Environmental Science Advances

ROYAL SOCIETY OF CHEMISTRY

PAPER

View Article Online
View Journal

Cite this: DOI: 10.1039/d5va00471c

The context-conundrum: why existing planning methodologies fail in the integration of water, sanitation and solid waste management services in small towns

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This study evaluated planning methodologies for integrating water supply, sanitation, hygiene (WASH) and solid waste management (SWM) services in small towns, using Uganda as a case study. A systematic review of documents identified 25 planning methodologies, revealing a fragmented toolbox. Most of the methodologies were designed for single sectors and lacked integration across WASH and SWM. The unbalanced distribution of these methodologies across the planning cycle, with an abundancy of diagnostic methodologies and a scarcity of implementation support, creates a gap. Key informant interviews (n = 64) with stakeholders in Uganda highlighted the context of methodology effectiveness, with technical capacity, financial constraints, governance structures, methodology design, and community engagement. Practitioners in Uganda have applied Town Sanitation Planning Guidelines developed by the Ugandan Ministry of Water and Environment (MWE) for urban integrated plans. The Community-Led Urban Environmental Sanitation (CLUES) approach developed by Eawag/UN-Habitat has been used for participatory planning in urban areas. Decision-support methodologies such as WASHCost and Life-Cycle Costing (LCC) for WASH by IRC have supported cost analysis. None of the methodologies has been successfully deployed across WASH and SWM sectors. To enhance the sustainability of water, sanitation, and SWM services in small towns, local actors must be empowered with practically contextualised methodologies, capacity, and data for informed decision-making. This study contributes to discussions on appropriate support methodologies for planning water and waste services in SSA, emphasizing the context and capacity strengthening.

Received 15th December 2025
Accepted 4th June 2026

DOI: 10.1039/d5va00471c

rsc.li/esadvances

Environmental significance

The provision of safe water, sanitation, and solid waste management is essential for environmental integrity in rapidly urbanizing Global South towns. Traditional sector-isolated planning causes water contamination, flooding, and resource waste. This study examines 25 planning methodologies and contextual barriers in Ugandan small towns, revealing that single-sector diagnostic tools perpetuate fragmentation. This mismatch hinders efficient resource use and climate-resilient urban systems. Achieving interlinked SDG 6 and 11 requires a fundamental shift to integrated, context-sensitive planning. By identifying barriers including methodological complexity and weak implementation support, this research provides an agenda for developers and policymakers. Advancing such planning is an environmental imperative to prevent pollution, promote resource recovery, and ensure sustainable growth of sub-Saharan Africa's small towns.

Introduction

Access to reliable water supply, sanitation, hygiene (WASH) and solid waste management (SWM) services is fundamental for improved public health, dignity, and socioeconomic development in urban areas, directly contributing to Sustainable Development Goals (SDG) 6 and 11.[1,2] However, these services are traditionally planned and managed in silos, leading to inefficiencies and systemic vulnerability. Sakaya[3] and Sankara,[4] document that failures in one system often compromise another, such as solid waste obstructing drains and causing wastewater overflows. Integrated provision is therefore crucial, as it can support resource efficiency in terms of staff time, funds as well as taking into account interlinkages. By planning these services together, municipalities can mitigate cross-system

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failures, and foster more resilient and sustainable communities.

Small towns in sub-Saharan Africa (SSA) are burgeoning across the continent and require adequate support for sustainable service planning.[5] These towns represent a crucial frontier, characterized by rapid urbanization and service delivery challenges that are more acute due to their intermediate size and limited capacity, facing urban complexities without resources.[6–8]

Urban environmental service delivery is shifting from siloed/isolated sectoral interventions to integrated approaches that recognize the interconnections among water, sanitation, and waste systems. This shift has led to the development of numerous planning methodologies over the past decade.[9–12] Urban areas face escalating challenges in managing environmental services, which are intensified by rapid urbanization and climate change.[13] These challenges are acute in the Global South, compounded by infrastructure deficits, financial constraints, and governance weaknesses.

Understanding the planning methodology is essential for addressing the intricate challenges of urban service delivery. A methodology is a systematic strategy that guides the planning process.[14] The hierarchy of planning methodologies comprises approaches, frameworks, guidelines, and tools. An approach delineates the philosophy, framework structures, and efforts. An approach serves as the guiding principle, informed by normative goals. In this context, the interconnections between WASH and SWM are viewed as an opportunity to enhance service delivery.[12] A framework operationalizes the approach by offering components and steps that translate into a structured model, addressing negative interlinkages.[15] Guidelines are a set of principles that translate the framework into actionable undertaking without being as specific as a methodology. It explains what to do and why, whereas a tool shows how to do it.[16] Methodologies are specific instruments employed within the frameworks. Under Citywide Inclusive Sanitation (CWIS), the Shit Flow Diagram (SFD) visualizes excreta flow through cities for decision-making.[17]

