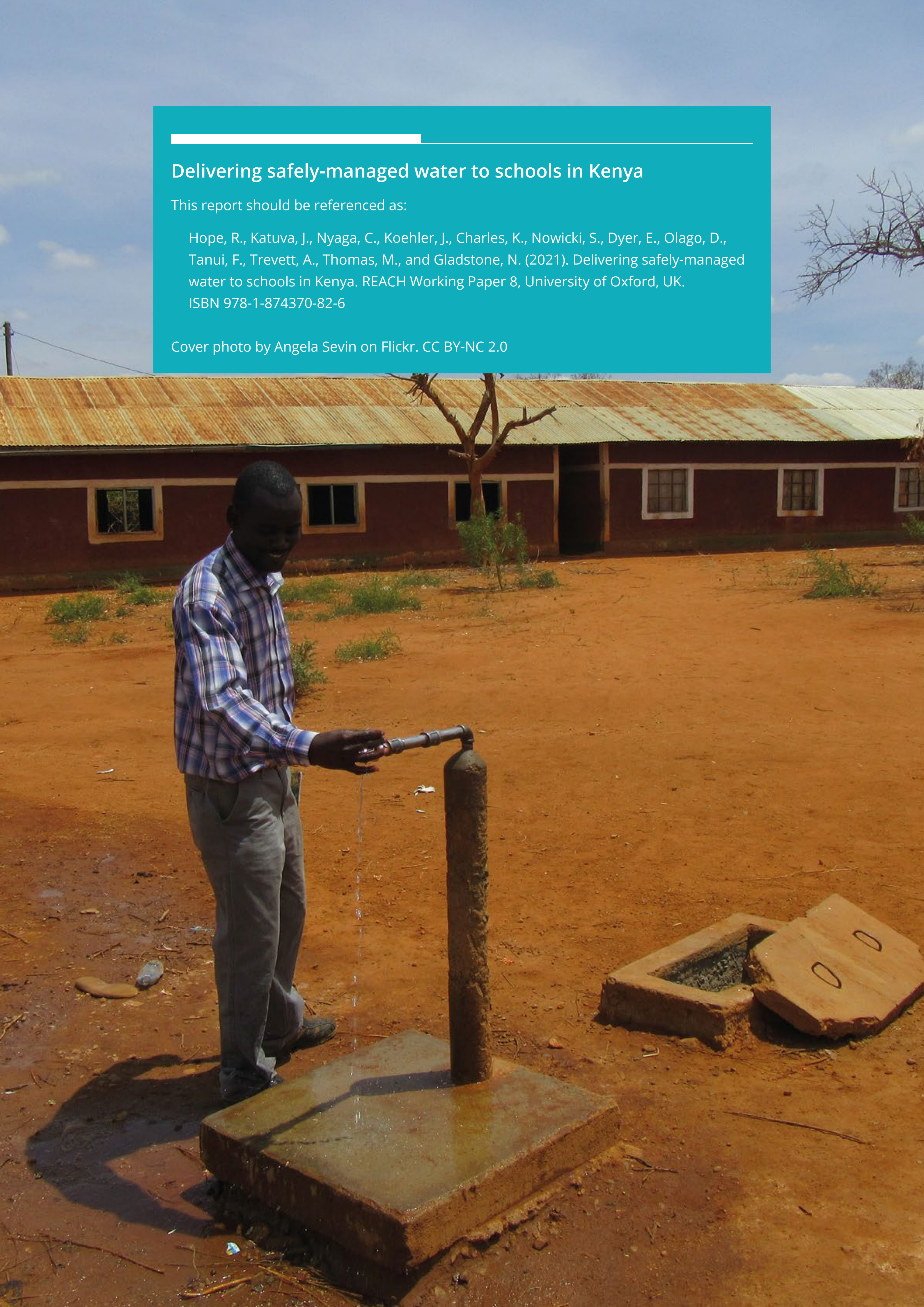

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Executive Summary

With two out of every five Kenyans aged between four and seventeen years old, education is critical for the current welfare and the future development of 20 million children attending 37,910 primary and 11,399 secondary schools. Without safe water in schools for drinking, food preparation, handwashing and general hygiene and sanitation, even basic education outcomes will prove difficult to achieve and sustain. The COVID-19 pandemic has increased understanding of the critical role of water services in schools for health, gender equality, and social development.

This report has two objectives. First, we present the status of school water, sanitation and hygiene (WASH) services in Kitui County drawing upon a survey of 1,887 primary and secondary schools in 2019. We evaluate water resource risks in the county to understand how climate anomalies affect rainwater harvesting for schools and the influence of geology on groundwater quality. Second, we consider policy responses to guide new thinking on the delivery of safely-managed water services. The latter is informed by the performance of a professional maintenance service provider guaranteeing rapid repairs to handpumps and small piped systems within days, and monthly monitoring of water quality.

Despite national education plans and policies, the allocation of responsibility for WASH services within schools at the county level remains ambiguous. County governments are developing their own laws and policies but until there is effective coordination between national and county governments, each school will continue to be individually responsible for managing the delivery of WASH services. In the absence of effective monitoring and regulation, there will be limited oversight to understand and improve performance.

Kenya's national education strategy predicted a USD 6.66 billion deficit for 2018 to 2022, without including the cost of delivering safely-managed WASH services in schools. National budget allocations are both insufficient and inefficiently allocated. Despite the legal, financial and service delivery challenges for safely-managed WASH services in schools in rural Kenya, there is evidence that services can be improved and sustained.

Inside cover photo by Rob Hope

We identify four conditions to improve outcomes. First, to clarify national and county responsibilities for WASH services in schools. Second, to improve monitoring and regulatory capacity at the county level. Third, to use information from monitoring systems to rethink funding models. And, finally, to pilot performance-based models to support a national programme of reform.

This is a watershed moment in a time of crisis. Kitui County is uniquely placed to scale up the results and lessons of a professional model for safely-managed WASH services in schools. The results provide a basis to plan for and execute a performance-based service delivery model for all schools in the county. The approach could be adapted to all counties in Kenya. Delivering safely-managed water to schools is feasible but will depend on exceptional political leadership and ministerial cooperation to agree and execute a shared vision.

Photo by Saskia Nowicki

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GOVT. OF KITUI. F.Y. 2015/2016.

PART 1

Inclusive schools with safe water

1.1 Introduction

With two out of every five Kenyans aged between four and seventeen years old, education is critical for the current welfare and the future development of 20 million children attending 37,910 primary and 11,399 secondary schools (Ministry of Education, 2018; UNICEF and WHO, 2020). Without safe water in schools for drinking, food preparation, handwashing and general hygiene and sanitation, even basic education outcomes will prove difficult to achieve and sustain. The COVID-19 pandemic has increased understanding of the critical role of water services in schools for health, gender equality, and social development.

This report has two objectives. First, we present the status of school water, sanitation and hygiene (WASH) services in Kitui County drawing upon a survey of 1,887 primary and secondary schools in 2019. We evaluate water resource risks in the county to understand how climate anomalies affect rainwater harvesting for schools and the influence of geology on groundwater quality. Second, we consider policy responses to guide new thinking on the delivery of safely-managed water services. The latter is informed by the performance of a professional maintenance service provider guaranteeing rapid repairs to handpumps and small piped systems within days, and monthly monitoring of water quality.

Safely-managed water in schools will contribute to the Government of Kenya's goal of quality education and training to achieve the Kenya Vision 2030 and is a prerequisite to a number of provisions in the Constitution of 2010. The national education strategy for 2018 to 2022 predicted a USD 6.66 billion resource gap, before the pandemic damaged global and national economies (Ministry of Education, 2018: xvi). With budgets under pressure, a pragmatic approach to water service delivery to schools is required. Improved efficiency, accountability and outcomes can demonstrate value to retain current funding and attract new sources of funds.

The safety, reliability and sufficiency of drinking water, sanitation and hygiene has an impact on the development of children and their learning (Jasper et al., 2012; Garn et al., 2013). The National Education Sector Strategic Plan (Ministry of Education, 2018:39) recognises these issues as part of the holistic learning and development of a child where the "availability of clean water, promotion of hand washing and proper sanitation at the pre-primary schools positively impact on the health of a child, deterring waterborne diseases and infections."

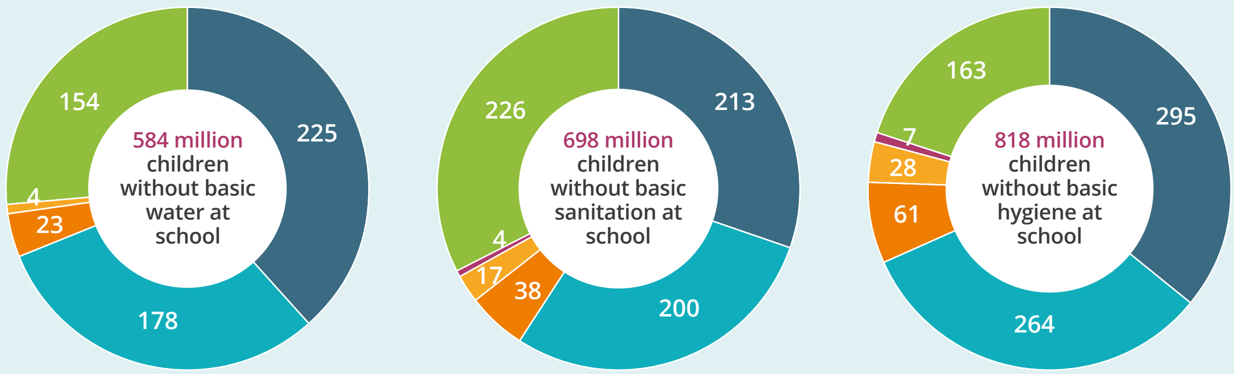
Photo by Jeff Waweru and Tim Mwangi

Faecal contamination of drinking water can result in diarrhoeal diseases that reduce children's time in school. Chemical contaminants have impacts over longer timeframes and can affect children's development. Long term exposure to either faecal or chemical contamination can permanently reduce children's cognitive abilities. While the school will not be the only source of drinking water for children, it will be a significant source for many of them, so safely-managed services will be essential to sustain the health, development and learning benefits of safe drinking water, adequate sanitation and effective hygiene facilities. The absence or failure of any one of these services will limit education outcomes with known inequalities determined by gender, disability, geography and household wealth (Ministry of Education, 2018:12;17-19.)

1.2 African schools in the global context

Globally, the number of children without basic WASH services at school are 584 million, 698 million and 818 million for water, sanitation, and hygiene services, respectively. (Figure 1; UNICEF and WHO, 2020). Compared to all other regions, Africa has millions more children without access to these services in school. The categories of basic, limited and no services are defined in Figure 2. These categories align to SDG 4.1a for 'inclusive education' to monitor the proportion of schools with a) basic drinking water, b) single-sex sanitation services, and c) basic hand-washing facilities, including soap and water. In contrast, SDG 6.1 and SDG 6.2 monitor the proportion of people using 'safely-managed' drinking water and sanitation services, and hand-washing facilities with soap and water. The criteria of 'safely-managed' WASH services is qualitatively higher and more onerous with wider financial and institutional challenges.

Figure 1: Africa lags behind global progress on WASH services in schools (UNICEF and WHO, 2020)



Number of school-age children without a basic drinking water service at school, 2019 (millions)

Number of school-age children without a basic sanitation service at school, 2019 (millions)

Number of school-age children without a basic hygiene service at school, 2019 (millions)

- Sub-Saharan Africa
- Central & Southern Asia
- Latin America & the Caribbean
- Northern Africa & Western Asia
- Oceania, Europe and Northern America, Australia and New Zealand
- Insufficient data

Recognising that the education SDG target for WASH services is lower for schools than the target for households, the JMP has identified other school-specific indicators that countries may consider in their national monitoring. These indicators include the distance, continuity, equality and location of WASH services, water quality measures by chemical or *E. coli* contamination, the use of individual cups or bottles for drinking water, daily cleaning and disinfection of surfaces and facilities, food hygiene, visual hygiene cues and nudges, and the financing of WASH services (UNICEF and WHO, 2020).

Financing to meet these higher standards is a major challenge in the process of re-opening schools to control the spread of COVID-19, which affects 1.57 billion children in 191 countries in June 2020 (ibid). Operation and maintenance (O&M) of school WASH services is also highlighted as another potential indicator. A strategy solely focused on building more infrastructure will have limited impact without maintaining the delivery of services over time.

In 2019, Africa reports basic provision of WASH services in schools at 44 per cent for drinking water, 47 per cent for sanitation and 26 per cent for hygiene in 2019. Progress between 2015 and 2019 is modest with basic sanitation increasing by 4 per cent, and basic drinking water and hygiene by 1 per cent. Inequalities in services emerge as the breadth of reporting includes by gender, facility (primary/secondary) or location. For example, children in rural schools are less likely to enjoy the same level of WASH services as urban children. The lack of rural hygiene services is of particular concern, given the context of the COVID-19 pandemic (Figure 3).

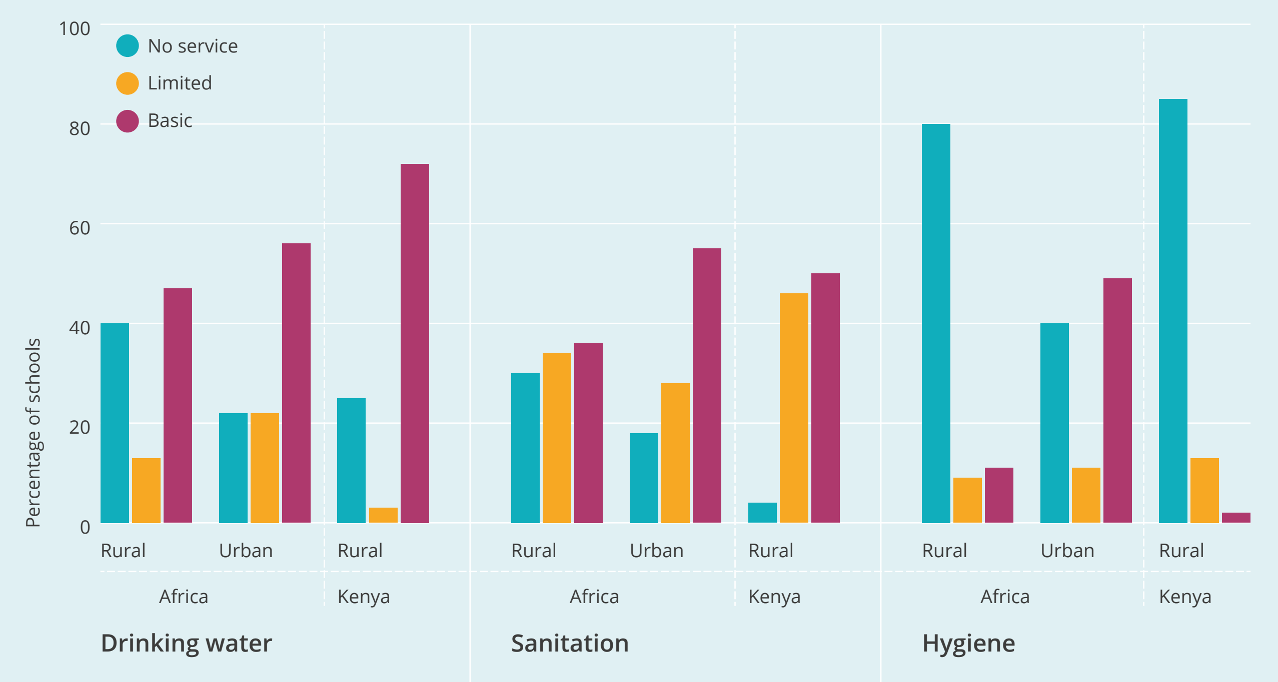
Figure 2: Water, sanitation and hygiene service ladders (UNICEF and WHO, 2020)

Service level	Drinking water	Sanitation	Hygiene
Basic service	Drinking water from an improved source* and water is available at the school at the time of the survey	Improved sanitation facilities at the school that are single-sex and usable (available, functional and private) at the time of the survey	Handwashing facilities with water and soap available at the time of the survey
Limited service	Drinking water from an improved source but water is unavailable at the school at the time of the survey	Improved sanitation facilities at the school that are either not single-sex or not usable at the time of the survey	Handwashing facilities with water but no soap available at the time of the survey
No service	Drinking water from an unimproved source or not water available at the school	Unimproved sanitation facilities or no sanitation facilities at the school	No handwashing facilities or no water available at the school

* defined by the JMP as "those that have the potential to deliver safe water by nature of their design and construction, and include: piped water, boreholes or tubewells, protected dug wells, protected springs, rainwater, and packaged or delivered water."

In Kenya, 72 per cent of schools are classified as rural which aligns to the national demographic profile (UNICEF and WHO, 2020:76). While there are no global monitoring figures for WASH services in urban schools, rural Kenyan schools report higher basic water (72%) and sanitation (50%) coverage than the estimates for Africa as a whole, but with lower hygiene services (2%).

Figure 3: Percentage of rural and urban WASH coverage in schools in sub-Saharan Africa and rural Kenya in 2019 (UNICEF and WHO, 2020)



1.3 Kenya's education sector

Here, we summarise Kenya's education sector and strategic plans. Despite national education plans and policies, the allocation of responsibility for WASH services within schools at the county level remains ambiguous. County governments are developing their own laws and policies but until there is effective coordination between national and county governments, each school will continue to be individually responsible for managing the delivery of WASH services. In the absence of effective monitoring and regulation, there will be limited oversight to understand and improve performance. The Government of Kenya has responded to the need to improve education at the constitutional level supported by a portfolio of national policies, plans and strategies.[1]

1 The sector policy documents include: The Kenya National Education Sector Strategy 2018-22, The Kenya Environmental Sanitation and Hygiene Policy – KESHP (2016 – 2030), National School Health Policy and Guidelines 2009, Water Act 2016, Environment Management and Coordination Act 2016, Basic Education Act. 2013, Public Health Act Cap 242, Building Code of the Republic of Kenya, Safety standards and guidelines for Kenyan Schools 2008, and the Kenya Public Procurement and Disposal Act 2005; 2015.