In SSA, these issues are exacerbated by underinvestment and fragmented institutional frameworks.[3] In response, the sector has evolved beyond isolated interventions to integrated planning approaches. Initiatives such as CWIS[18] and Strategic Sanitation Planning[19] have emerged to navigate institutional fragmentation and guide investment. These frameworks are operationalized through technical methodologies, including SFDs, City Service Delivery Assessments (CSDA), Sanitation Safety Planning (SSP), WASHCost, and SaniChoice, which provide structured avenues for data-driven diagnostics, planning, and community engagement.[12]

Constraints to the application of the planning and implementation methodologies

Despite the availability of various planning and implementation methodologies, a significant gap remains in their effective application within small towns. The issue is not the absence of methodologies but the misalignment between the available methodologies and the specific capacities, resources, needs and peculiarities of the small towns. Local governments and utilities are ensnared in a cycle of constraints, hindered by a lack of technical expertise, limited financial resources, and weak institutional capacity.[3,8] This capacity-implementation gap obstructs their ability to adopt available complex planning and implementation methodologies.[20] Therefore, planners are often compelled to adopt simplistic and fragmented approaches. These ad hoc methods are a critical failure point: they ignore systemic interlinkages and root causes, thereby negatively

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perpetuating public health and environmental crises and directly undermining sustainable development.

Inherent systemic fragmentation of the planning and implementation methodologies

Environmental sanitation planning is characterized by significant fragmentation. Current methodologies frequently function in isolation, concentrating on specific sectors such as waste collection or wastewater treatment, rather than offering integrated frameworks that are essential for the comprehensive delivery of water and waste management services. This forces planners to use multiple, disconnected methodologies, a challenge worsened by sectoral fragmentation.[12,21,22] Existing methodologies concentrate on either a single sector or, utmost, two sectors, rather than encompassing all the three. For instance, Community-Led Total Sanitation (CLTS) primarily focuses on sanitation issues. City Sanitation Planning (CSP) and CLUES briefly mention water service delivery and lack a concrete framework for promoting effective integrated planning.[12,19,23]

Most approaches, frameworks, and methodologies require training and expertise to implement, leading to a reliance on external consultants rather than building lasting local capacity.[24] There are more diagnostic methodologies supporting early planning steps than those for implementation and evaluation, indicating a gap where diagnosis is possible, but effective action remains elusive.[25,26]

The evaluation deficit in methodology contextualization

As the discourse on systemic fragmentation demonstrates, methodologies such as CLTS and CSP are implemented without a thorough analysis of the financial, governance, technical, political, and cultural factors that influence their effectiveness.[27] This issue is exacerbated by dependence on external consultants, which undermines the development of local capacity for their application. Consequently, both the literature and practice exhibit a lack of understanding regarding the adaptation of these sector-specific methodologies into an integrated planning framework that addresses the demands of WASH and SWM. This deficiency in evaluation has direct consequences; it results in the application of unsuitable methodologies, resource waste, and the perpetuation of inadequate urban services.

Scope and analysis of planning methodologies in small towns

This study is specifically positioned within the critical and often overlooked context of small towns, focusing on Uganda's Wobulenzi and Kakooge, while also drawing insights from Kenya, Zambia, Ghana, Rwanda, and other SSA countries.[3] Small towns in these regions face urban-scale service demands but lack the institutional, financial, and technical capacities of larger cities.

This study aims to identify and evaluate the appropriateness of existing planning and implementation methodologies for the integration of WASH and SWM, and to understand their contextual demands for small towns. Additionally, the study maps the versatility of existing methodologies and their contextual demands for their application.

This study ultimately aims to provide actionable insights that can direct future planning methodologies and approach development that is more suitable for the integration of these services in resource-constrained small towns.

Materials and methods

This study examined the inadequacies of existing planning methodologies in achieving integrated WASH and SWM services, with a focus on two small towns in central Uganda. The temporal scope focuses on the contemporary period, approximately from 2000 to the present, coinciding with the era of SDG implementation and the associated rise in planning methodologies.[28] A sequential mixed-methods approach was employed, combining a systematic document review with in-depth qualitative data collection. This design facilitated a comprehensive analysis that integrated a global inventory of methodologies with grounded insights from Uganda.

This study was conducted in Uganda, where the rapid urbanization of small towns poses significant challenges to service delivery. Two small towns, Wobulenzi and Kakooge Town Councils, situated 45 km and 85 km north of Kampala, respectively, were selected as the case studies. According to UBOS,[29] Wobulenzi had a population of approximately 36 000, while Kakooge had 24 100 inhabitants. These towns were chosen because of their contrasting population sizes, locations, and institutional structures for water supply service delivery, thus providing a natural experiment for analysing the impacts of these factors. Since 2013, Wobulenzi has been served with water by the National Water and Sewerage Corporation (NWSC), a centralized national utility with substantial resources that manages water and sewerage services in more than 260 towns in Uganda. In contrast, Kakooge's water supply is managed by a decentralized umbrella of water and sanitation authorities under the Ministry of Water and Environment (MWE). This setup facilitated an analysis of how centralized *versus* decentralized governance affects service delivery performance.[11]

Data collection and analysis

The data collection and analysis procedures were explicitly divided into document reviews and key informant interviews.

Review and evaluation of planning methodologies

A comprehensive document review was conducted to identify, categorize, and assess existing planning methodologies pertinent to WASH and SWM. Documents were sourced from repositories of prominent international organizations, including Sandec – Eawag, the Sustainable Sanitation Alliance (SuSanA), *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ), the World Bank, and civil society organizations (CSOs) such as Water For People, International Water and Sanitation Centre (IRC-WASH), and WaterAid.[30] National-level documents from Uganda's NWSC and MWE were also incorporated. This review focuses on methodologies developed or

Table 1 Distribution of key informants ($n = 64$) by sector and role

Sector/institutional affiliation	Number	Roles/duties
Ministry of Water and Environment (MWE), NWSC, Central Umbrella of Water and Sanitation (CUWS)	10	Managers, and Engineers, at MWE, NWSC, CUWS
Ministry of Health (MoH)	8	Public Health Officers; Environmental Health Specialists; District Health Inspectors
Ministry of Education and Sports (MoES)	4	Policy implementers on Water, Sanitation and Hygiene (WASH) in Schools
National Planning Authority (NPA)	5	Urban Development Planners; Sector Specialists in Infrastructure and Environment
Municipal and Town Councils	8	Town Clerks; Engineers; Physical Planners; Health Inspectors
Local Government (District Level)	7	Chief Administrative Officers; District Planners; District Water Officers, Public Health Officers
Private Operators	9	Managers of private water tanker services, sanitation emptying services, and waste collection/recycling enterprises
Civil Society Organizations	7	Program Managers, WASH Coordinators, and Policy Strategists
University Staff and Students	6	Researchers specializing in urban planning, and public health
Total	64	

updated from 2000 onwards. Methodologies were required to have been developed, tested, and validated within low- or middle-income country contexts, with a preference for those applied in SSA, thereby ensuring that the analysis was based on methodologies designed for the study context.

The initial screening identified 25 methodologies, which were systematically categorized into three functional groups: diagnostics for assessing current service states include SFDs and Waste Flow Diagrams (WFDs); planning guidelines, such as CLUES and CSP, which offer structured steps for developing service-implementation plans. Others included decision support methodologies, including but not limited to Sani-Choice and Life-Cycle Costing, which support in technology selection and financial planning. These methodologies are detailed in the results section in Table 2.

Each methodology was scrutinized for its sectoral emphasis on water supply, sanitation, and SWM, and/or integration, its stage in the planning cycle, and its intention for cross-sectoral integration. To assess integration, a dichotomous scoring matrix was used.[31] A methodology received an "X" for a sector if it showed a primary focus on that sector within its framework. An "X" was assigned if the sector was only mentioned or tangentially considered without integration into operational steps. This process yielded an inventory of 25 methodologies.[32,33]

Analysis of contextual demands and the enabling environment

To address contextual demands and the enabling environment, primary data were collected through Key Informant Interviews (KIIs). Sixty-four (64) key informants were purposively selected to represent stakeholders involved in the funding, planning, and implementation of WASH and SWM services in Uganda. The selection criteria ensured that the participants possessed direct professional experience with planning and implementation challenges in small towns in Uganda. Some informants had first-hand knowledge of the case study towns, Wobulenzi and Kakooge, through implementation work, oversight roles, or national-level supervision in similar contexts. This was crucial for capturing insights into the specific contextual barriers and facilitators.[34] The informants were drawn from eight key stakeholder groups (Table 1), ensuring representation from the national ministries, local governments, private operators, civil society, and academia.

Data collection

Semi-structured interview guides were employed to investigate participants' experiences, perceptions, and challenges concerning the applicability, effectiveness, and integration of the planning methodologies. The interviews explored themes such as technical capacity, financial constraints, governance, political will, methodology design, and community participation. Of the 64 interviews conducted, 85% were carried out online *via* video conferencing, and 15% were conducted face-to-face. All interviews were recorded with informed consent and were professionally transcribed for analysis.

Data analysis

Qualitative data from both the document review and KII transcripts were imported and managed using ATLAS.ti (v.23) software. The analysis was structured to answer the two study objectives.