Article 53(1b) of the constitution of Kenya (2010) provides that every child has the right to free and compulsory basic education, among other rights. This is further spelt out by the Basic Education Act (2013) which stipulates promotion and regulation of free and compulsory basic education in Kenya. It makes provisions for accreditation, registration and licensing, governance, and management of basic education institutions in Kenya.

> **“Kenya’s policies, plans, and strategies that guide the education sector include aspects of the Kenya Vision 2030, its five-year rolling Medium-Term Plans (MTPs), national education sector plans, and the County Integrated Development Plans (CIDPs). SDG 4 focuses on quality education and Goal 5 on gender equality. Further, the Constitution of Kenya (2010) provides that all citizens have a right to access quality basic education (which includes pre-primary, primary and secondary education), while the national policy strives for 100 per cent transition to secondary education. (KIPPRA, 2018: p2)”**

In Kenya, the education system is structured across four levels: (1) Early Learning and Basic Education, which includes pre-primary, primary, secondary, and teacher education; (2) Vocational Education and Technical Training, which focuses on promoting technical and vocational education and training; (3) University Education; and (4) Post Training and Skills Development.

Following the enactment of the Constitution of Kenya (2010), some roles and responsibilities in education provision were decentralised to the 47 County Governments in Kenya. The National Government retained responsibility for development of education policy, standards, curriculum, examinations, granting of university charters, universities, tertiary educational institutions, institutions of research, higher learning, primary schools, special education, secondary schools, special education, institutions, and promotion of sports and sports education. County Governments are now responsible for pre-primary education, youth polytechnics, homecraft centres, farmers training centres and childcare facilities.

With respect to early learning and basic education, responsibility for development of facilities is with national government for primary and secondary levels, and with county governments for pre-primary level. To bridge the gap on education access, other key actors involved in funding early learning and basic education level infrastructure and operations include households, Non-Governmental Organisations (NGOs), Faith-based organisations (FBOs), individuals, and corporate organisations. For this reason, primary and secondary levels comprise both public and private schools receiving pupils on a day, boarding, or mixed (day/boarding) basis. Public day primary and day secondary is partially ‘free’ to all, with parents contributing towards the cost of food and school uniforms, while public boarding primary and secondary schools charge additional fees. The fees structure for private schools is not regulated by the government.

1.4 WASH provision in the education budget

The government has committed to achieving 100 per cent transition from primary school level (compulsory to all children) to secondary school, which has resulted in increasing infrastructure investments in primary and secondary school, and the progressive implementation of various recommendations e.g. increased subsidies for water and electricity in schools. This process is informed by a 2015 government taskforce that examined the cost of public secondary education in Kenya (Ministry of Education, 2015). Government funding for primary and secondary education is outlined below.

Based on the latest data, national education spend increased by 65 per cent from KES 251 billion[2] in 2013/14 to KES 416 billion in 2017/18 (KIPPRA, 2018:5). In 2018, this resulted in an overall spend of USD 141 per pupil per year. Primary education was the major budget recipient (36.9%) followed by secondary education (30.9%) and university education (22.7%) in 2017/18. An estimated 92 per cent of the overall education budget is spent on salary and other recurrent costs, leaving around seven per cent for development. The development allocation has implications for the quality and delivery of WASH services in schools.

Photo by Rob Hope

2 The rough exchange rate for the report is KES 100 = USD 1, though not all figures are adjusted by year.

Since decentralisation in 2013, increasing allocations are made to county governments with a six-fold increase between 2013/14 and 2017/18, though this excludes development budgets for primary and secondary schools. While government is the major funder of education (57.6%), parents are estimated to spend the second largest share (33.7%), including costs for school fees and boarding school (ibid).

Since 2015, the government allocates a Free Primary Education (FPE) annual subsidy of KES 1,420 is allocated to each pupil attending public, day primary schools (non-boarding) by the government. This amount is released into two school accounts – 51 per cent (or KES 730.97) to the School Instructional Materials Account (SIMBA) for teaching-learning materials, and 49 per cent or KES 688.98 to the General Purpose Account (GPA) for operational costs. The GPA includes a lumped budget line for electricity, water, and conservation services of KES 63.18 for each pupil per year. Other implicit budget lines that could be leveraged to support water service delivery are: environment and sanitation (KES 52.43), and renovations, maintenance, and improvement of physical facilities (KES 105.53). However, spending on water services largely depends on the headteacher who prepares the annual budget for schools and the school boards of management that approves them.

Under the Free Day Secondary Schools (FDSE) programme, the government of Kenya has since 2017 allocated KES 22,244 for each pupil in public, day secondary school every year. Compared to primary schools, the allocation for electricity, water and conservation budget line is higher, at KES 3,151 for each pupil every year. Of note, there is no separate environment and sanitation budget line available under FDSE; however, an annual allocation is made for renovations, maintenance, and improvement of physical facilities worth KES 1,886 per pupil, per year.

In summary, national education policies and budgets recognise and promote WASH services in all schools, though responsibility for the delivery of services falls on individual schools facing widely differing infrastructure, environmental, social, and geographic contexts and circumstances. If WASH services are critical to education, learning and development outcomes, the monitoring, management, and regulation of WASH services needs to clearly allocate risks and responsibilities between policy, regulation, and service delivery.

PART 2

Results from Kitui County

2.1 Kitui County

Kitui county is the sixth largest county by area (30,430 km^2) with 95 per cent of the 1.1 million residents living in rural areas of the eight administrative sub-counties (KNBS, 2019, Vol.II). The sub-counties vary in population size[3] from 17 per cent (Mwingi Central and Kitui South) to 7 per cent (Mwingi West). Agro-pastoral livelihoods dominate the rural economy with the production of pigeon peas, beans, sorghum, millet, mangoes, cassava and, in some places, cotton, tobacco and sisal. Human development indicators by education, welfare, poverty, nutrition and child stunting, and access to basic services, such as drinking water, sanitation or electricity, are low (KIPPRA, 2018; KNBS, 2014, 2016, 2018; County Government of Kitui, 2019).

Education facilities in the county include 1,520 early child development and education (ECDE) centres, 1,367 public primary and 415 public secondary schools, the latter two under the management of the national government. Access to basic education in the county stands higher than the national average and as of 2017, the county had Gross (GER) and Net Enrolment Rates (NER) of 103 per cent and 66 per cent respectively for ECDE centres/level, 115 per cent and 88 per cent respectively for primary schools, and 72 per cent and 31 per cent respectively for secondary schools (County Government of Kitui, 2019). The gender parity index (GPI) at ECDE, primary, and secondary education level stand at 0.96, 0.97, and 1.03 respectively (Ministry of Education, 2016).[4]

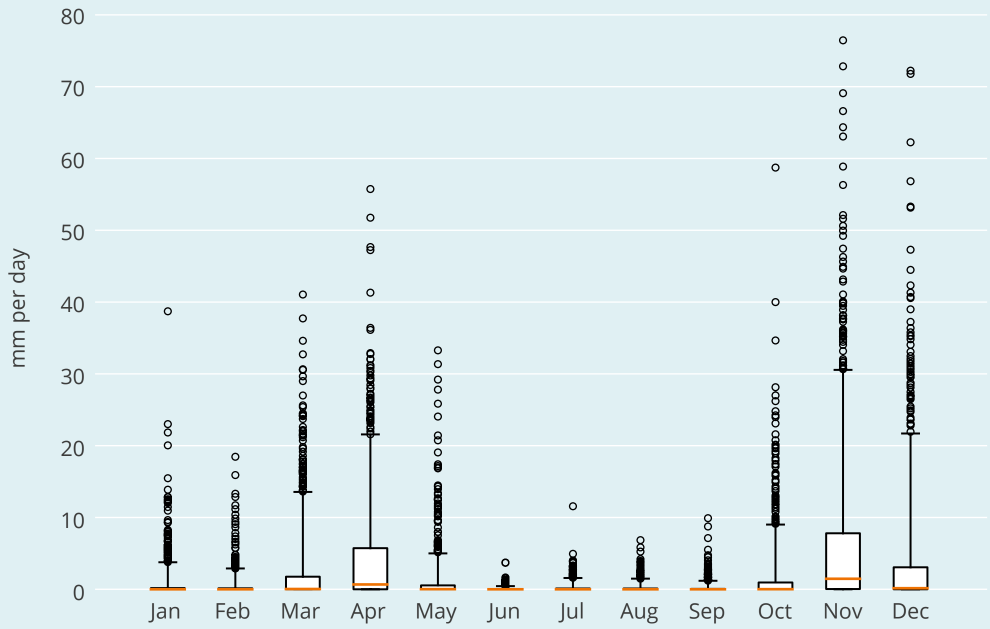
Kitui County has an arid and semi-arid climate with a bi-modal rainfall pattern of short and long rains. Average rainfall is misleading as the short and long rains are separated by an extended dry period (Figure 4). Water resources include the Tana River, which is the only major perennial river, defining the northern boundary with Machakos, Tharaka-Nithi and Embu counties.

3 Percentage of the 1.136 million county population living in the eight sub-counties: 1) Mwingi North (14%), 2) Mwingi Central (17%), 3) Mwingi West (7%), 4) Kitui West (10%), 5) Kitui Rural (10%), 6) Kitui Central (13%), 7) Kitui East (11%), 8) Kitui South (17%) [rounding error sums to 99%].

4 GER: The ratio between all pupils enrolled in primary education, regardless of age, and the population of official primary education age. NER: The ratio between all pupils in the theoretical age group for primary education enrolled in that level and the total population in that age group; GPI: The ratio of girls to boys in education at the specified level.

Kitui town and Mwingi town are the two main urban centres and rely on water pumped south from Masinga and Kiambere dams. The dams are located on the Tana river and water is supplied to these towns by the two county-owned water utilities, Kitui Water and Sanitation Company (KITWASCO) and Kiambere-Mwingi Water and Sanitation Company (KIMWASCO).

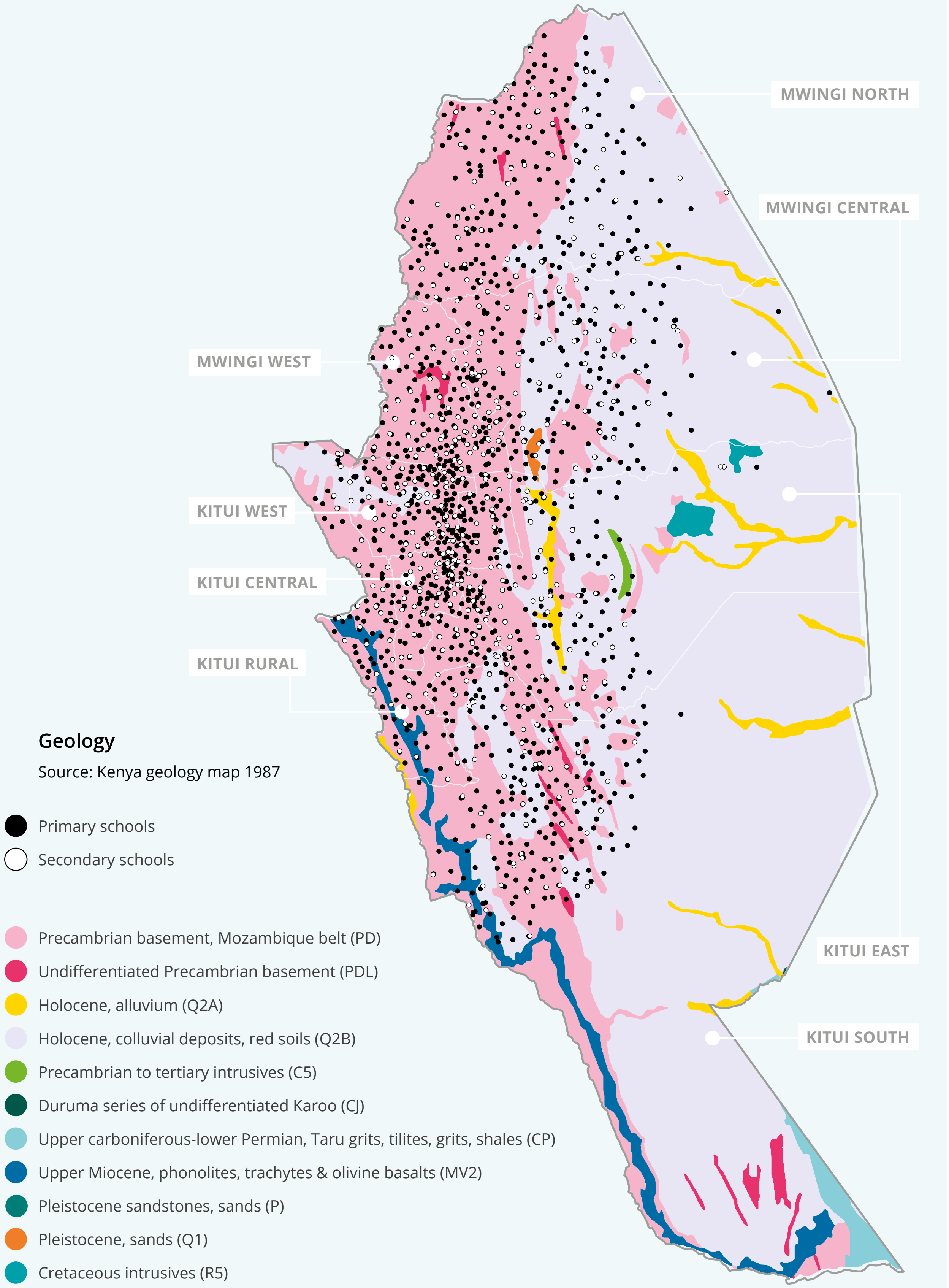
Figure 4: Daily rainfall climatology in Kitui County (CHIRPS, 1981–2018)



In many rural locations, groundwater is lifted using handpumps or pumped using solar, electricity or diesel power to piped systems and kiosks. Groundwater varies in quality with salinity a challenge in many areas of the county. On a geological map of the county (Figure 5), the areas denoted by pink, largely Precambrian basement and Mozambique belt rocks (PD, PDL), would be expected to have low salinity, whereas the lilac areas (Q2B), largely red soils, would be expected to have high salinity; the yellow bands, Holocene alluvial deposits (Q2A), may have higher salinity in the dry season. We estimate around one in four schools are located in areas likely to have higher salinity in the groundwater.

Surface water is also commonly used by households in the county with over 400,000 people stating it is their main drinking water source (KNBS, 2019). Households, communities and schools also capture and store seasonal rainfall from roofs, rock catchments, small earth dams or sand-dams. The drier months between June and late October present significant water supply challenges and affect the resilience of rainwater harvesting strategies.

Figure 5: Geological map of Kitui County showing location and type of schools



Rock catchment dam at Ngomeni, Kitui County

Photo by Jeff Waweru and Tim Mwangi

A water infrastructure audit in the county identified 460 piped water schemes and 687 handpumps of which 50 per cent were not functional (Nyaga, 2019). Often community water schemes serve local schools though water services are unreliable with limited to no monitoring of the quality and quantity of water supplied.

Kitui County government has identified water as one of its five development pillars under the leadership of its second governor after the 2017 election. The development pillars include Food & Water; Health Care; Education & Youth Development; Women Empowerment and Wealth Creation. Policies and budgets have been aligned to support these pillars (County Government of Kitui, 2018).

The first County Water Bill and Policy with specific provision to improve the coordination, monitoring, delivery and financing of water services is in draft in Kitui County as of October 2020. The reform process has included close collaboration with UNICEF and water sector partners in quarterly WASH forums where local expertise has supported county consultation in the scope and purpose of the reforms. This work has also included information and insights from a professional maintenance service delivery company operating in Mwingi North sub-county since 2016. The company (FundiFix Ltd) contracts with community and school water schemes to guarantee faults are fixed within three days for handpumps and five days for small-piped schemes. Recent work includes monthly monitoring of water quality in 17 schools during 2019, which we report below.

A survey instrument was developed and piloted with a team of 26 local, trained enumerators and administered between 16 September and 15 October. The survey included the 'short' JMP school questions (UNICEF and WHO, 2018) complemented by questions on school management, WASH infrastructure and management, and school concerns. A total of 1,887 schools were interviewed with up to 10 schools omitted due to security issues in Kitui East sub-county and the refusal of a few secondary schools to participate.

The primary respondent was the Head teacher and, if unavailable, we interviewed the Deputy Head and then a senior teacher. The majority of respondents were Head or Deputy Heads (>88%) with over three in five respondents male. On average, respondents were in their 40s with roughly 4–6 years' experience in their current school (Figure 6). The time to administer the survey took between 30 and 120 minutes (average = 90 minutes).

Tablets were used to administer the survey using ONA (www.ona.io) with quality control coordinated by a locally-based research manager with support from the Oxford team. The research was registered with Government of Kenya's National Commission for Science, Technology and Innovation (nacosti.go.ke) and complied with the University of Oxford's research and ethics guidelines (CUREC) to ensure informed consent, confidentiality and no harm to all participants. The methodology and survey instrument are available from the UK Data Service.