Thematic analysis of KIIs

A multistage coding process was applied to the interview transcripts. Salience for each factor was calculated as the percentage of key informants who mentioned that factor (as a barrier or enabler) during their interview, relative to the total number of informants ($n = 64$). The initial deductive codes were based on pre-identified themes from the literature, such as technical capacity, financial constraints, institutional framework,

political will, and community engagement. Inductive coding allowed the emergence of new, unanticipated themes. Codes such as contextual facilitator and contextual barrier were used to categorize factors influencing methodology application.[35]

Integration analysis

To evaluate the levels of integration facilitated by the methodologies, the data were coded into categories of siloed approach, cross-sectoral linkage, and integrated planning. This coding was applied to both documented methodologies from the review and practical experiences from the KIIs, enabling a direct comparison between theoretical intent and practical application.[36] To synthesize and quantify the qualitative findings on contextual factors, a qualitative severity-impact score ranging from 1 = low to 5 = very high was assigned to each identified factor.[37] This score was derived by analyzing the reported salience in conjunction with the perceived impact on the success of methodology application, as explicitly described by the informants during the interviews. The code co-occurrence and network analysis features of ATLAS.ti were employed to investigate the relationships between themes, thereby visualizing the disconnect between methodologies characterized by a siloed approach and those oriented towards integrated planning.[36,38] The organization and synthesis of the coded data were supported by DeepSeek AI to ensure systematic grouping of the findings, which were subsequently validated.[39]

Ethical considerations

Ethical clearance for this study was obtained in July 2023 (VCDREC168). Prior to each interview, informed oral consent was obtained from all participants, ensuring they understood the study's objectives and their right to withdraw. Confidentiality was strictly maintained; all identifying information was anonymized during transcription, analysis, and reporting.[40]

Results

This study systematically assessed the range of available planning methodologies for integrating WASH and SWM in light of the specific constraints and requirements of small towns. The findings are organized into two main subsections aligned with the study's objectives: an inventory, categorization, and integration analysis of key planning methodologies, and an evaluation of the contextual factors affecting their effectiveness and relevance in small-town settings.

Inventory, categorization, and integration analysis of planning methodologies

The document review identified and categorized 25 distinct planning methodologies, including approaches, frameworks, guidelines, and tools, currently applied in WASH and SWM planning. These methodologies were classified into three functional categories based on their primary purpose within the planning cycle: diagnostics, planning guidelines, and decision-support methodologies. Diagnostic methodologies are employed to understand the current state of services, such as mapping the flows and assessing the service levels. Planning guidelines offer structured steps for developing service-implementation plans. Decision support methodologies assist in specific decisions, such as technology selection and financial planning.

Table 2 presents this inventory, detailing each methodology's category, primary developer, and sectoral focus of the analysis. A nuanced scoring system was employed to evaluate the applicability and strength of each methodology across the water, sanitation, and SWM sectors.

The inventory reveals several critical findings regarding the landscape of the available methodologies.

Pronounced sectoral siloing and uneven coverage

The analysis revealed the sectoral compartmentalization of existing methodologies. Most methodologies are tailored for a single sector (Table 2). The sanitation sector is the most extensively served, with 13 methodologies, followed by the water supply and solid waste sectors, with seven and four methodologies, respectively. Only a limited number of methodologies, such as the CSDA, IWSSP, and several financial methodologies such as WASHCost, effectively address two sectors, primarily water and sanitation.

Importantly, our scoring matrix evaluation indicated that no methodology comprehensively focused on all three sectors concurrently. Methodologies such as CLUES, TSP, and CSP, frequently cited as integrated, only marginally addressed water supply and solid waste, as indicated by (X) in Table 2, with their core methodologies and operational steps predominantly centred on sanitation. For example, while CLUES promotes a holistic perspective, its detailed guidelines and indicators remain sector-specific, positioning it as a framework that advocates for integration rather than an operationally integrated methodology.

Scarcity of implementation support and the planning cycle gap

The distribution of methodologies across the planning cycle was unbalanced. There is an abundance of diagnostic methodologies (11 methodologies) that provide a robust foundation for situational analysis. However, there is a paucity of methodologies designed to support the subsequent stages of implementation, operation and maintenance as well as monitoring and evaluation of these programs. This results in a critical implementation gap, wherein towns can diagnose issues but lack the practical, actionable support necessary to effectively execute and sustain solutions.

Analysis of integration potential and practical disconnect

The evaluation of the integration intent *versus* practical application reveals a stark disconnect. The codes for siloed-approach and contextual-barrier are strongly linked to the discussions of widely used, single-sector diagnostic methodologies such as SFDs and rapid waste assessments. In contrast, integrated planning is a peripheral code, connected mainly to high-level

Table 2 Categorization and sectoral focus of identified WASH/SWM planning methodologies[a]