Figure 6: Profile of respondents by position, age, gender and years teaching, by primary and secondary schools

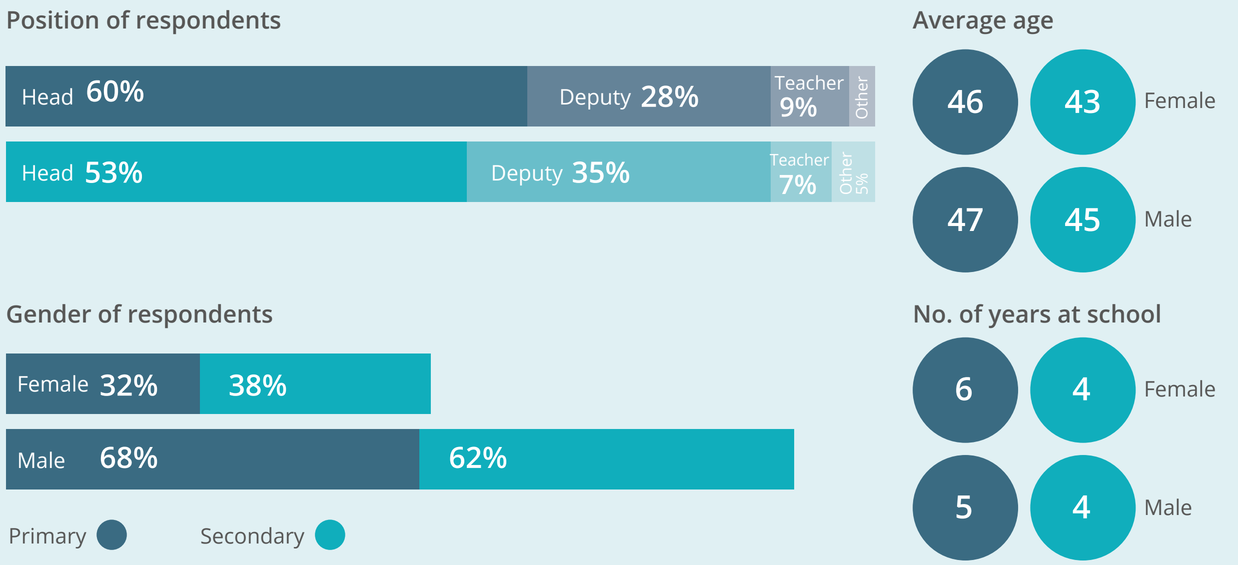



Photo by Rob Hope

The survey took place a few weeks after the national census administered at the end of August (KNBS, 2019, vol. II). The unit of analysis and respondent for this survey was the school and the Head/Deputy teacher compared to the household and parent(s) for the census. The estimated primary and secondary school population in Kitui is 397,854 pupils from the household census and 418,474 pupils from the school survey (Table 1). Teachers identified an additional 20,000 children (5.2%) not counted in the census. The largest differences are for primary schools with more girls and boys identified in the survey than in the census. The differences largely disappear for secondary schools.

Table 1: Kitui County primary and secondary school populations by census and survey data

		Male	Female	Female: male ratio
Census	Primary schools	**157,004**	**149,286**	0.95
Survey		166,127	161,295	0.97
Census	Secondary schools	**45,045**	**46,519**	1.03
Survey		43,493	47,559	1.09
Percentage change to census	Primary	6%	8%	
	Secondary	–3%	2%	

2.2 Infrastructure and inequalities

2.2.1 Historical growth of schools

The quality and provision of WASH facilities in schools today is partly influenced by their emergence over time. From our survey, the oldest schools in Kitui County are Matinyani and Migwani primary schools which were founded in January 1927. The pattern of school establishment over subsequent decades has been influenced by many historical factors, with past decisions shaping future options. Based on respondent's recollection of the school's year of establishment, we plot a 5-year moving average from 1950 to 2020 for primary and secondary schools with indicative dates of political, environmental and democratic change (Figure 7).

In Kenya, it is common for primary schools to start as community, faith-based organisations, non-governmental organisations, or community development fund initiatives and become formally recognised by government at a later stage. This can contribute to structural inequalities in geographic location, gender, and education standards, as well as social-economic factors including the provision of essential services such as water, sanitation, and hygiene.

Before independence, secondary schools were established and supported by the colonial state, missionaries or community initiatives. The response of communities reflected the limited and uneven opportunities for most Kenyans to access good quality education. This contributed to the growth of the 'Harambee' (self-help) movement popularised by Jomo Kenyatta in 1963 (Mwiria, 1990).

Government data illustrate the growth of Harambee schools (assisted or unaided) from 52 per cent in 1969 to 73 per cent in 1987, compared to a falling share of government (aided) schools (ibid: 355). Though Harambee schools outnumbered state schools, the student population was more even, with the state educating 45 per cent of pupils in 1987. State schools had greater resources but created regional and gender inequalities in education provision. The latter is reflected by girls in the 1980s more likely to have been educated in Harambee schools with more limited facilities. As Mwiria argues, the emergence and establishment of Harambee schools played a role in the "legitimation of inequality in Kenya" (ibid: 364). Since the 1980s, the government has intervened more directly by creating district schools. The government introduced a cost-sharing policy by which teachers and learning resources were supplied by the government with communities largely responsible for infrastructure and recurrent expenditure (Ngware et al., 2007). The structural adjustment shocks of the late 80s and 90s reduced government support to paying teaching salaries only, with fewer schools being constructed despite an increasing school-age population.

Following the economic shocks of the 1990s and severe flooding (1997/98) and drought (1999/2000), the Kibaki Government introduced the Economic Recovery Strategy and the Constituency Development Fund[5] (CDF) in 2003. The constituency-level development projects had a strong education focus aligned to the introduction of free primary education. This period led to a large increase in the number of schools being developed which peaked with the new constitution of 2010 and the introduction of 47 county governments in 2013.

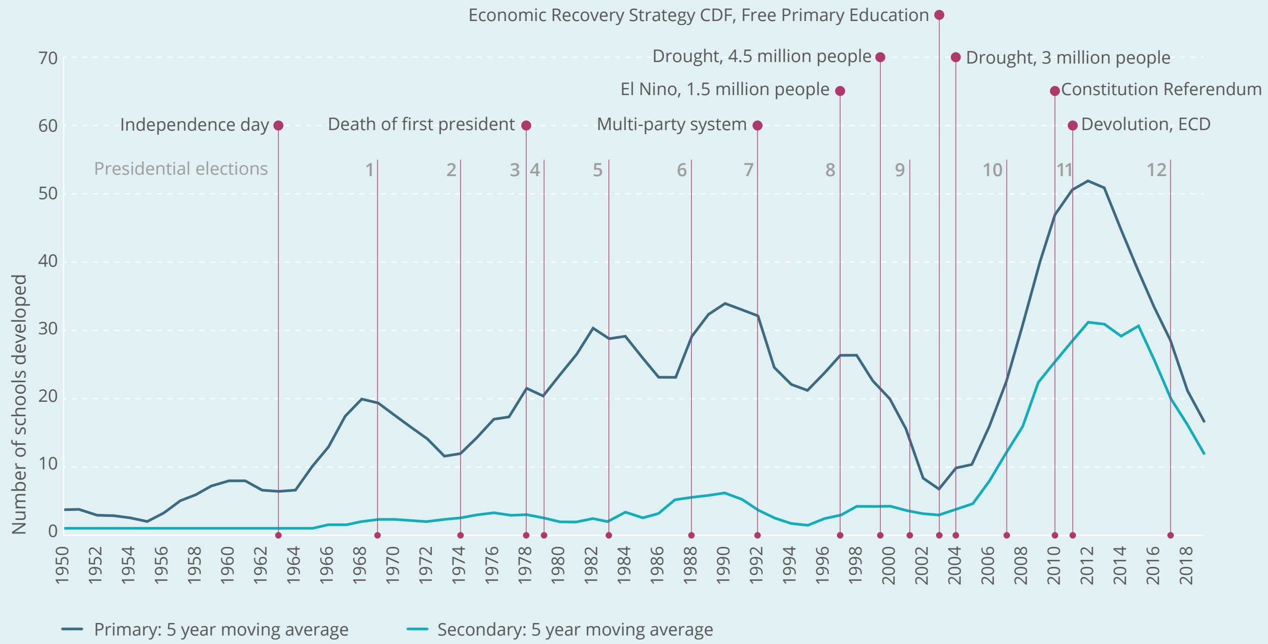
During the first decade of the CDF (2003–2012) the number of primary and secondary schools increased. The introduction of county governments saw this high growth period return to former levels of school growth in Kitui County. We do not know if this reflects national patterns. The long-term pattern of small annual increases in the number of secondary schools is in contrast to the turbulence of primary school growth. It is difficult to discern a clear pattern to the peaks or troughs, other than to note when additional resources became available school growth peaked at a historical high in 2012.

In the results section, we examine four periods to explore WASH implications in schools: a) 1927–1962 (pre-independence), b) 1963–2002 (first presidents[6]), c) 2003–2012 (CDF) and, d) 2013–18 (decentralisation). The periods are indicative to explore changes in school growth. The low proportion of schools that were founded in the pre-independence period (5%) is unsurprising given the political context of the colonial era (Mackatiani et al., 2016). The 'first presidents' period of 40 years is when 49 per cent of schools were established. In contrast, in the ten years of the first phase of the CDF 32 per cent of schools were opened with 14 per cent of schools established during the first five years of county government.

5 The Constituency Development Fund programme was established in 2003 to promote more equitable distribution of national resources to reduce poverty and promote development at constituency level. Providing water, health and education facilities as a priority across the country, including in rural areas. (NG-CDF Act, 2015).

6 This period refers loosely to the presidential and prime ministerial terms of Jomo Kenyatta (1963-1978) and Daniel Arap Moi (1978-2002).

Figure 7: Growth of primary and secondary schools in Kitui County, 1950–2019 (plot of 5-year moving average)



2.2.2 A typology of school water services

To examine our first objective on the status of WASH services in schools, we disaggregate data by three measures: 1) a typology of water supply infrastructure, 2) school status, and 3) sub-county. There are multiple ways to present the water supply in each school given that the majority of schools have more than one supply of water (Figure 8). Three out of four schools report using more than one source over the last 12 months. Global monitoring reports the main source, which would only provide an accurate impression in the one in four schools reporting a singular source, whereas we find the majority have two sources, with one in five using three or more sources.

To reflect the diversity of water sources, we present a typology based on common reporting metrics. Our typology is divided by on-site and off-site supplies with radar figures of respondents' concerns by water sufficiency, reliability, safety, cost, and distance for the school's main water supply (Figure 9). It should be noted, however, that over four in five schools report rainwater harvesting (RWH) on-site, which is common throughout Kenya.

Three findings are highlighted. First, off-site water supplies are as common as on-site water supplies reflecting the dependence on unimproved sources, including rivers and surface water, for over one in five schools, and informal water vendors. Reliability and distance feature as concerns for off-site water sources. Second, of the schools mainly relying on rainwater, there is a concern with 'sufficiency' of the supply. Third, piped water supplies, on-site, are found in one in five schools with cost the major concern for these schools.

Photo by Rob Hope

Figure 8: Number of water sources used by primary and secondary schools

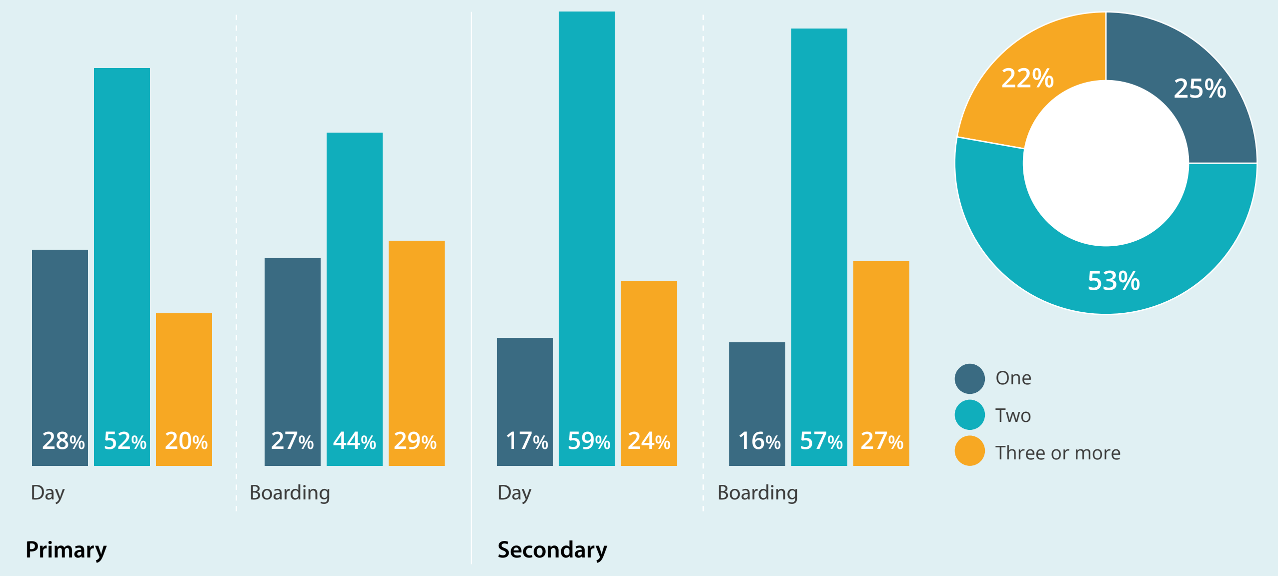
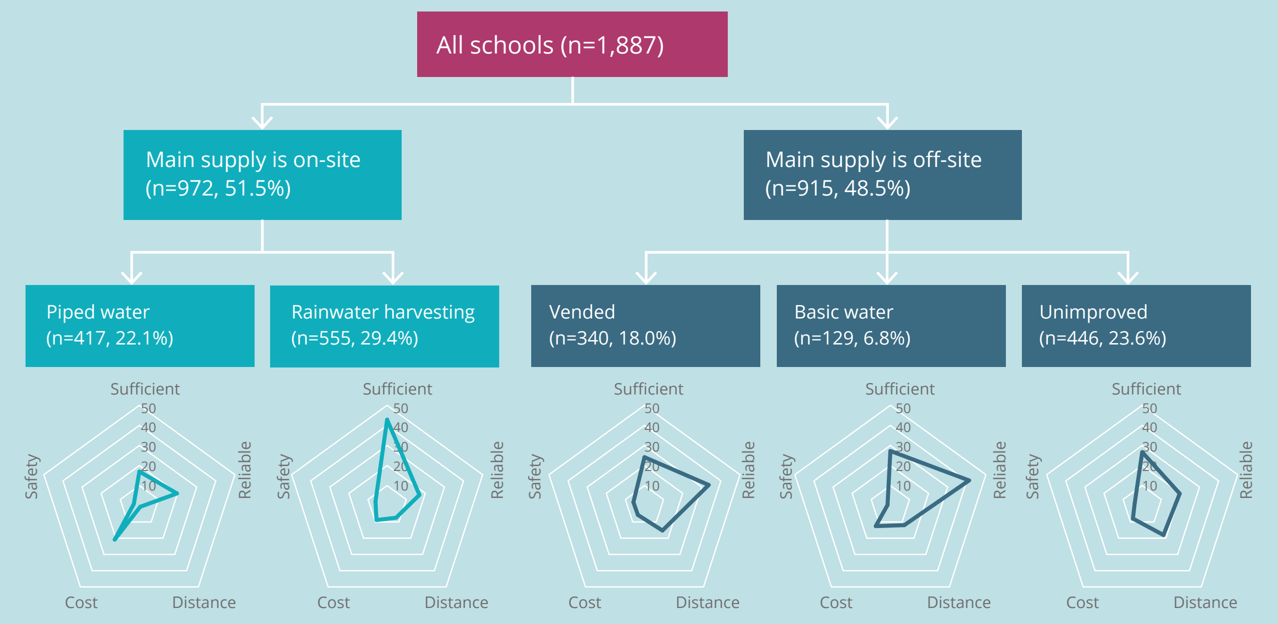


Figure 9: A typology of the main water supply and concerns for primary and secondary schools



Disaggregation of main water supply by school category reveals distinct patterns with boarding schools far more likely to have access to on-site piped water in both primary and secondary schools (Figure 10). This contrasts with the pattern seen in day schools which more usually depend on rainwater harvesting, particularly at primary level. Unimproved water sources feature more highly for primary day schools. Finally, vended water is a common pattern for all school types in the order of 15–20 per cent of all schools.