Category	Name	Primary developer	Water supply	Sanitation	SWM
Diagnostic methodologies	Water Flow Diagram (WFD)	Eawag	X		
	Shit Flow Diagram (SFD)	World Bank		X	
	Faecal Sludge Management (FSM) Diagnostic Tool	IRC		X	
	Faecal Waste Flow Calculator	IWA/WSP		X	
	Rapid Assessment Tool (for Sanitation)	Various		X	
	City Service Delivery Assessment (CSDA)	World Bank	X	X	
	Urban Sanitation Status Index (USSI)	World Bank		X	
	City MSW Rapid Assessment Tool	US EPA			X
	Waste Flow Diagram (WaFD)	GIZ			X
	Waste Wise Cities Tool (WaCT)	UN-Habitat			X
	Risk Indicators, Design Action (RIDA) Analysis	WHO/USAID	(X)	X	
Planning Guidelines	Town Sanitation Planning Guidelines	MWE, Uganda	(X)	X	(X)
	Community-Led Urban Environmental Sanitation (CLUES)	Eawag/UN-Habitat	(X)	X	(X)
	City Sanitation Plan (CSP)	Eawag/GIZ	(X)	X	(X)
	Integrated Sustainable Waste Management (ISWM)	Waste, GIZ			X
	Sanitation Safety Planning (SSP)	WHO	(X)	X	
	IWSSP (Integrated WSP and SSP)	WHO	X	X	
	IWRM and WASH Toolkit	GWP/UNICEF	X	(X)	
Decision-Support methodologies	WASHCost	IRC	X	X	
	Life-Cycle Costing (LCC) for WASH	IRC	X	X	
	WASH Expenditure Tracking and Funding Gap Analysis	World Bank/UNICEF	X	X	
	CLARA Planning Tool	BOKU Vienna	X	X	
	Sanitation Decision Support	Akvo Foundation		X	
	SaniChoice	Eawag		X	
	Integrated Water Supply and Sanitation Model (IWSSM)	Various	X	X	

[a] Legend: X = primary and substantive focus; (X) = mentioned or tangentially considered but not meaningfully integrated.

frameworks such as CLUES and abstract concepts, with weak links to practical, on-the-ground applications.

This indicates that while the principle of integration is widely acknowledged, the ecosystem of available methodologies is dominated by single-sector diagnostic instruments that actively reinforce siloed planning. This is compounded by the fact that the few methodologies with a broader scope, such as CLUES, TSP, and CSP, were consistently reported in the KIIs as being too complex and resource-intensive for effective application in typical small-town contexts.

Methodology application in case study towns

Inventory and KII data further reveal that in Wobulenzi, which is serviced by the centralized NWSC, the utility predominantly utilized water sector-specific methodologies, consistent with its mandate. These methodologies include internal water supply modelling instruments and, for particular projects, diagnostic methodologies such as SFDs, often with the assistance of external consultants. The centralized structure facilitated access to more resources; however, it did not inherently encourage the adoption of cross-sectoral methodologies for their use. Conversely, Kakooge, operating under the decentralized MWE umbrella authority, had access to planning materials such as the Town Sanitation Planning (TSP) guidelines but often encountered challenges in their implementation due to limited capacity and institutional fragmentation. This comparison highlights that governance models affect the capacity to utilize methodologies; however, the siloed nature of the methodologies themselves remains a pervasive issue across both centralized and decentralized systems.

Contextual factors influencing methodologies application and effectiveness

Data obtained from 64 KIIs across eight stakeholder groups in Uganda revealed a complex interplay of five overarching factors influencing the adoption, application, and sustainability of technical methodologies. Table 3 presents a synthesized summary of these factors, detailing their nature, reported salience, and qualitative severity-impact scores.

Technical and institutional capacity

A near-universal barrier was the critical lack of in-house technical capacities. A town engineer stated, *"We received training on the SFD. However, the consultant left, and the file is now only on my computer. I am the only one who understands it, and with my workload, I cannot single-handedly update it or use it to plan"*. This reliance on external consultants was frequently reported,

Table 3 Contextual factors influencing planning methodology application in Ugandan small towns[a]

Factor	Specific factor	Nature of influence	Reported salience	Reported enabler	Severity-impact score[1–5]
Capacity	Lack of technical expertise	Barrier	92%	8%	5
	High staff turnover	Barrier	78%	22%	4
	Data scarcity	Barrier	85%	15%	4
Financial	High methodology implementation cost	Barrier	88%	12%	5
	Competition for scarce funds	Barrier	81%	19%	4
	Donor dependency	Mixed	75%	25%	3
Governance	Sustained political will	Enabler	70%	30%	5
	Centralized *vs.* decentralized governance	Mixed	65%	35%	3
	Institutional fragmentation	Barrier	83%	17%	5
Methodology design	Complexity and data intensity	Barrier	90%	10%	5
	Web-only access	Barrier	72%	28%	4
	Lack of simplified versions	Barrier	68%	32%	3
Community	Limited participation	Barrier	77%	23%	4
	Cultural acceptability	Mixed	63%	37%	3

[a] % Salience = (number of informants mentioning the factor/64) × 100.

leading to a cycle of dependency in which methodologies were abandoned post-project. High staff turnover, with a reported salience of 78%, further eroded institutional memory, meaning that even if capacity was built, it was often lost.

Financial constraints

The high costs associated with methodology application are a significant impediment. These costs extend beyond software to data collection, analysis, and requisite consultant fees. A district water officer explained, *"The theory of these methodologies is good, but the reality is our budgets. We are forced to use simpler, less optimal methods because they are within our means"*. This financial constraint forces local governments into reactive crisis management rather than strategic, data-driven planning. Donor dependency at 75% reported salience was a double-edged sword; it enabled initial access to methodologies but often prioritized donor-aligned over contextually optimal methodologies, hindering sustainable ownership.

Governance and political will

The governance structure significantly impacts the application of methodologies. The centralized NWSC model in Wobulenzi facilitated enhanced access to technical resources, whereas Kakooge's decentralized framework encountered challenges due to isolated decision-making and frequent turnover of staff. A notable finding was that sustained political and administrative leadership emerged as a more crucial factor for success than the methodology's technical sophistication. Methodologies that could deliver rapid, visible outcomes, in view of political leaders were more likely to secure ongoing support and resources.

Methodology design and accessibility

Informants consistently critiqued methodology design, describing it as overly complex, data-intensive, and ill-suited to data-scarce environments. The need for simplified, lightweight, and offline-capable versions was a recurring theme. A public health officer expressed a common sentiment: *"Many of these methodologies feel like they were designed in Geneva for Geneva. We need methodologies that work with the data we have, not the data we wish we had"*. Web-based methodologies were particularly problematic because of unreliable internet, limiting their practical use for daily planning.

In response to these constraints, local practitioners have developed informal workarounds that deviate from formal methodologies. Examples identified from KIIs include: (i) paper-based checklists for waste collection routes instead of GPS-enabled Waste Flow Diagrams; (ii) informal stakeholder meetings without structured CLUES workshop protocols; (iii) using health centre registers as proxy sanitation data instead of full Shit Flow Diagram analysis; and (iv) spreadsheet-based cost estimates instead of full Life-Cycle Costing tools. These adapted methods are locally contextualized and resource-efficient but remain undocumented and, crucially, lack systematic cross-sectoral linkage mechanisms.

Community engagement

Despite being emphasized in the guidelines, community engagement is often superficial. A District planner observed, *"The consultants conduct a one-day meeting with local leaders, labelling it community participation, while actual users remain excluded"*. This lack of genuine co-design directly undermines sustainability. A public health officer recounted a failed project where facilities went unused because the community felt excluded, confirming that technically sound but socially disconnected solutions are seldom sustained.

The severity-impact scores presented in Table 3 underscore that the most significant barriers, namely, the lack of technical expertise (92%), high costs (88%), institutional fragmentation (83%), and methodology complexity (90) reported saliences, are not only highly prevalent but are also perceived to exert the most detrimental impact on the success of planning initiatives.

Discussion

This study examined the disparity between the theoretical goals of integrated WASH and SWM services and the actual

occurrence of sectoral siloing in small towns. Our findings, derived from a systematic inventory of 25 planning methodologies and their application analysis in Uganda, reveal a context-specific conundrum: the failure of integration arises from a fragmented set of methodologies within a complex, capacity-limited environment. The discussion interprets these findings by (1) critiquing the siloed nature of the planning toolbox, (2) elucidating the predominance of contextual factors over methodology design, and (3) deconstructing the illusion of integrated planning in practice. Finally, we outline the study's limitations, key conclusions, and propose an agenda for researchers, methodology developers, policymakers, and practitioners.

A fragmented toolbox for inherently interconnected systems

Our inventory reveals a concerted global initiative to address urban WASH and SWM challenges, with numerous available methodologies.[41,42] Nevertheless, this abundance conceals a significant drawback. The toolkits are fragmented along the sectoral lines, as illustrated in Table 2. The predominance of single-sector methodologies in WASH and SWM reflects the historical development of these sectors, characterized by distinct funding, institutional mandates, and professional communities.[18] This siloed structure compels planners to address interconnected issues in isolation, thereby perpetuating fragmentation that undermines the service delivery.

The compartmentalization of sectors is misaligned with the integrated nature of small towns, where water, sanitation, and waste systems are inherently interconnected.[7,43] Our KIIs revealed that waste disposal sites approved without consultation with water authorities could result in groundwater contamination. As one respondent expressed, "*We only find out about a new dump site when the community's shallow wells turn brown. By then, the damage is done, and we lack the budget for cleanup. If only the physical planners would sit with us before signing off on these sites*". Furthermore, inadequate water supply undermines sanitation systems, and insufficient drainage obstructs waterways, leading to flooding and sanitation overflow. Our analysis indicates that only CLUES, TSP, CSP, and ISWM attempt to address these synergies, albeit tangentially, as reflected by the "(X)" scoring in Table 2. These frameworks serve as high-level advocates for integration rather than as operational offering cross-sectoral methodologies. Consequently, planners are left without guiding methodologies for integration, resulting in interventions that address symptoms within silos while neglecting cross-sectoral root causes.[44]

Notably, most tools were designed for single sectors (sanitation or water supply) rather than the combined WASH + SWM domain; thus, their lack of integration stems partly from their original scope, not merely from design flaws. This observation does not excuse sectoral fragmentation but rather reframes it: the toolbox was never architecture for cross-sectoral planning, yet it is routinely applied as if it were. Consequently, expecting integrated outcomes from fundamentally siloed instruments represents a category error embedded within the planning culture itself.