Figure 10: Main water supply by primary and secondary, day and boarding categories

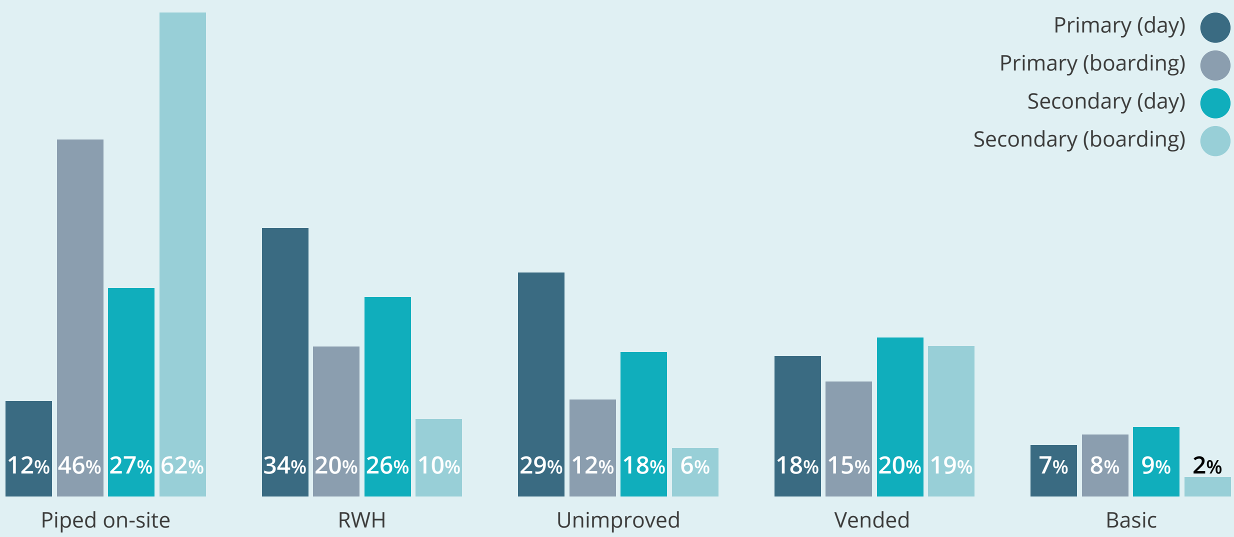
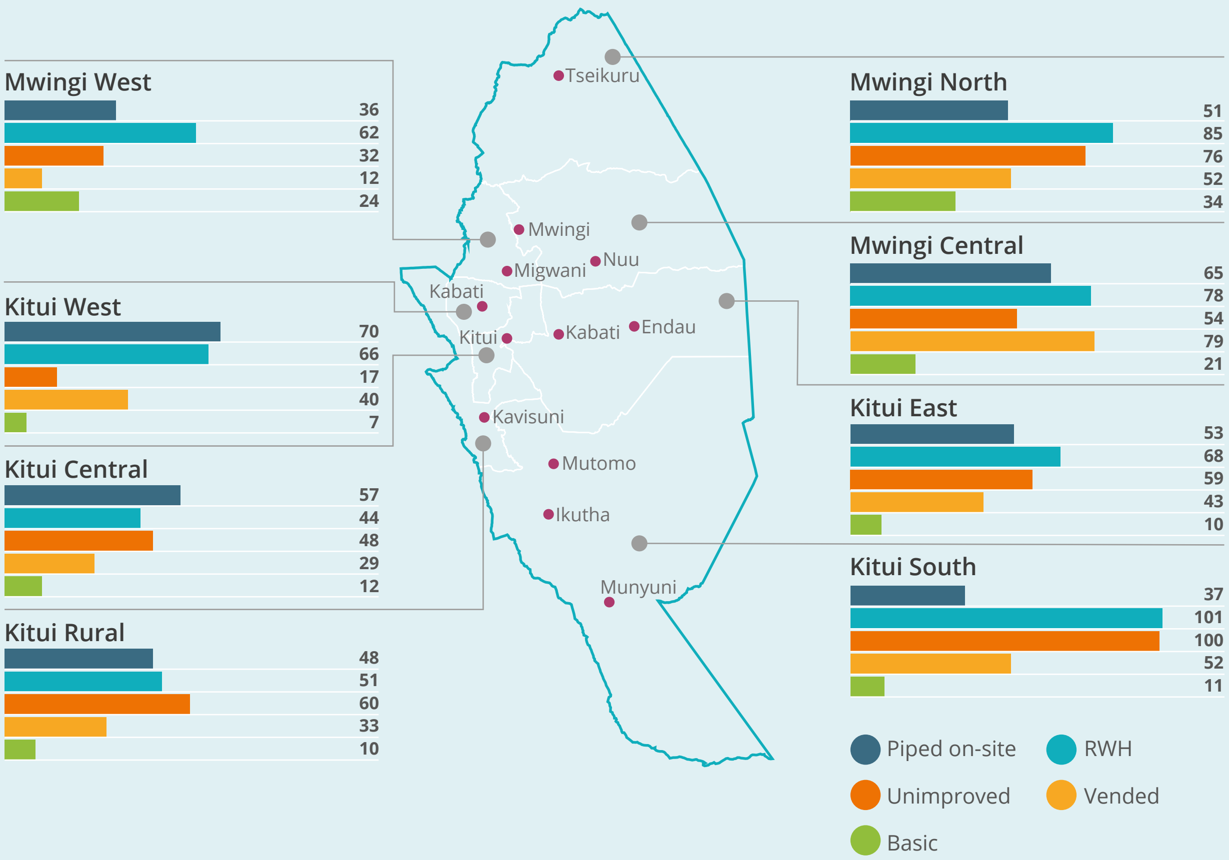


Figure 11: Main water supply for schools by sub-county (number of schools)



The distribution of water supplies in schools varies across the county (Figure 11). We present these data by the number of main water sources in each sub-county. In crude terms, four sub-counties depend primarily on rainwater harvesting in their schools (Mwingi West and North, Kitui East and South). In contrast, two sub-counties depend primarily on piped water (Kitui Central and West).

From a historical perspective, we can see annual growth of schools spiking for three sub-counties (Mwingi North, Mwingi Central and Kitui South) during the CDF phase of 2003–2012 (Figures 12 and 13). In all sub-counties, the CDF produced increases in school access though this was more muted in Kitui Central and Kitui West. Progress has been maintained under county government (2013–2018) with levels above the 'first presidents' period (1963–2002) though lower than the CDF phase. Secondary schools witnessed a dramatic increase in annual growth during the CDF phase rising from 2.4 per year during 1963–2002 to 21.6. Primary schools also increased in growth during the CDF phase to 37.1 per year but from a higher base of 20.7 per year during 1963–2002; this has reduced to 25.2 per year during 2013–18. Since 2013, the CDF programme can only fund projects under national government functions, such as education, which explains continued investment in building new schools and limited progress on safely-managed WASH services that are a county responsibility.

Figure 12: Average number of schools built per year during defined periods presented by sub-county, 1927–2108

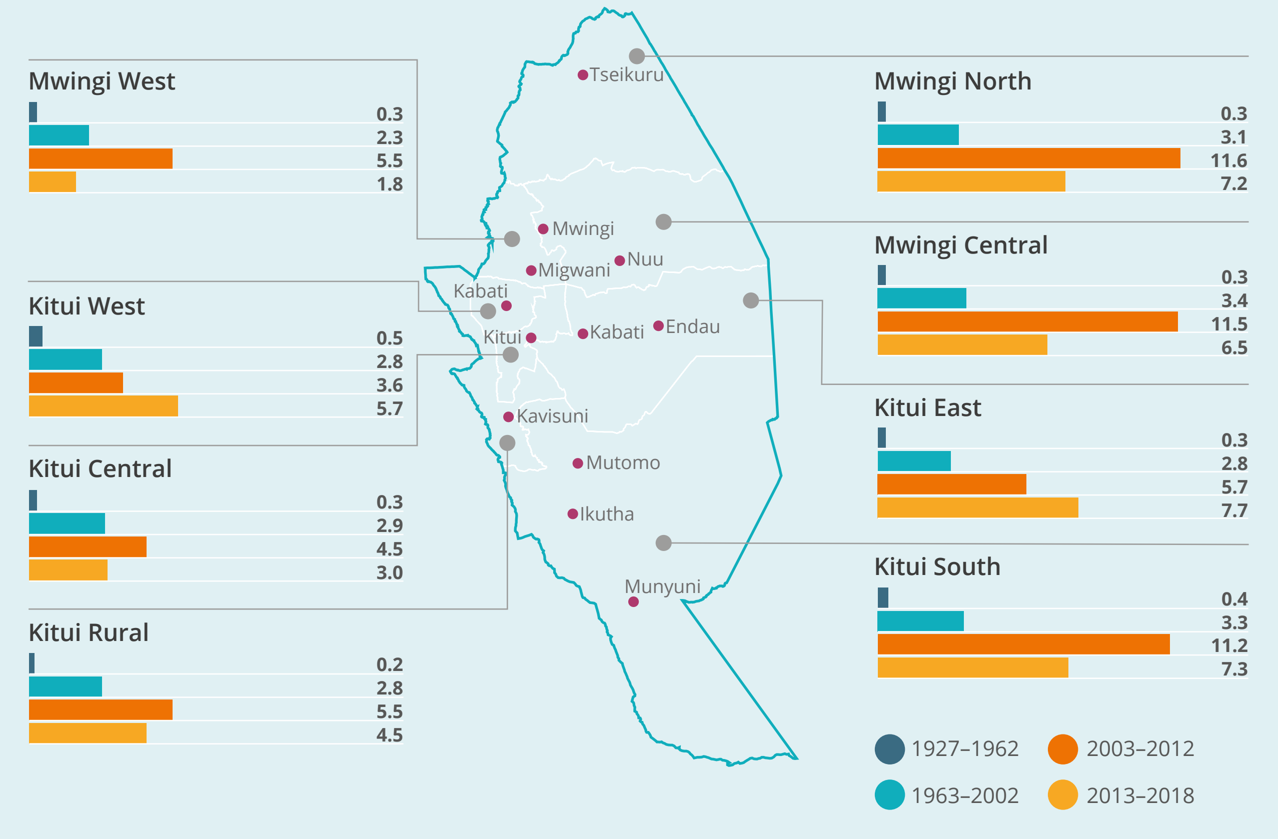


Figure 13: Average number of primary and secondary schools built per year during defined periods, 1927–2018

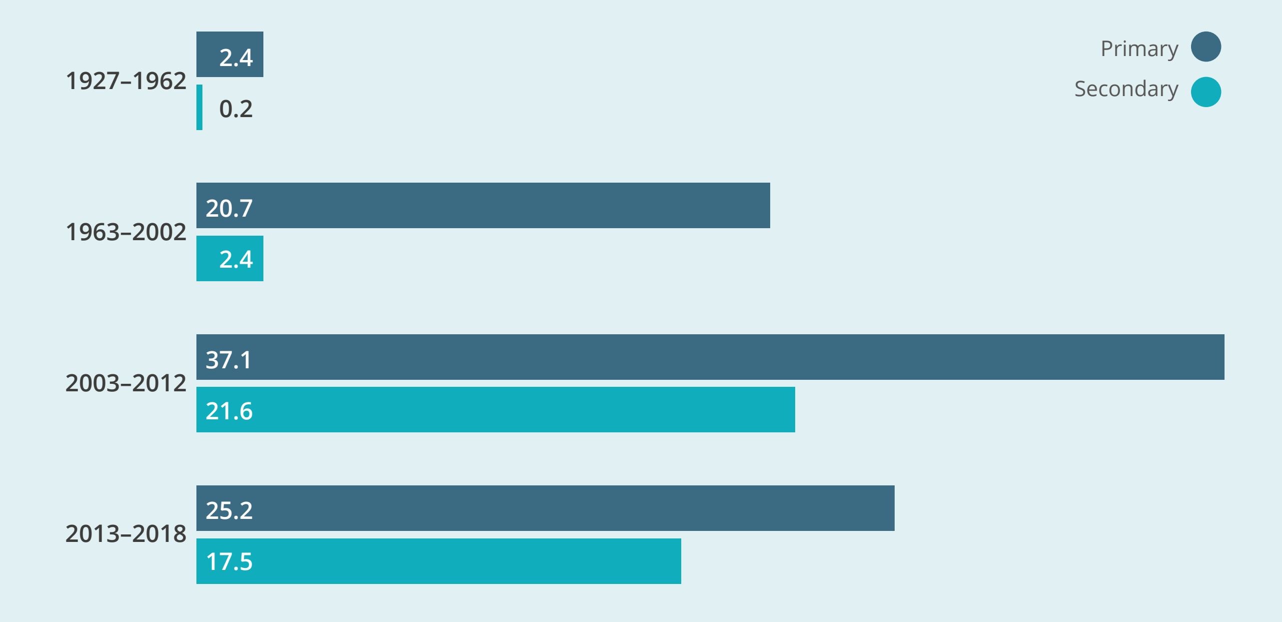


Figure 14: Average number of schools built per year during defined periods by main school water supply, 1927–2018

In terms of the type of water supply infrastructure installed, we see an increase in schools primarily reliant on piped and rainwater harvesting built during the CDF phase (Figure 14). However, this is in the context of similar increases in the number of schools from this period with unimproved, vended and basic water infrastructure. While more schools have been built to increase education access, the quality of the water services is notably variable with the largest relative change in unimproved water sources. Of concern is that schools built during the period from 2013–18 are most likely to have unimproved water supplies followed by rainwater harvesting and vended water systems.

2.2.3 Water storage

Water storage is a common strategy with the majority of schools having a large plastic tank, usually with the capacity of 10m^3. Other storage units are identified but rarely in comparison to plastic tanks (Figure 15). Responses to how long each school's water storage lasts indicates that 47 per cent of schools have between one day and a month's storage.

School water tank

Photo by Rob Hope

Current global monitoring for 'basic water' asks if the source is available on the day of the survey. While useful as a measure that can be objectively validated at the time of the survey, it has limitations. First, water needs to be provided every day. With surveys only occurring every few years simply knowing that on a single day a school had water available seems inadequate and misleading. Second, surveys may be administered in wet or dry periods. As we document, seasonality has an important role in the use of multiple sources and the risks schools face in managing water.

Here, we asked schools about their water availability over the last year with categories of a) always available, b) mostly available (<30 days with no service), and c) limited availability (>30 days with no service) (Figure 16). The categories are simple and arbitrary but provide a measure of how each water source performs over time.

Schools reporting water is most available have piped water (44%) and basic offsite water (37%) as their main water source. Alternatively, schools reporting limited availability commonly have rainwater harvesting as their main source (38%). Regardless of main water supply, schools are commonly reporting short (<30 day) periods of unavailability (50–64%). In sum, no single water source guarantees availability meaning that technology is only part of the pathway to available supplies throughout a school year. Rainwater is predictably the least reliable and therefore has to be considered in combination with other sources, not as the only water supply for a school.

Figure 15: School water storage by infrastructure and duration (n=1,887)

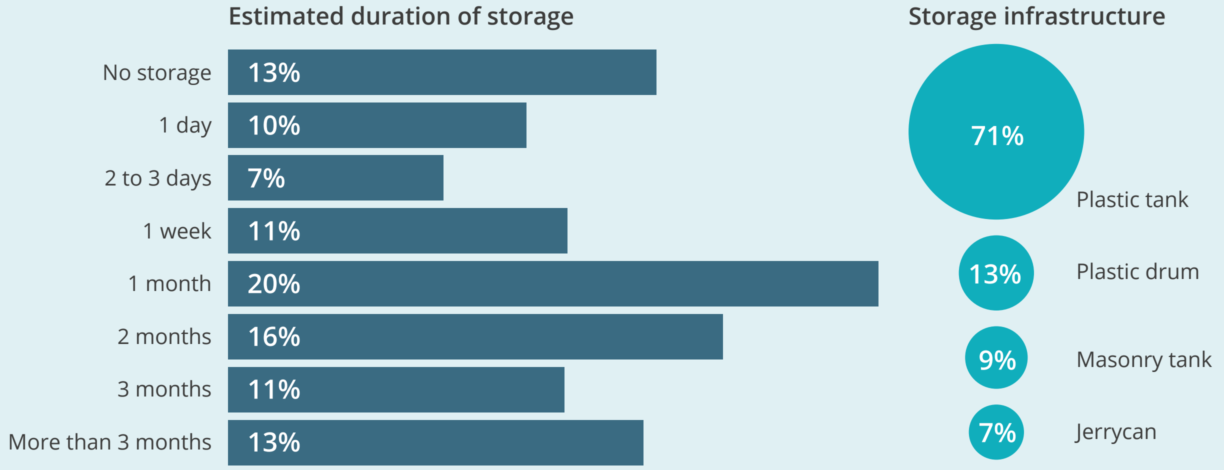
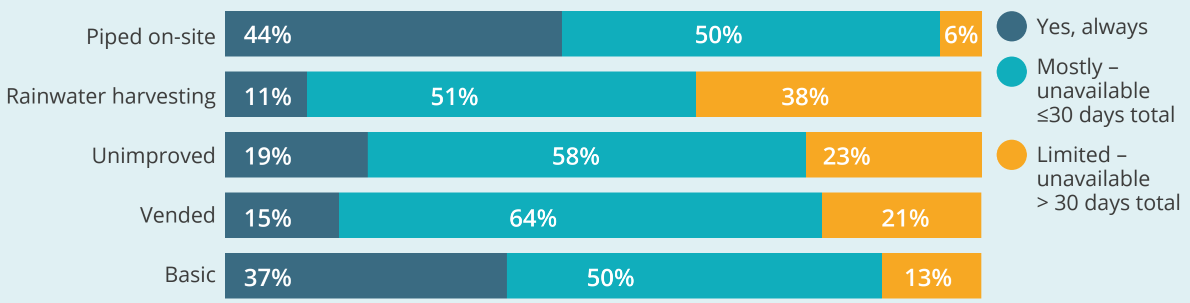


Figure 16: Reported water availability in Kitui County schools by main school water supply (n=1,884)



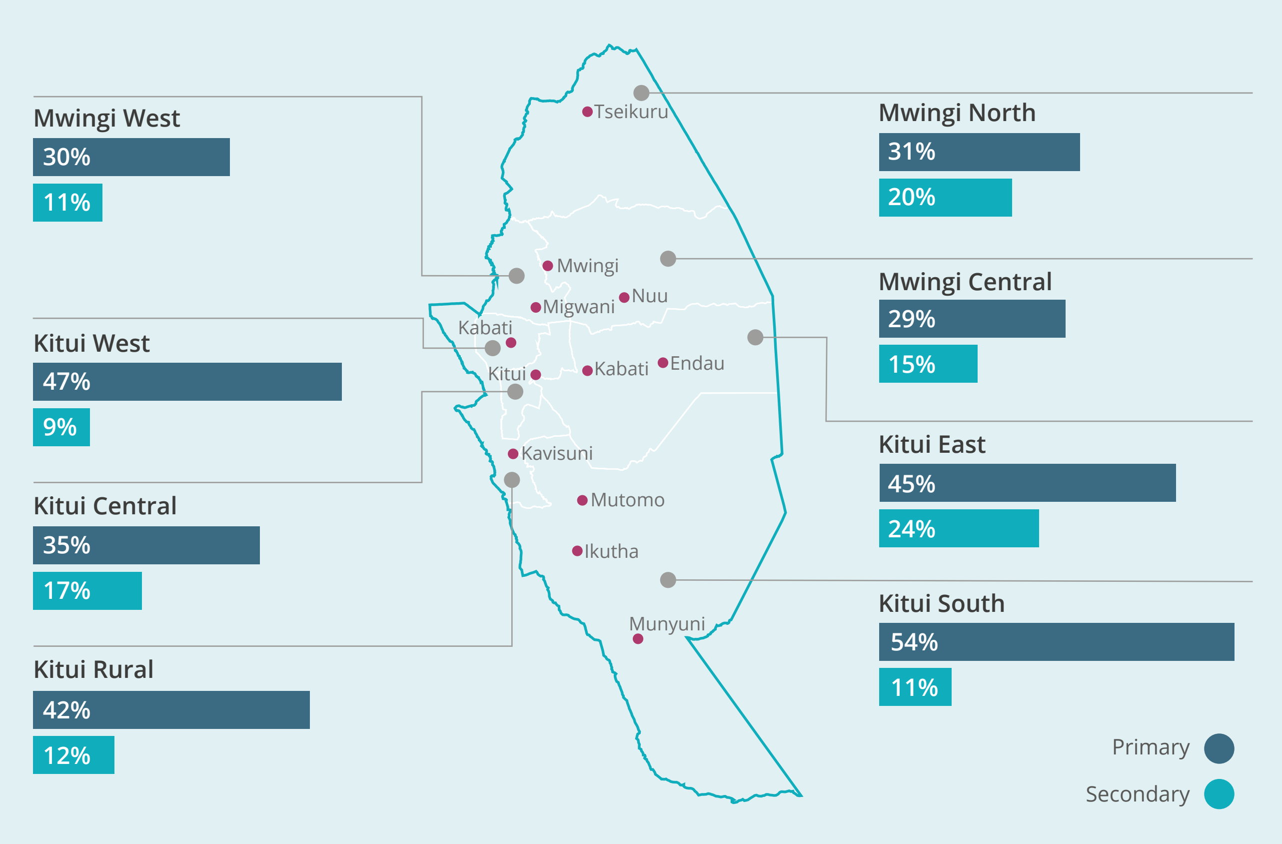
2.3 School water economy

To determine policy and management responses for safe WASH services in schools, it is important to characterise and understand the school water economy. The water economy reflects both supply and demand factors revealed in decisions in water expenditure and storage. As noted, purchase from water vendors by schools is a common strategy to supplement water, particularly in drier months.

2.3.1 Water expenditure

Water expenditure data for schools is estimated by respondents based on the last 12 months. We did not have access to financial records so these are estimations with data outliers or anomalies excluded to provide a conservative figure. We estimate one third of schools spent nothing on water supplies. Primary schools are more likely to have zero expenditure compared to secondary schools with variation across the sub-counties (Figure 17).

Figure 17: Share of schools with zero expenditure on water in Kitui County



Despite this finding, water featured high on the five priorities for school expenditure, second to wages (83%) and above transport (68%), electricity (66%), and sanitation (60%). While most schools stated they received their overall budgets on-time, the majority stated the funds were not received 'in full' and less than one in five stated the budget was 'sufficient' (Figure 18). There is general agreement across school typologies for these questions reflecting earlier concerns on sector funding. Given the high proportion of primary schools in the county, and country, these data are particularly relevant to Free Primary Education provision for day schools.

Figure 18: School budget: perceived sufficiency and reported receipt of funds

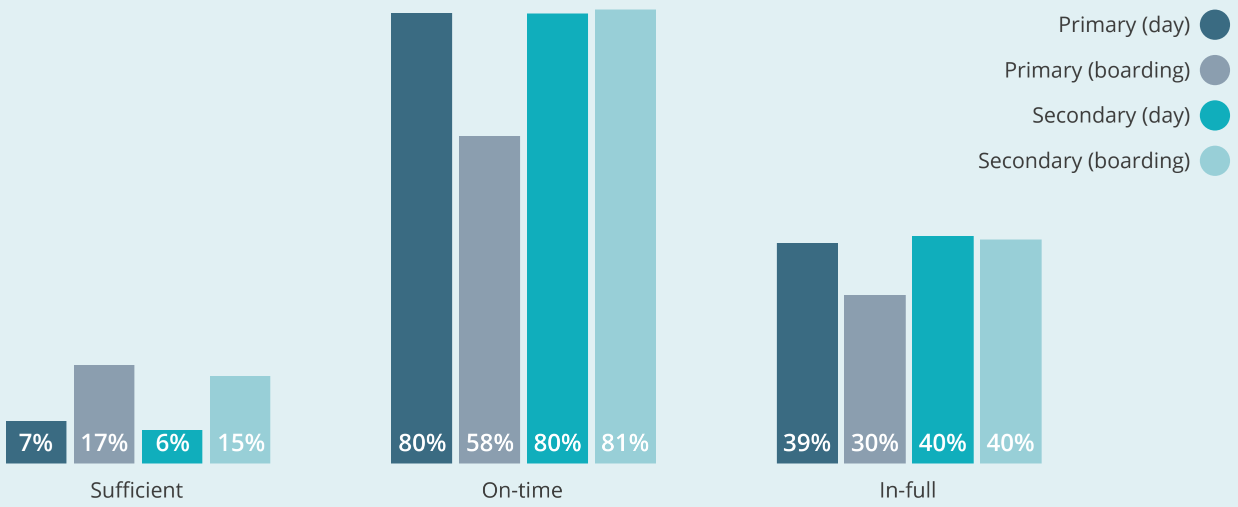
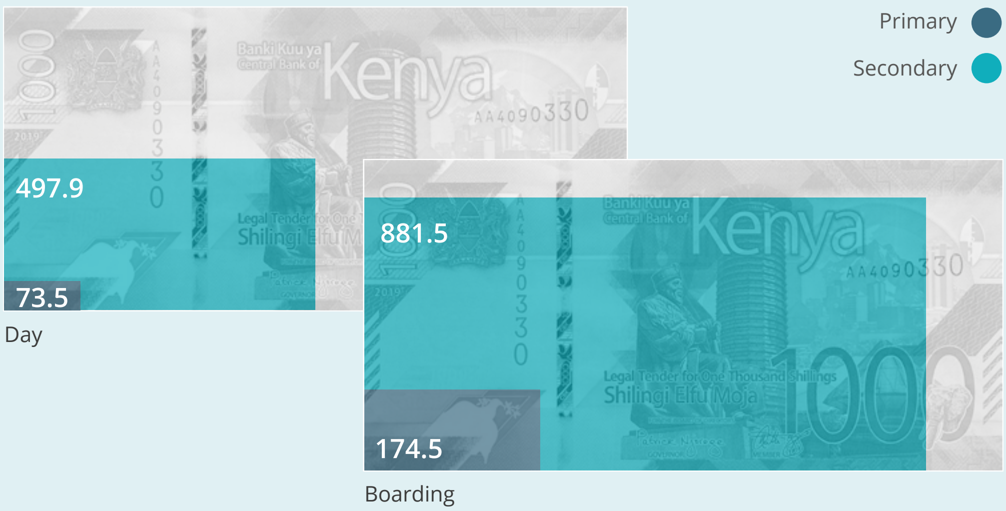


Figure 19: Median annual water expenditure per pupil, by primary and secondary, day and boarding schools (KES per pupil per year)



For the two thirds of schools who report water expenditure, we estimate median annual values per pupil. Secondary schools spend over five times as much per pupil as primary schools with boarding schools spending significantly more than day schools (Figure 19). A child attending a primary day school receives less than one tenth of the water expenditure of a pupil attending a secondary boarding school.[7]

7 Water expenditure estimates in KES for each category are: 1) Primary schools: a) Day (Ave. = 110.2; st.dev = 103.6; n=600), b) Boarding (Ave. = 283.2; st.dev = 294.8; n= 117); 2) Secondary schools: a) Day (Ave. = 622.3; st.dev = 480.8; n= 184); b) Boarding (Ave. = 1,021.5; st.dev = 914.6; n = 122).

2.3.2 Vended water

One component of water expenditure is the purchase of vended water. Schools report three types of vendors operating in their area: a) push-carts, b) tankers, and c) tuktuks. Overall, 623 vendors are identified in the county with a geographic spread across the sub-counties (Figure 20). One caveat is the likely ‘double-counting’ of tankers which serve multiple sub-counties. For example, the county government and two water utilities have an estimated ten tankers which supply water to the whole county. While we report the survey data below we know the tanker share of the market will be lower though the volumetric and tariff data will be accurate, as well as the coverage of tankers across the eight sub-counties. In relative terms, push-carts dominate the vending market with 67 per cent followed by tankers (28%) and then tuktuks (5%).

A push-cart, a water tanker and a tuktuk

Photos by UNICEF; Cliff Nyaga

The volume of water vended varies by transport category and we exclude tuktuks due to a low sample size. After excluding extreme values (volumes >50 m^3), we have a sample of 606 vendors with the majority (n=368) vending less than one cubic metre (1,000 litres) per trip, with a median of 200 litres per trip (mean = 239.4; st.dev. = 213.6). A second group (1–50 m^3) vends a median of 10 m^3 per trip (mean = 11,423.3; st.dev. = 8,381.1).

Tankers sell higher volumes per school trip with a median estimate of 15 m^3 compared to push-carts with 200 litres (10 jerry cans[8]). Our estimate of the volume vended in a dry month is 3,546 m^3 of water. Of the monthly estimate, tankers deliver 2,130 m^3 and push-carts 1,416 m^3 to 524 schools with data.

One third of schools report the months in which they purchase water from vendors with the proportion of schools reporting using vendors peaking in September and October (Figure 21). We can combine school seasonal demand with the tanker and push-cart estimates of vended water to provide an estimate of the total water vended to schools across in the county over a year. The annual volume of vended water from tankers and push-carts is estimated to be 16,544 m^3. Tanker water represents 60 per cent of the total water vended with the five months from June to October representing 70 per cent of the annual total of vended water.

8 Vended volumes by mean and standard deviation are: a) tankers in m^3 (ave. = 16.4; st.dev = 10.9; n= 142), and b) push-carts in litres (ave. = 282; st.dev = 209; n= 341).

Figure 20: Water vendors to schools by sub-county

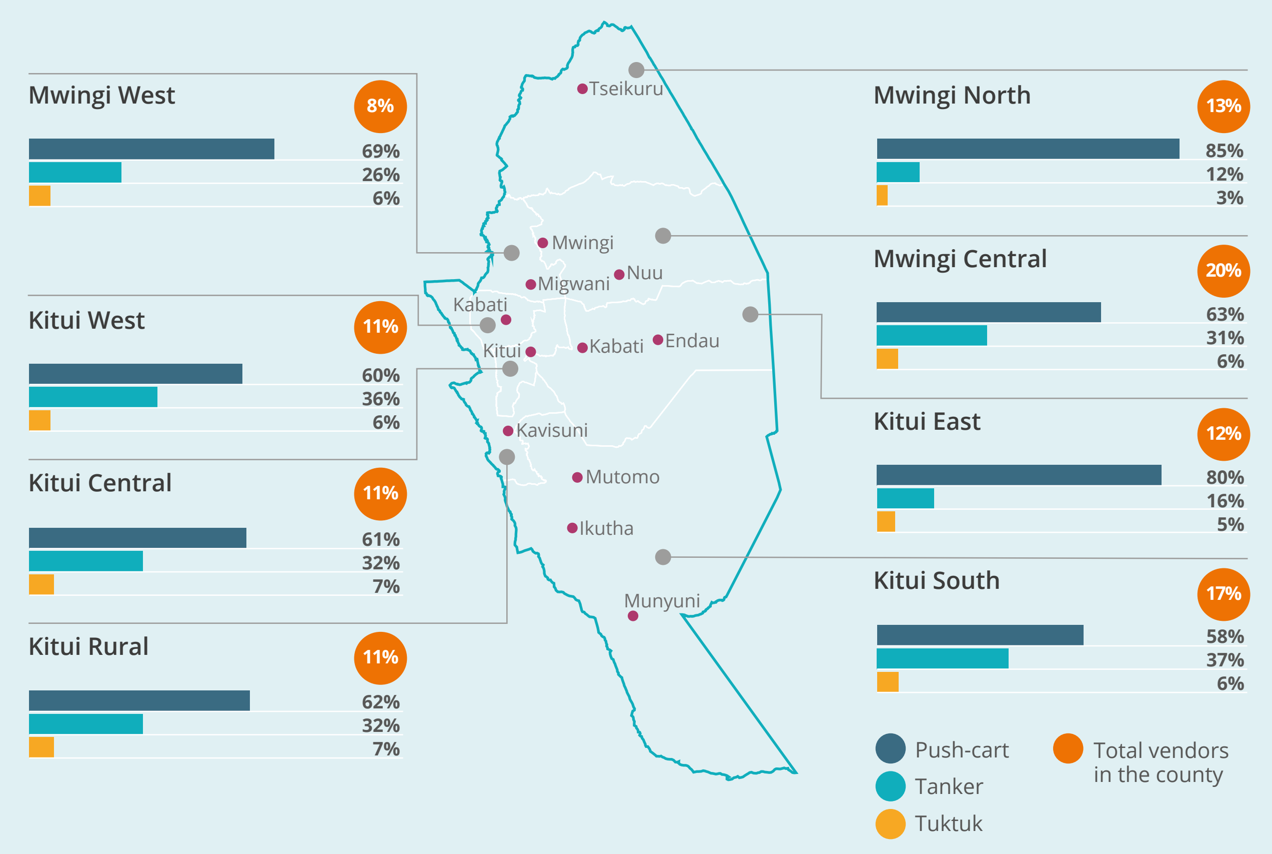
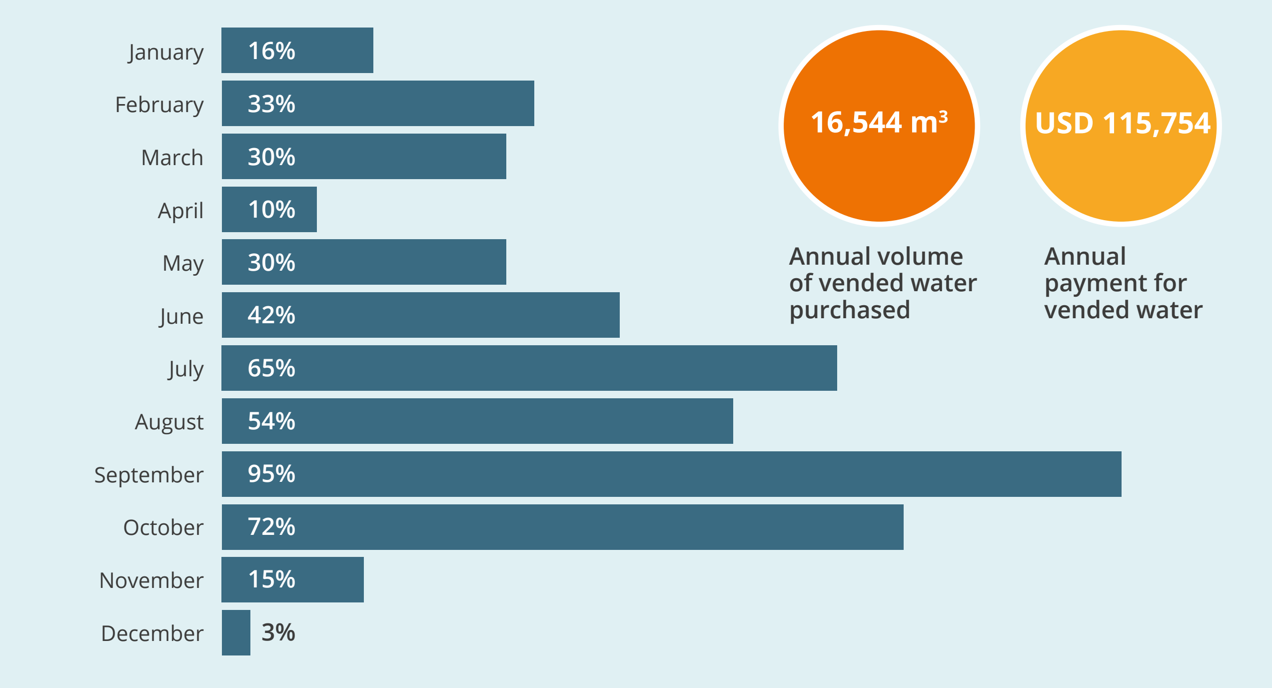


Figure 21: Percentage of schools reporting 'high vending' by month, September 2018–October 2019 (n=643)



2.3.3 Rainfall and water vending

The seasonality of vended water reflects the bimodal rainfall pattern with peak vendor sales occurring at the end of the June to September dry period (JJAS). One third of schools reported months when they purchased water from vendors. Of this group, we can see 65 per cent of schools buying vended water in July rising to a peak of 95 per cent schools in September. In turn, this highlights the timing of the onset of the short rains in October which, on average, occur in the middle of the month, but has varied over the historical period, sometimes starting as late as mid-November (Figure 22). A late short rains onset extends the long summer dry season in which most days have zero rainfall.