Furthermore, the distribution of methodologies across the planning cycle is critically inequitable in the study area. The abundance of diagnostic methodologies (11 out of 25) establishes a foundation for problem identification, which is an essential first step.[45]

However, the scarcity of methodologies supporting financing, implementation, and monitoring creates a significant implementation gap. We acknowledge that a single high-quality tool per planning stage could suffice; however, the near absence of implementation and M&E tools (only 2 out of 25) creates a structural bottleneck, irrespective of absolute numbers. This implementation bottleneck is not merely numerical, it is functional. This gap means that towns can diagnose their challenges but face difficulties in executing solutions.[46] This finding underscores a development paradox: meticulously crafted plans, often produced with external support, remain shelved due to a lack of actionable implementation methodologies and financial resources.[47] The methodology development community has disproportionately focused on mapping problems rather than on devising practical solutions.

Bridging the design-reality gap

A significant contribution of this study lies in empirically demonstrating that the effectiveness of a methodology is not derived from its technical design but is contingent upon the contextual environment in which it is introduced. Our data, collected from 64 KIIs within the Ugandan ecosystem, revealed a discrepancy between theoretical potential and practical application, influenced by five overarching factors (Table 3).

Technical and institutional capacity emerged as the most significant barrier, with a salience of 92% and a severity impact score of 5. The high staff turnover with a salience of 78%, and overwhelming workloads render sophisticated methodologies ineffective in the field. This reliance on fly-in and fly-out expert trainers/consultants fosters a dependency on external consultants, which collapses when project funding ceases. Our findings indicate that a methodology's effectiveness is inversely related to its requirement for specialized skills, underscoring that utility for generalist local government staff is more critical than technical sophistication.[48] Financial constraints are deeply intertwined with these problems. As clarified by our KIIs, costs extend beyond software to data collection, analysis, and consultant fees, which are necessary to bridge the capacity gap. This forces local governments into crisis management using simpler methods within limited budgets rather than strategic, data-driven planning. This aligns with the concept of affordable sanitation,[49] which encompasses the entire planning process.

Donor dependency at a salience of 75%, facilitates initial access but often skews methodology selection towards donor priorities, jeopardizing long-term sustainability (Heidler *et al.*, 2023; Sakaya, *et al.*, 2025a).[50] A case study comparison of the governance structures in Wobulenzi (centralized under the NWSC) and Kakooge (decentralized under the MWE) provides insight. The centralized model provided in Wobulenzi with better resources did not foster integrated methodologies but

instead reinforced sector-specific ones. Kakooge's decentralized authority, consistent with evidence that decentralization outpaces local capacity,[51] struggled with isolated decision-making and institutional memory loss occasioned by high staff turnover through resignations and frequent staff transfers. Across both models, sustained political and administrative leadership with 70% salience proved more crucial for methodology adoption than technical staff.

Methodologies demonstrating quick, visible results have gained traction, highlighting the need to align implementation with political incentives. A consistent critique is centred on methodology design. Methodologies were described as overly complex, data-intensive, and web-dependent, creating a design-reality mismatch. Given the unreliable internet and data scarcity in small towns, there is an urgent demand for simplified, offline-capable versions. This challenges developers to adopt human-centred design principles that prioritize functionality with imperfect data.[52] The value of a methodology is determined by its ability to provide insights with existing data, not ideal data.[53,54]

Finally, while emphasized in the guidelines, community engagement was often reported as superficial, with a salience of 77%. Methodologies with structured participation mechanisms are resource-intensive, leading to neglect. This lack of genuine co-design and local buy-in was frequently cited as a reason for project failure, confirming that technical solutions without social embedding are unlikely to be sustainable (Alba *et al.*, 2016; Narayan *et al.*, 2024).

From theoretical framing to practical disconnect

The third major finding is the stark contrast between the widely endorsed principle of integrated planning and its actual practice. Our analysis revealed that this disconnect is reinforced by the methodologies and contextual factors. The current toolbox, dominated by single-sector diagnostics, perpetuates isolated planning, aligning with segregated funding and institutional mandates. CLUES, TSP, and CSP, intended as integrated frameworks, have been reported as challenging to implement, often remaining conceptual with fragmented methodologies. The qualitative coding analysis illustrates this: the siloed-approach code was strongly linked to discussions of widely used methodologies, whereas integrated planning was peripheral, connected mainly to abstract concepts with weak implementation links. This disconnect, stems from a triple bind: *donors fundsector-specific projects, creating disincentives for integrated approaches; municipal councils operate with distinct departments and budgets, with no incentives for collaboration; and the absence of practical integrated methodologies makes cross-sectoral planning theoretical rather than operational*. Consequently, service delivery remains ineffective because addressing one issue often exacerbates another. Our findings suggest that while integration is lauded in conference discourse, the architecture of service delivery needs more understanding; otherwise, it is engineered for separation.