Figure 22: (a) Rainy season onset and cessation for 1981–2018 CHIRPS climatology data using the accumulation method of Liebmann et al. [2012] (b) The distribution of short rains onset dates from 1981–2018. CHIRPS climatology data

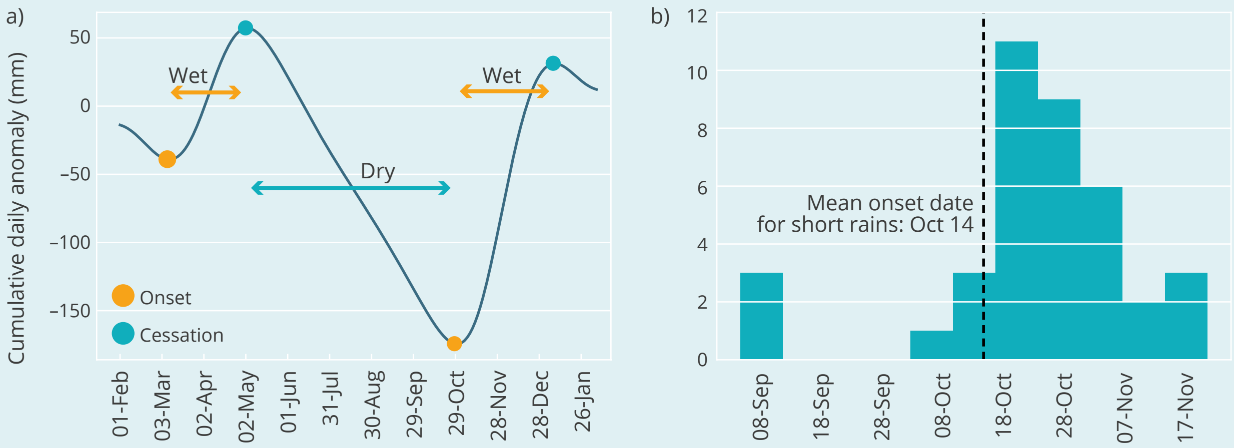


Figure 23: Ratio of days in September and October with zero rainfall (CHIRPS, 1981–2018)

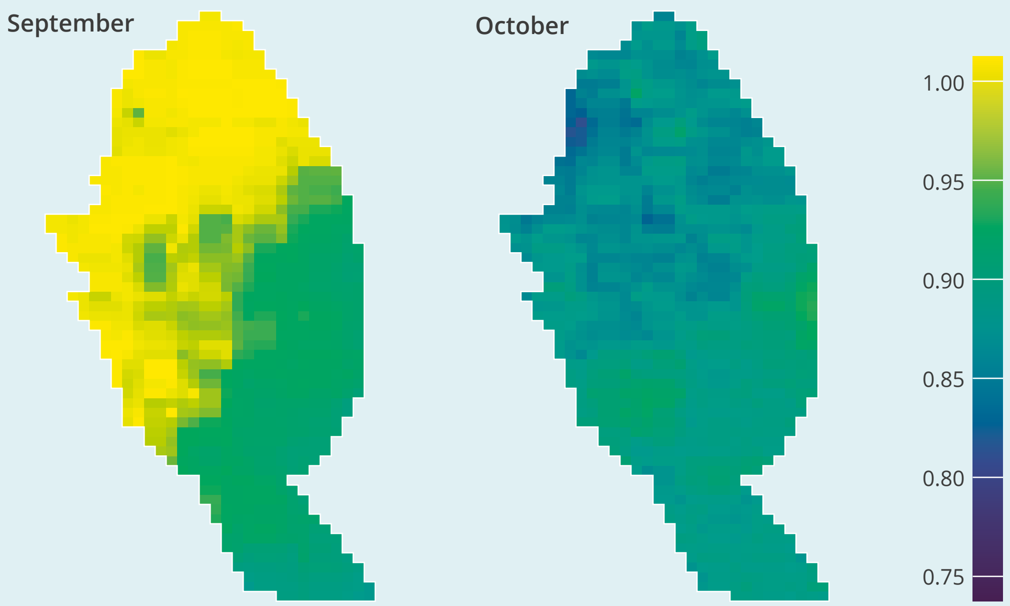


Figure 24: Spatial variation in short and long dry spells in Kitui County. How many times in an average JJAS season will dry spells of varying lengths occur on average, at a minimum, or at a maximum. JJAS seasons from 1981–2018 were considered using the CHIRPS rainfall dataset with a threshold of 0 mm/day as a dry threshold.

Care must be taken with averages as there is still spatial variation on the county level. The ratio of zero rainfall days in September and October is higher in the north west of the county, with relief from the dry season potentially happening sooner in the southeast (Figure 23). There is less spatial variation in October, but the majority of days are still dry.

Across the county, we see different risks with the southern part of the county more susceptible to shorter periods of dry days with no rainfall (10 days) and less susceptible to longer periods of dry days (30 days) (Figure 24). This helps to consider where, and if, rainwater harvesting strategies may be part of a wider approach to increase water security. While climate research suggests rainfall may increase in the wet seasons in the future, with more extreme rainfall days, there is less understanding of the dry season. Planning for a wetter dry season, based on current knowledge, seems risky and investing only in rainwater harvesting will not address the requirement to provide safe water every school day.

2.3.4 Vended water prices

Turning to the price of vended water, the median payment for smaller volumes is KES 200 per 200 litres (USD 10 per m^3) with payments for larger volumes at KES 500 per m^3 (USD 5 per m^3). As such, smaller vendors charge twice the price charged by tankers. There is a positive association[9] with larger volumes being paid for by secondary schools which aligns with the expenditure data. Primary schools with more basic water supplies pay more for smaller volumes of vended water, mainly from push-carts.

The overall, median cost of vended water is KES 1,000 per m^3 (USD 10 per m^3). The estimate trims outliers from the lower (<KES 100) and upper (>KES 2,000) ends of the distribution to provide a conservative figure (n=406). The cost of vended water varies by delivery by tankers or push-carts, and by sub-county location (Figure 25).

Combined with the estimates of volumes of water vended to schools in the county, we estimate the total annual spend on vended water by schools at USD 115,754 per year. While push-carts supply 40 per cent of the vended water, they account for 57 per cent of the annual school spend on vended water. On a per pupil basis for the one in three schools buying vended water, the cost equates to roughly USD 0.80 (KES 80) per pupil per year.

The vended water market for schools exists in schools built during the 'first presidents' period but is more common in schools built during the CDF phase of school growth (2003-2012) (Figure 26). Tanker and push-cart are three times as likely to supply water to schools built in the CDF period. The push-cart market is still high in schools built most recently but tanker provision is less commonly seen.

9 $\chi^2 = 59.46$, $p<0.00$; Cramer's V = 0.33, $p<0.00$.

Figure 25: Median vended water prices by push-carts and tankers in Kitui sub-counties

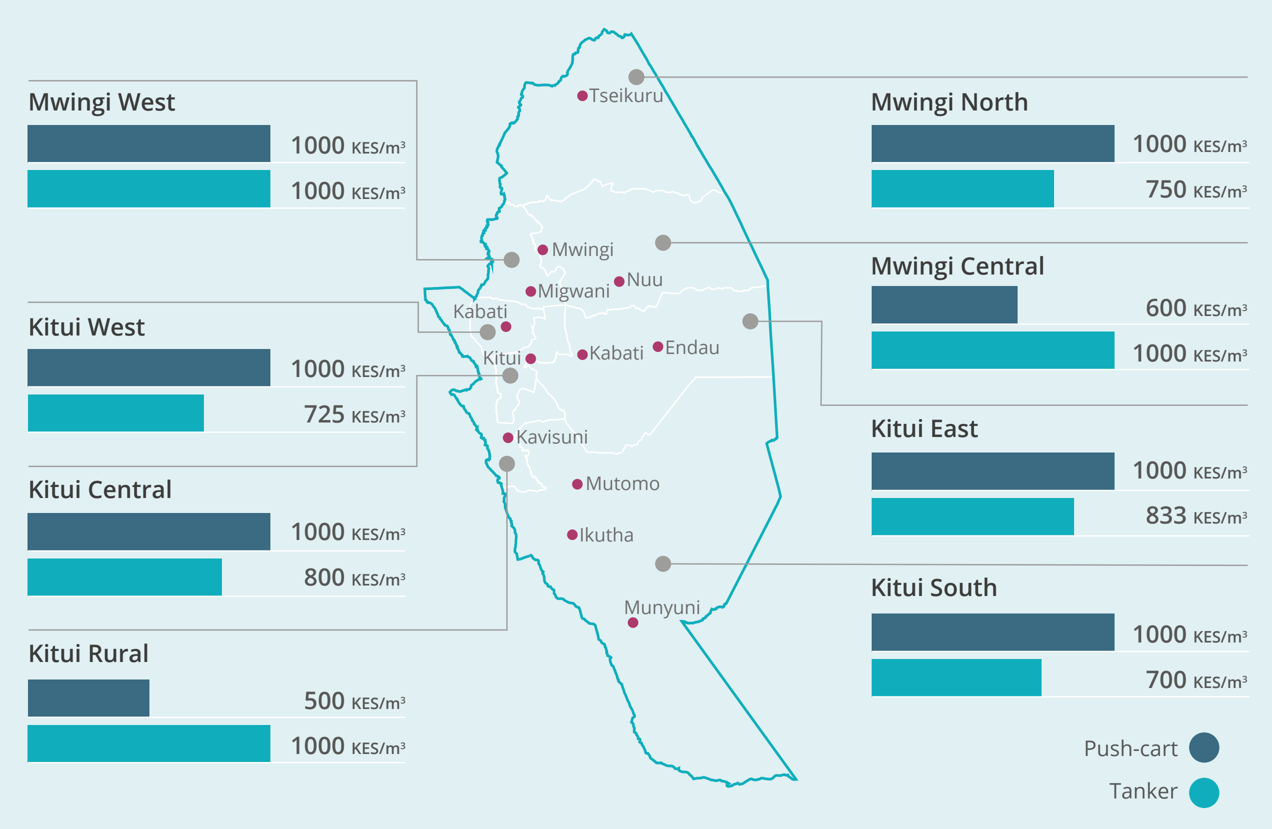
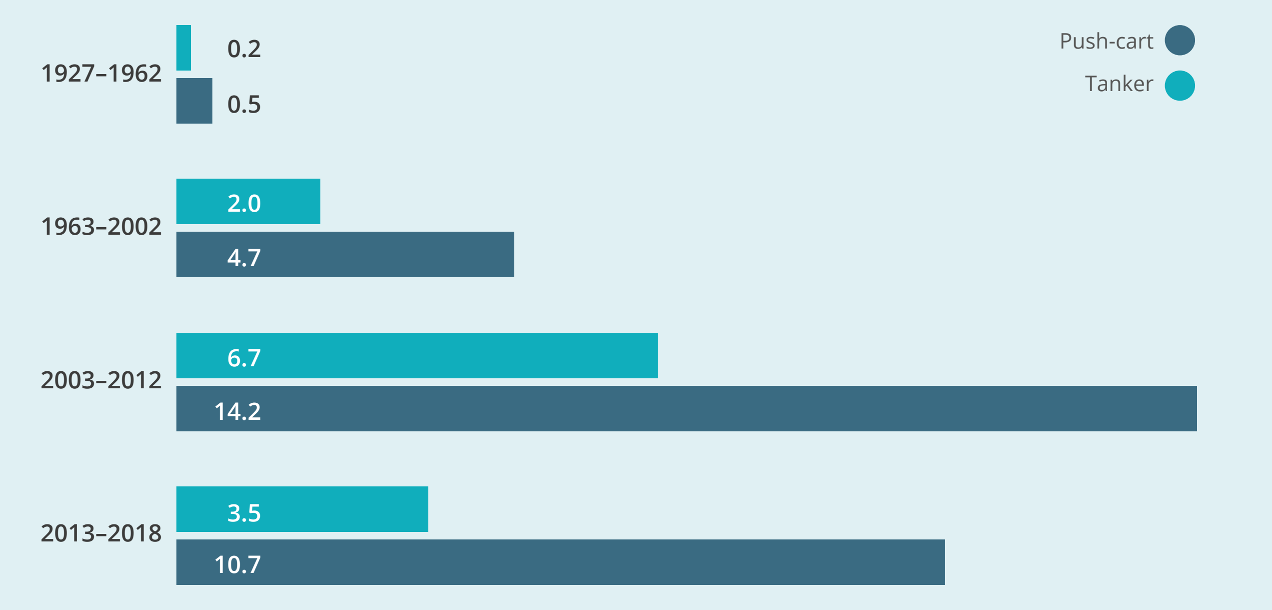
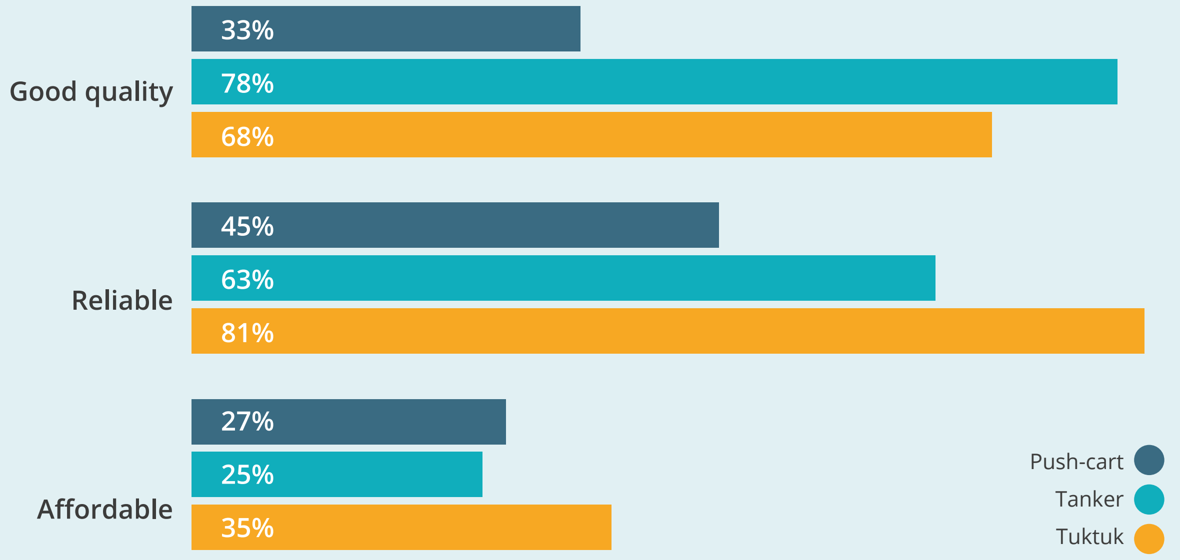


Figure 26: Annual share of schools purchasing vended water by period of establishment in Kitui County



Finally, schools provided an assessment of the vended services by affordability, reliability, and water quality for each vendor category (Figure 27). Predictably, the majority of schools find affordability a concern which reinforces the earlier views on the sufficiency of their budget. Schools are twice as likely to consider tanker water supplies of 'good quality' compared to push-carts. Furthermore, push-carts are considered less reliable than tankers or tuktuks.

Figure 27: School assessment of vended water services by affordability, quality and reliability



2.4 Water safety

Evidence from across the schools in this survey highlights that, while water quality is not a primary concern, teachers are reporting water safety issues. Only one in three schools (32%) reported that the water is always safe (Figure 28), with the main concerns related to faecal contamination (28%) and to organoleptic properties of taste (15%) and smell (11%). Water treatment was not commonly provided by the schools, with just over a quarter (27%) of schools reporting that the water is treated. In two thirds of schools that provide water treatment, treatment was by chlorination, which is effective at killing bacteria and viruses, but is not effective against protozoa like *Cryptosporidium*, which is among the leading causes of diarrhoea in children in sub-Saharan Africa (Betancourt and Rose, 2004; Kotloff et al., 2013).

Access to information on water safety is important to inform appropriate water management in schools; however, water safety is not routinely assessed in schools, so there are no national or county level datasets available for analysis. In the survey, only 10 per cent of schools reported having received information about water safety (Figure 28). The information was received from a diverse range of institutions, including the Ministry of Health, Ministry of Water, NGOs (in particular Impact East Africa), and the Fundifix team. Schools that received information on water safety were almost twice as likely to treat their water, although the effectiveness of the treatment was not evaluated.

Figure 28: Perceived water safety, water treatment and access to water safety information in Kitui County schools

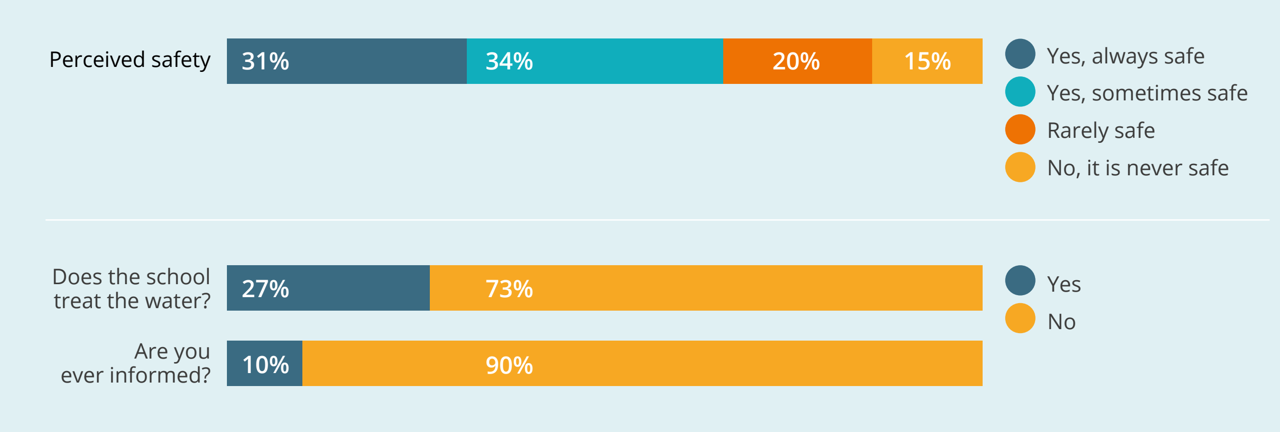
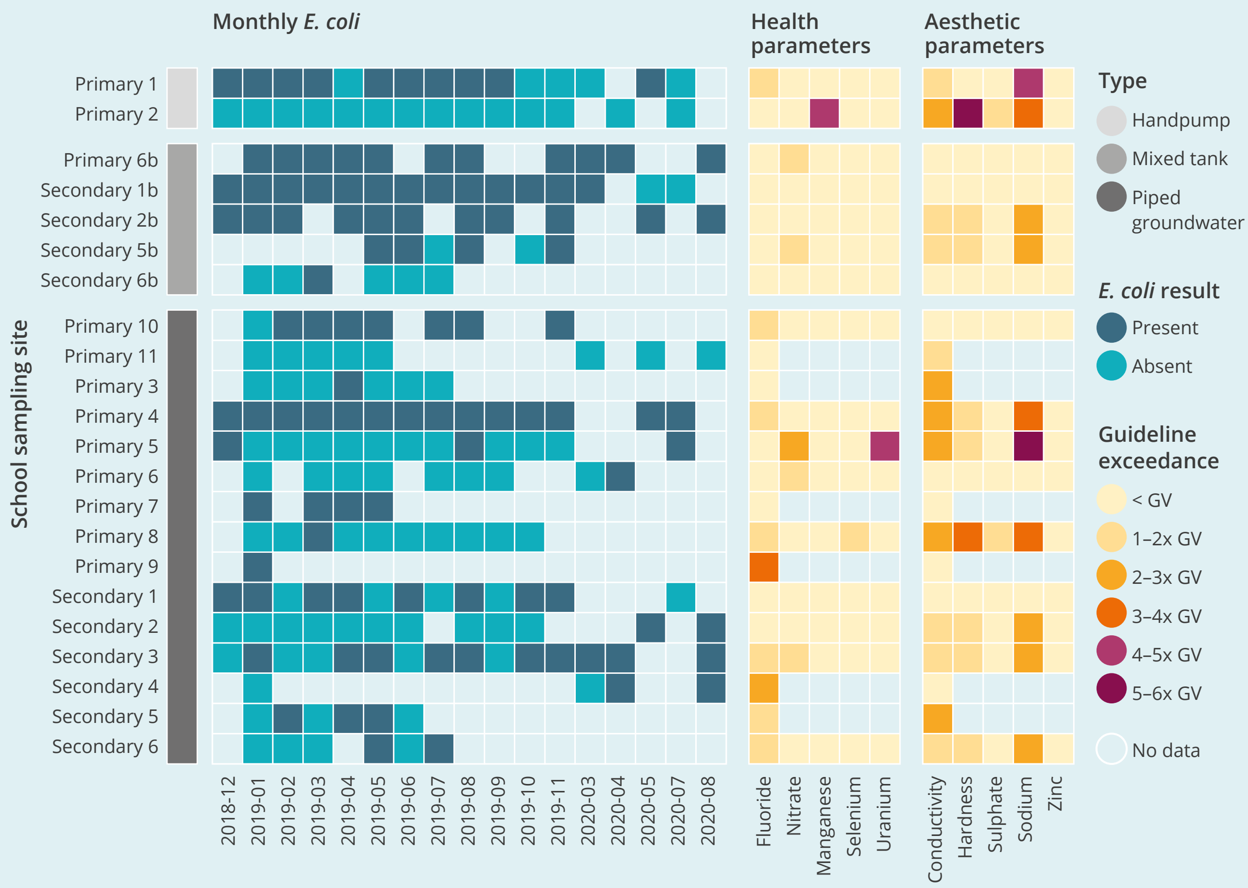


Photo by Saskia Nowicki

In Mwingi North sub-county, an ongoing study of water quality has included schools and provides a snapshot of water safety issues. In 2019, routine sampling was conducted for 22 water points across 17 schools, including 11 primary schools and 6 secondary schools. This was part of a wider programme of water quality sampling to understand drinking water safety risks and hydrogeological conditions. The heatmap in Figure 29 presents the results from the school sampling.