Limitations of the study

This study has limitations regarding context selection, stakeholder selection, and data sources. The two study sites in Uganda represent typical small towns in SSA in terms of demography, service provision, and municipal financing, although governance structures may vary across nations. The study's focus on planners, officials, CSOs, and institutional stakeholders may have overlooked the outcomes for household users of WASH and SWM services. The research relied on expert interviews to understand contextual and methodology needs without longitudinal tracking of methodology applications. While providing critical insights, the inventory may not include methodologies developed by local actors, which are not available in the published literature. The qualitative data from the KIIs ($n = 64$), while rich, were specific to Uganda, although the findings may transfer to similar SSA small towns, with varying factor salience across different governance systems. The study identified an implementation gap but did not track long-term methodology application outcomes.

Conclusion

Methodology effectiveness is a function of congruence with local capacity, financial resources, and governance structures, not merely technical sophistication. Methodologies operate within complex socio-technical systems, where the failure of any component, whether individual capacity, institutional memory, or political will, can compromise the entire intervention.

For methodology developers, this study calls for a shift from the technically perfect to the contextually practical. Priority should be given to: (1) developing simplified versions of complex methodologies that function with the available data and offline capabilities; (2) embedding capacity development and technical support into methodology dissemination strategies beyond one-off workshops; and (3) integrating designs that ensure that data outputs from one methodology can serve as inputs for another, enabling cross-sectoral exchanges.

National policymakers have the opportunity to curate context-appropriate methodologies. This could involve adopting well-developed methodologies to create nationally endorsed, simplified toolkits that are aligned with existing data structures and funding schemes. By introducing incentives, such as collaborative grants, national governments can encourage town councils to develop joint cross-sectoral proposals that break down administrative silos and unlock greater impact.

Future work should focus on action research to co-design simplified and integrated planning methodologies with appropriate teams such as planners, utility managers, solid waste and sanitation crew, in small towns. Achieving integrated water and waste services in small towns across SSA requires more than just technical methodologies. This, demands addressing the political, economic, and institutional barriers that hinder effective implementation. Future research should prioritize comparative studies to examine how distinct political economies shape methodology adoption. There is also a critical need to develop sustainable financing and capacity-building models for technical support, transitioning from short-term funding to enduring institutionalized systems. It demands context-driven,

pragmatic, and system-sensitive planning support that is interconnected with the services it aims to deliver.

Author contributions

Eng. R. Sakaya: transcription of raw data, analysis and interpretation, data collection, interviews, manuscript drafting, composition, and manuscript revision. Abishek S. Narayan: manuscript review & editing. J. Fritzsche: manuscript review & editing. Charles B. Niwagaba: manuscript review & editing. Alex Y. Katukiza: manuscript review & editing. Christoph Luthi: manuscript review & editing.

Conflicts of interest

The authors of this study hereby affirm that they have no conflicts of interest to disclose.

Data availability

The data supporting this article has been included within the article and citations. It includes the complete inventory of the 25 planning methodologies analysed in this study (Table 2), detailing their categorisation, primary developers, and sectoral focus scoring matrix. Furthermore, the semi-structured interview guides used for the Key Informant Interviews (KIIs) are separately provided to ensure transparency and reproducibility of the qualitative data collection process.

The full transcripts from the 64 key informant interviews are not publicly available due to confidentiality agreements and ethical restrictions concerning participant privacy. The informed consent process, approved by the institutional review board (VCDREC168), assured participants that their raw interview data would remain confidential and would not be shared publicly.

Researchers seeking further details on the qualitative coding framework or aggregated, anonymised data supporting the contextual factor analysis (Table 3) may contact the corresponding author, Ronald Sakaya (sakayaronald@gmail.com), subject to a formal data sharing agreement and compliance with the ethical provisions of the original study. All documents reviewed as part of the systematic methodology inventory are publicly available from the repositories of the cited organisations.

Supplementary information (SI) is available. See DOI: https://doi.org/10.1039/d5va00471c.

Acknowledgements

This study was part of the Water, Behavioral Change, and Environmental Sanitation (WABES) initiative funded by the Swiss Agency for Development and Cooperation (SDC), number: 81074222. Collaboration between Makerere University, College of Engineering, Design, Art, and Technology, and the Department of Sanitation, Water, and Solid Waste for Development (Sandec) at the Swiss Federal Institute of Aquatic Science and Technology (Eawag) made this research possible. The authors also thank Abubakr Batte and Joshua Obara for supporting data collection for this study.

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