Figure 29: Heat map of water quality results for Mwingi North schools. Monthly *E. coli* results demonstrate variability in faecal contamination. Fluoride and conductivity values represent median values; other chemical parameters are all based on single samples. Sampling sites at mixed tanks were the second sampling point for those schools. Relevant guideline values are from the Kenya Bureau of Standards for natural potable water and the World Health Organisation.[10]



Almost 90 per cent of the schools had at least one sample positive for *E. coli* bacteria and 52 per cent of all samples contained *E. coli*, demonstrating widespread risk of faecal contamination. Furthermore, all of the schools had at least one contamination issue identified across the range of tests performed for *E. coli* and chemical parameters of health and aesthetic concern. These results highlight the critical need to improve management of water safety in schools.

All of the monitored schools relied on groundwater for at least part of their supply. Especially in rural areas, groundwater provides a reliable supply throughout the year. Groundwater in Kitui has particular water safety issues associated with the geochemistry including salinity and fluoride.

10 Values used to determine guideline exceedance: Fluoride – 1.5 ppm, Nitrate – 45 ppm; Manganese – 100 ppb; Selenium – 10 ppb; Uranium – 30 ppb (not listed in Kenya, World Health Organisation drinking water quality guideline); Conductivity – 2500 µS/cm; Hardness – 600 ppm; Sulphate – 400 ppm; Sodium – 200 ppm; Zinc – 5000 ppb.

While salinity can have direct impacts on health through blood pressure effects, the biggest challenge is often indirect: due to taste and satiation issues, people may choose to drink water that is microbially unsafe because it has less salt content. Salinity (measured as conductivity with sodium and chloride confirmed as dominant ions) was above guideline values in almost two thirds of schools.

In addition to salinity, median fluoride concentrations exceeded guideline levels in half of the schools. Fluoride has beneficial effects at low concentration, but at high concentrations it can cause dental and skeletal damage. Fluoride concentrations were not correlated with conductivity levels, and unlike salinity there are no taste, smell or visual cues to identify high fluoride waters without testing. Testing also identified other health risks for some of the schools (Figure 29).

One opportunity to reduce salinity, fluoride and other chemical contaminants, is through dilution with rainwater in mixed tanks. However, tanks can compromise water quality where not properly managed because bird and animal faeces, which can contain pathogens such as *Cryptosporidium*, *Salmonella* and *Campylobacter*, can be washed in off the roof in rainwater catchment systems and larger openings in tanks can allow windblown particulates and possibly small animals to enter. In our study, most of the mixed tanks containing rainwater showed consistent faecal contamination over time.

2.5 Implications for hygiene and welfare

2.5.1 Handwashing, menstrual hygiene management and sanitation

Our findings illustrate the nature of school water supply services with implications for handwashing, hygiene, welfare and student performance. We consider two dimensions here. First, we describe handwashing, menstrual hygiene management provision and sanitation. Second, we present findings on pupils carrying water to school and broader issues of absenteeism.

The majority of schools report no handwashing facility (53%), whilst secondary schools have greater access to handwashing facilities (69%) than primary schools (40%). Across all schools, one in four schools have a handwashing facility with soap and water (26%). Of those schools with handwashing facilities (n=882), 45 per cent were observed to have soap and water available at the station, and this was more commonly observed in secondary than primary schools: of primary schools with a hand-washing facility (n=575), 48 per cent were observed to have soap and water available compared to 68 per cent for secondary schools. Handwashing facilities are more often said to be accessible for a ‘small child’ (28%) than for a child with limited mobility (9%). The location of handwashing facilities are generally by toilets (56%) or the school yard (52%) with less access by food consumption areas (11%), food preparation areas (10%) or classrooms (8%).

The practice of group handwashing activities in school is an additional indicator of hygiene (UNICEF and WHO Joint Monitoring Programme (JMP), 2020. p.14). Across all schools, the frequency of group handwashing activities as reported by teachers is more likely to be once per week (37%) than once per day (24%). Daily group handwashing activities were reported at least once a day by 22 per cent of primary schools (n=733) and 30 per cent of secondary schools. (n=266).

The reported frequency of group handwashing activities is partly influenced by the type of water supply (Figure 30) as well as the reliability of water supplies and other behavioural factors. For example, daily group handwashing activities are as likely with piped water as with vended water (25%). However, schools with rainwater supplies most commonly report group handwashing activities less than once per week (32%). Only 16% of schools with rainwater as their main water supply say that they conduct group handwashing activities at least once a day. If the school's main water supply is rainwater, then children are less likely to have access to handwashing facilities near toilets and food preparation areas.

Figure 30: Frequency of group handwashing activities, as reported by teachers, by main school water supply (n=1,887)

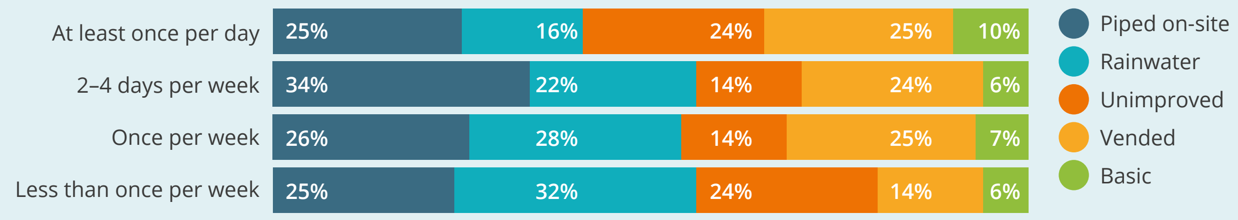
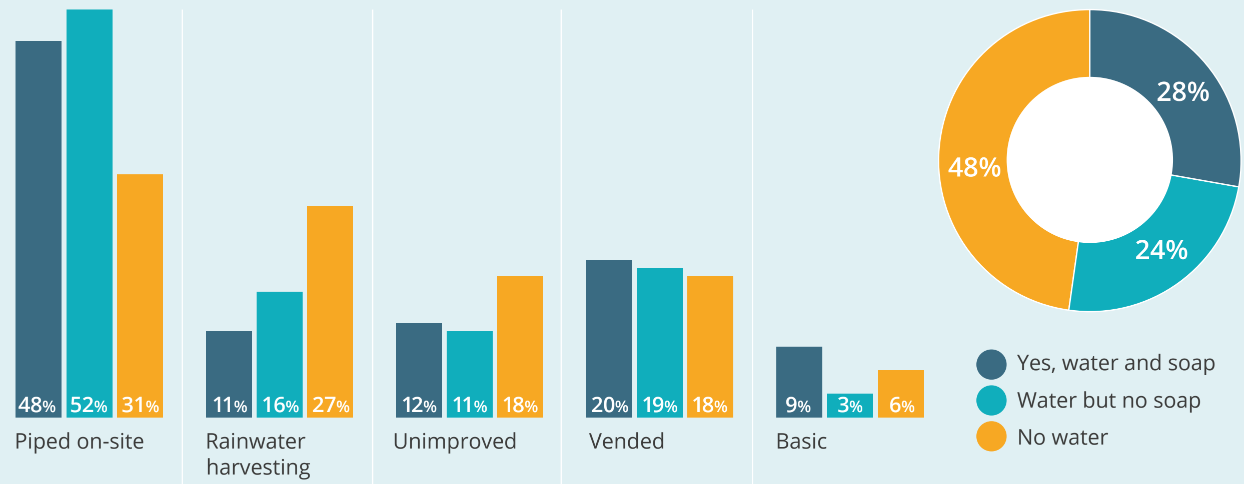


Figure 31: Water and soap availability for menstrual hygiene management in secondary schools (n=390)



Menstrual hygiene management (MHM) in secondary schools is directly affected by water provision. Across all secondary schools, one in two schools report no water available for MHM. One quarter report water but no soap (24%) with a slightly higher share reporting both water and soap for MHM (28%). The type of water supply has a strong association with these outcomes.[11]

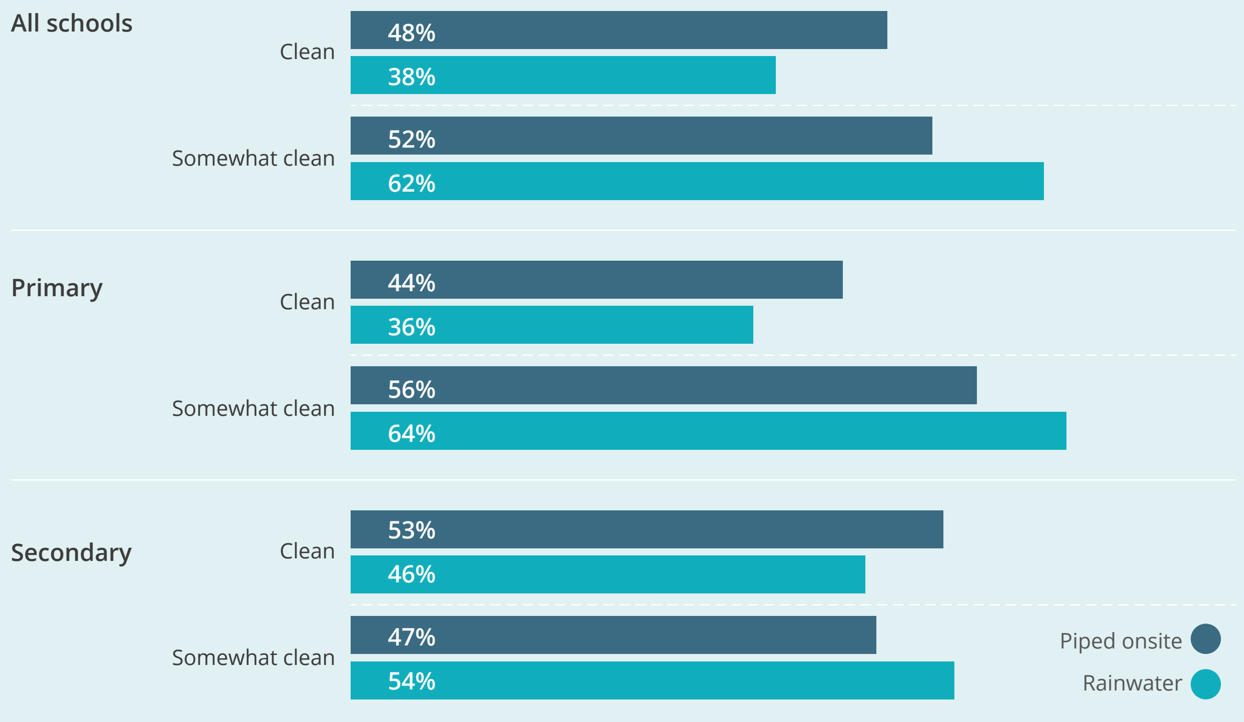
11 χ^2 = 24.01, df = 8, p<0.01; Phi coefficient = 0.25, p<0.01.


BOYS' LATRINES

Secondary schools with piped water as main source have double the likelihood of water and soap provision with schools in the main source vended water category performing next best. In contrast, schools relying on rainwater supplies are most likely to not have any water available (Figure 31). However, it is noted that schools with piped water have the highest share with no water available (31%), reinforcing wider findings that water supply choice is insufficient to deliver and maintain water services over time.

The dominant type of sanitation across all schools is a pit latrine with slab (>97%). On average, there are ten 'usable' toilets per school with a median of four separate toilets for boys and girls. Overall, there are slightly more usable toilets for girls (9,114) compared to boys (8,001) with no common toilets reported. Disaggregating by primary and secondary schools, there is an increase of over two toilets per school between the average provision for primary (9.14) and secondary (11.88) schools. The difference is due to an increase in the average number of usable girls' toilets in secondary schools (6.47) compared to usable boys' toilets in secondary schools (5.22) and girls' usable toilets in primary schools (4.36).

Figure 32: Reported cleanliness of toilets in schools with piped onsite and rainwater harvesting as their main school water supply



Daily cleaning of toilets is reported in two out of three schools (68%) with respondents indicating they are 'somewhat clean' (56%) or 'clean' (43%). Secondary schools are more likely to have clean toilets (51%) compared to primary schools (41%). Toilets are commonly located outside buildings but on school premises (78%) though one in six are open only at specific times (18%). Children with limited mobility face significant access issues with few schools offering usable toilets (6%) and the majority of schools without a usable toilet for a 'small child' (62%). Primary schools report a higher proportion of usable toilets for a small child (40%) compared to secondary schools (24%). Mobility restrictions apply equally to both categories of school.

We find the main water source has an association with a toilet being 'somewhat clean' versus 'clean'. Not one of the 1,887 respondents reported their toilets as being 'unclean'. Across all schools, schools with a main supply from rainwater harvesting are more likely to report 'somewhat clean' toilets, acknowledging that many factors will influence this outcome. This is reflected by the highest share of secondary schools with clean toilets (71%) relying on basic offsite water supplies. Primary schools with a higher dependency on rainwater harvesting show a greater likelihood of being 'somewhat clean';[12] this association is not found with secondary schools (Figure 32).

2.5.2 Student welfare and absenteeism

Teachers provided their qualitative assessment of why pupils were absent (Figure 33). Sickness was a common and dominant response in both primary and secondary schools. Home chores featured more often in primary schools (21%) in contrast to school fees in secondary schools (77%). Home chores have a significant and positive association with absenteeism in both primary and secondary schools, whereas fees are only significant for secondary schools. The latter are a major impediment for enrolment in Kenya and many countries (Kamau and Wambogo, 2017; Ministry of Education, 2018; KIPPRA, 2018).

Lack of water and food have more direct relationships with infrastructure provision. Two thirds of primary schools associate absenteeism with a lack of food, twice the proportion of secondary schools. The association is significant and positive for both school types, though larger for primary ($\chi^2 = 191.02$, $p<0.00$) compared to secondary ($\chi^2 = 57.74$, $p<0.00$) schools. A more muted pattern emerges for a lack of water and absenteeism with a third of primary schools and one in six secondary schools identifying a significant and positive association.

Student welfare and absenteeism should be considered in relation to facilities for menstrual hygiene management (Pearson and McPhedran, 2008; Mooijman, 2006) with one in three schools reporting no water for this purpose. While this was not specifically noted as a cause of absenteeism, female teachers were significantly more likely to report a lack of water for MHM ($\chi^2 = 42.46$, $p<0.10$) compared to male respondents (non-significant result). Female teachers represent one third of the 3,141 staff in the schools surveyed with slightly higher representation in secondary schools (38%) compared to primary schools (32%).

Finally, we report on school assessment of the share of children who sometimes carry water to school (Figure 34). Roughly seven in ten children attending a primary day school sometimes carry water to school compared to one in three in a secondary day school. Boarding school children only exhibit a small response in the primary sector which likely reflects that our categorisation of boarding includes some day pupils who bring water from home. The practice of carrying should not be over-interpreted either as a positive or negative outcome; it might increase access to water for drinking and washing during the school day but could equally be associated with increased health risks from unsafe community water sources or water collection burden for households.

12 $\chi^2 = 8.07$; $p<0.10$; $n = 1{,}438$.

However, this behaviour is three times more likely to be reported at primary level than secondary level and therefore may be associated with the more limited and poorer quality of water services accessed by primary schools. While children carrying their individual bottle to school may be associated with poor water services in the school, the implications of the COVID-19 pandemic and the return to school may make this practice part of a wider strategy of protecting health and containing the virus.

Figure 33: Reported causes of absenteeism by primary and secondary schools

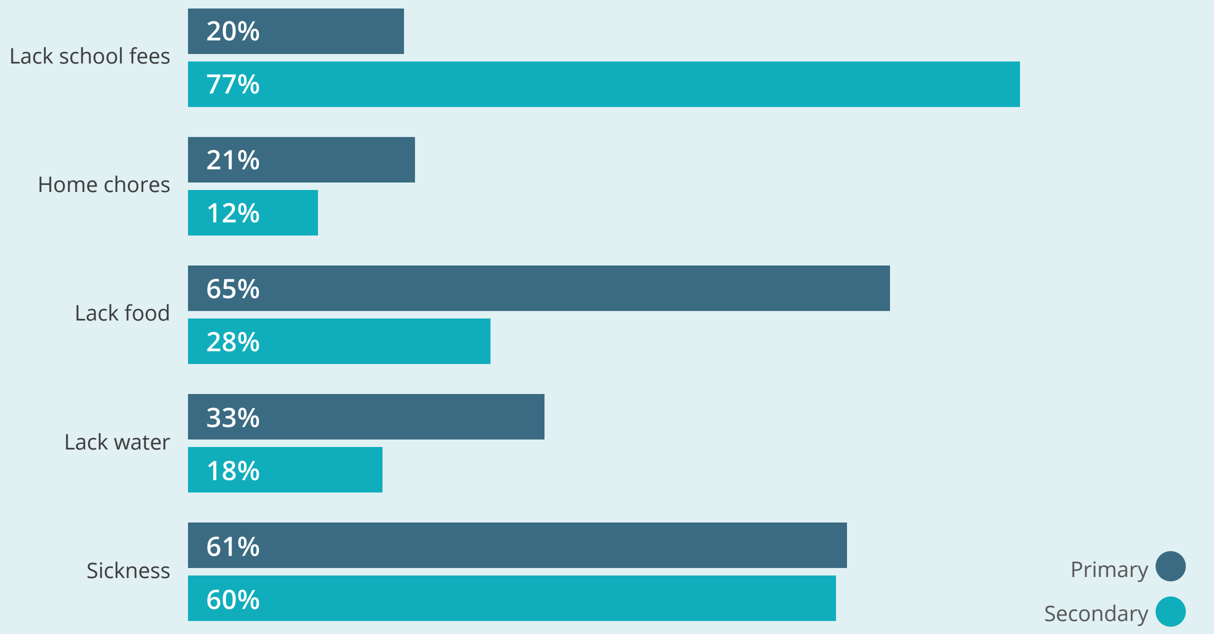
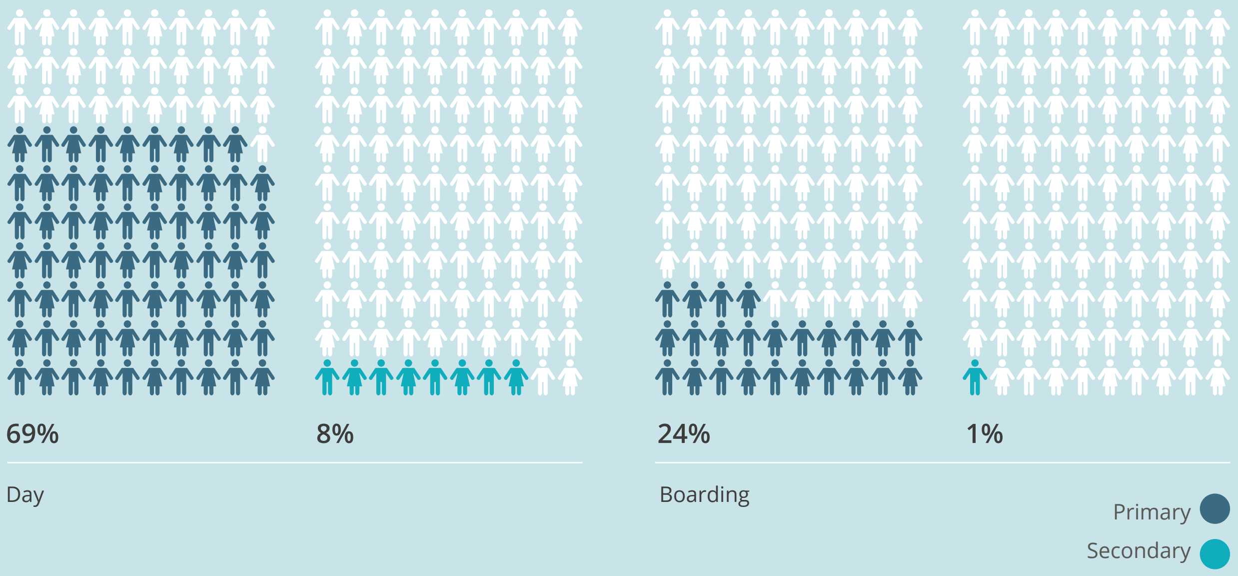


Figure 34: Percentage of pupils who sometimes carry water to school

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Conclusion and recommendations

Despite the legal, financial and service delivery challenges for safely-managed WASH services in schools in rural Kenya, there is evidence that services can be improved and sustained. We identify four conditions in this process. First, to clarify national and county responsibilities for WASH services in schools. Second, to improve monitoring and regulatory capacity at the county level. Third, to use information from monitoring systems to rethink funding models. And, finally, to pilot performance-based models in selected counties to support a national programme of reform.

3.1 Clarify national and county responsibilities for WASH in schools

Without clear separation and accountability in the roles for WASH provision in schools between national and county governments, the prospects to achieve and maintain safely-managed WASH services in schools are remote. The enormous deficit in hygiene services highlights the acute and chronic nature of the challenge in the context of the COVID-19 pandemic. The historical data extending back to January 1927 indicate that this is not a new issue but has been pervasive for decades.

Whilst national government through the Ministry of Education remains the responsible authority for WASH services, there is a confusion of roles with county government. Kitui County Government has responded to the uncertainty by developing a new County Water Bill where the provision of school WASH services will fall under its mandate and management. This is a pragmatic but uncoordinated response. National budgets make insufficient and non-binding WASH allocations to head teachers which result in inefficient and unregulated outcomes. There is a need for budgetary reform to align financial resources with measurable outcomes.

National and county governments can work in partnership to support and simplify provision of services. History has shown national government has not been successful in providing safe and reliable school water services in Kitui County even under the current Free Primary Education and Constituency Development Fund programme when significant resources were allocated to schools, but did not improve WASH services. Working together, the national government's Ministry of Education can focus on education outcomes supported by the county governments in delivering universal WASH services.

Photo by Jeff Waweru and Tim Mwangi

Clarifying legal roles will take time and the national government through its Ministry of Education can advance this commitment through phased and time-bound collaboration with one or more county governments to inform the necessary legal, financial and policy steps for wider uptake.

3.2 Improve monitoring and regulatory capacity

Without improved monitoring and measurement of WASH service delivery, legal and policy reform will be unaccountable and non-transparent. The narrow goals and occasional nature of global reporting are insufficient to meet the Government of Kenya's constitutional commitments. The SDG 4 target of basic water for schools discriminates against children in providing a lower level of WASH services than required in the home. The Joint Monitoring Programme (JMP) recognise these limitations and recommends wider and stronger measures at the national level (UNICEF and WHO, 2020). Global measurement and monitoring of progress is incomplete and inadequate due to 'basic' WASH indicators disguising the chronic challenges that pervade services for children in schools. The JMP only serves as a global proxy for relative progress. National monitoring and regulation is paramount. Kenya has clear and binding constitutional targets for WASH services, though they are weakly executed for schools as illustrated by this study.

Monitoring of WASH services needs independent regulation and enforcement without political interference. Monitoring and regulation has to be independent of policy to avoid conflicts of interest and corruption. Monitoring at the county level can support national regulation of school WASH services as part of wider county responsibilities and requires legal and policy provision with resources to ensure progressive realisation of safely-managed services is achieved. The Kitui Water Bill recognises these requirements and, if passed into law, will provide a foundation to develop clear strategies for the scope and nature of monitoring and measurement. A county water supply database has been collaboratively developed through the County WASH Forum where all WASH stakeholders convene under the leadership of the county government, including Ministries of Health and Education. A common database is necessary for monitoring and regulation. County WASH partners will be required to collaborate in new and existing investments aligned to the goals of the County Water Act and Water Policy.

Results from Kitui County provide evidence of key measurement issues to guide regulation and enforcement. The water quality results demonstrate that local and regular monitoring is possible and could be scaled up with local service delivery mechanisms. The exceedance of water quality measures demonstrates all water supply infrastructure in schools (and communities) can be contaminated with a need for regular monitoring. Water safety management needs to consider multiple hazards and the multiple water sources and infrastructure types used in schools. Piped water is at risk from contamination and should not be assumed to be safe, reliable or sufficient.

While rainwater collection diversifies the water supply and can dilute the risk of geogenic contaminants, such as fluoride, they introduce other water safety risks that need to be managed. Providing rainwater tanks to schools is neither a sufficient nor safe response, on its own.

Management should focus on verifying that chemical contaminants are measured, and ensuring that faecal contamination is treated with disinfection such as chlorine or UV. In addition, water tanks should be designed to minimise evaporation to avoid concentrating chemical contaminants and reducing stored volume. Water supplied by vendors also needs to be monitored with consideration of regulating the informal vending market and coordinating bulk delivery from tankers.

Rainfall risks have illustrated the significant seasonal challenges and requirement for monitoring the sufficiency and functionality of water supply infrastructure. Spatial analysis identifies different risks at different times in different locations, which can help to inform the allocation of resources to provide reliable and safe services for all school children. Measurement of water volumes in piped networks or rainwater tanks can be complemented by water quality monitoring. Ensuring functionality of both school and community water supply infrastructure, particularly in drier months and to increase resilience to shocks, such as COVID-19, is more effectively delivered by local, professional service delivery models. The results of the FundiFix enterprise in Mwingi North have demonstrated that guaranteed maintenance services of less than three days for handpumps and less than five days for piped systems can be achieved. This means water keeps flowing during crises like COVID-19 or the extended dry months.

3.3 Performance-based service delivery models

Results from Kitui County demonstrate professional delivery and monitoring of water services in schools is feasible. The lack of accountable and professional models in rural Africa is a known challenge. While legal, policy and regulatory provision have been established for over a decade, mechanisms to deliver the services have not advanced. Head teachers bear the responsibility with 1,887 individual approaches across the schools of Kitui County. Supporting head teachers by sharing this responsibility has occurred already in over 50 schools in Mwingi North sub-county which share their water supply with communities contracting the FundiFix maintenance service. However, without a clear mandate for all schools to enrol in such a model, individual schools can choose not to participate with variable results and no sector-wide progress.

Exclusive service areas with clear legal provision will promote investments and achieve economies of scale in service delivery, monitoring and exploiting economies of scale with community and healthcare water supply infrastructure. Local operational costs for FundiFix in Mwingi North to guarantee reliable water services in schools is estimated at USD 1.3 per person, or roughly USD 520,000 (KES 50 million) per year for Kitui County. This excludes capital costs, indirect costs, and establishing water quality field laboratories for water safety management in the county.

Government, household, and donor funding for water services in schools, including the costs of vended water, suggest equivalent resources are being spent today. With a transition to a professional service delivery model, efficiency and equity gains could be achieved. The costs for improving sanitation and hygiene facilities are not known but these are likely to require a lower subsidy if coordinated at scale.

3.4 Rethink sector funding

Kenya's national education strategy predicted a USD 6.66 billion deficit for 2018 to 2022, without including the cost of delivering safely-managed WASH services in schools. The global pandemic demands new thinking on how sustainable funding can be secured and maintained. National budget allocations are insufficient and inefficiently allocated. The pandemic has increased political attention and public demand for change but it is uncertain if budgets will be sustainably increased or allocated more efficiently. Improving allocation efficiency requires legal changes and coordination between national and county governments. This is illustrated by the mandate of the Constituency Development Fund (CDF) to support national responsibilities, such as increasing education access, but not devolved services, such as safely-managed water. Allocating a county WASH fund for schools from the Ministry of Education budget to address current inefficiencies and inequalities would align responsibilities with resources. Donors could advocate for this approach given national budgets have a minor component for 'development'.

Results-based funding for performance in delivering rural water services has been successfully demonstrated in two counties in Kenya since 2016. County Water Services Maintenance Trust Funds have been legally registered and operational in Kitui and Kwale counties, incubating the FundiFix enterprises. Non-traditional funds have been secured from within Kenya and internationally.

Kitui County is at the vanguard of this new funding model with reforms to its County Water Bill promoting public finance management alignment. At the time of writing, this process is ongoing, political and not guaranteed. Over 80,000 rural people in schools and communities in Kenya contribute a share of the costs to the FundiFix performance-based model. With many rural schools sharing waterpoints with communities, there is a logic of accountability and efficiency in exclusive service-area contracts at the sub-county or county level.

3.5 Conclusion

This is a watershed moment in a time of crisis. Kitui County is uniquely placed to scale up the results and lessons of a more sustainable model for safely-managed water services. The foundational work and empirical results provide a basis to plan for and execute a performance-based service delivery model for all schools in the county. The costs will be modest given the benefits for the health, development and educational outcomes for the 400,000 pupils in schools. The approach would be adaptable to all counties in Kenya. Delivering safely-managed water to schools is feasible but will depend on exceptional political leadership and ministerial cooperation to agree and execute a shared vision.

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References

Betancourt, W.Q., & Rose, J.B. 2004. Drinking water treatment processes for removal of Cryptosporidium and Giardia. *Veterinary parasitology*, **126** (1–2): 219–234. doi: 10.1016/j.vetpar.2004.09.002

County Government of Kitui, 2018. County Integrated Development Plan 2018–2022. (pdf, 674 pages, 14 MB)

County Government of Kitui, 2019. County Gender Data Sheet July 2019. (pdf, 2 pages, 1.2 MB)

Garn, J.V., Greene. L.E., Dreibelbis, R., Saboori, S., Rheingans, R.D. & Freeman, M.C. 2013. A cluster-randomized trial assessing the impact of school water, sanitation and hygiene improvements on pupil enrolment and gender parity in enrolment. *Journal of Water Sanitation and Hygiene for Development*, **3** (4): 592–601. doi: 10.2166/washdev.2013.217

Jasper, C., Le, T-T. & Bartram, J. 2012. Water and sanitation in schools: a systematic review of the health and educational outcomes. *International Journal of Environmental Research and Public Health*, **9** (8): 2772–2787. doi: 10.3390/ijerph9082772

Kenya Institute for Public Policy Research and Analysis (KIPPRA), 2018. Education and Training Budget Brief No. 64/2018-2019. Nairobi: Kenya Institute for Public Policy Research and Analysis. (pdf, 16 pages, 2.7 MB)

Kamau, N.J. & Wambugu, B.N. 2017. Towards free day secondary schooling in Kenya: exposing the impediments. *Journal of Education and Practice*, **8** (14): 63–70. (pdf, 8 pages, 186 KB)

Kenya National Bureau of Statistics (KNBS), 2014. Kenya demographic and health survey 2014. Washington DC: World Bank.

KNBS, 2016. Kenya integrated household budget survey 2015/16. Nairobi: Kenya National Bureau of Statistics.

KNBS, 2019. Kenya population and housing census volume II: distribution of population by administrative units. Nairobi: Kenya National Bureau of Statistics.

Kotloff, K.L., Nataro, J.P., Blackwelder, W.C., Nasrin, D., Farag, T.H., Panchalingam, S. et al. 2013. Burden and aetiology of diarrhoeal disease in infants and young children in developing countries (the Global Enteric Multicenter Study, GEMS): a prospective, case-control study. *The Lancet*, **382** (9888): 209–222. doi: 10.1016/S0140-6736(13)60844-2

Liebmann, B., Bladé, I., Kiladis, G.N., Carvalho, L.M.V., Senay, G.B., Allured, D. et al. 2012. Seasonality of African precipitation from 1996 to 2009. *Journal of Climate*, **25**: 4304–4322. doi: 10.1175/JCLI-D-11-00157.1

Mackatiani, C., Imbovah, M., Imbova, M, & Gakungai, D.K. 2016. Development of education in Kenya: influence of the political factor beyond 2015 Mdgs. *Journal of Education and Practice Online*, **7** (11): 55–60.

Ministry of Education, 2015. Fees guidelines for public secondary schools in Kenya. Nairobi: Government of Republic of Kenya.

Ministry of Education, 2016. Basic education statistical booklet. Nairobi: Government of Republic of Kenya. (pdf, 70 pages, 2,6 MB)

Ministry of Education, 2018. National education sector strategy plan, 2018–2022. Nairobi: Government of Republic of Kenya. (pdf, 129 pages, 4.9 MB)

Mooijman, A. 2006. Girl-friendly toilets for schoolgirls : helping adolescent girls. IRC: The Hague, The Netherlands. (pdf, 5 pages, 157 KB)

Mwiria, K. 1990. Kenya's Harambee secondary school movement: the contradictions of public policy. *Comparative Education Review*, **34** (3): 350–368. The University of Chicago Press on behalf of the Comparative and International Education Society. www.jstor.org/stable/1187989

Ngware, M.W., Onsomu, E.N. & Muthaka, D.I. 2007. Financing secondary education in Kenya: cost reduction and financing options. *Education Policy Analysis Archives*, **15** (24): 1–21. epaa.asu.edu/ojs/article/viewFile/753/830

Nyaga, C. 2019. Sustainable WASH Systems Learning Partnership: a water infrastructure audit of Kitui County. Oxford: University of Oxford. (pdf, 65 pages, 2.5 MB)

Pearson, J. & McPhedran, K. 2008. Sanitation has gender, education, disability, economic and environmental implications to those it serves: A literature review of the non-health impacts of sanitation. *Waterlines*, **27** (1): 1756–3488. www.jstor.org/stable/24684955

UNICEF and WHO Joint Monitoring Programme, 2018. Drinking water, sanitation and hygiene in schools: global baseline report 2018. New York: United Nations Children's Fund (UNICEF) and World Health Organization. (pdf, 84 pages, 12.9 MB)

UNICEF and WHO Joint Monitoring Programme (JMP), 2020. Progress on drinking water, sanitation and hygiene in schools: Special focus on COVID-19. New York: United Nations Children's Fund and WHO.

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