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Discussion Paper

Citywide Inclusive Sanitation: Reviewing the State of the Art

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Photo: Abdullah Al-Muyeed, Bangladesh

Executive summary

Urban sanitation is a basic service essential for public and environmental health. Incorporating various advances over the past two decades, the urban sanitation agenda has evolved towards the paradigm shift of Citywide Inclusive Sanitation (CWIS). Overall, CWIS aims at providing equitable and sustainable sanitation services and is closely linked to Sustainable Development Goal (SDGs) 6 on clean water and sanitation and directly and indirectly benefits several other SDGs. Since its inception in 2016, CWIS has evolved through various research and implementation experiences, resulting in four conceptual frameworks that redefine sanitation as a service delivery process, emphasizing the entire sanitation value chain and the coexistence of sewered and non-sewered technologies.

This discussion paper draws on 77 journal articles and grey literature explicitly linked to CWIS, reviews the state of the art on the topic by comparing the four prominent CWIS frameworks and by identifying key advances, current gaps, and emerging issues to inform ways forward towards a more unified CWIS framework.

The literature review covered eight aspects of CWIS: Institutions & Regulations; Service Models & Financial Arrangements; Planning: Incremental, Integrated & Participative; Equity, Social Inclusion & Gender; Mix of Technologies; Public & Environmental Health; Capacity Development & Decision Support Tools; and Implementation Experiences. Institutions and regulations, and planning had the most publications, while technologies and public and environmental health had the fewest. This reflects a focus on the enabling environment aspects of urban sanitation within CWIS. The review suggested that the effective implementation of CWIS relies on an enabling environment with political will, supporting policies, comprehensive regulation with clearly defined institutional roles and responsibilities, adequate funding and stakeholder engagement. In addition, it emerged clearly that strengthening public sector mandate, roles and investments, including establishing transparent accountability mechanisms for effectively monitoring and enforcing CWIS was crucial. Finally, it was noted from several sources that increasing targeted capacity development and bottom-up approaches is important to increase ownership and legitimacy so as to foster accountability, and, ultimately, ensure citizens' rights to safe water and sanitation.

However, despite the comprehensive coverage of CWIS topics in the reviewed literature, there is limited evidence of the benefits and practical guidance for key decision-makers adopting the CWIS approach. Emerging issues that are not systematically incorporated include globally consistent terminology and standards, recognition of the climate change–sanitation link and integration with other related urban services.

Overall, this review underscores the latest developments in CWIS, showcasing its significant uptake over the past decade and its potential for both large-scale development projects and grassroots initiatives. Addressing the identified gaps in CWIS literature will be crucial for its continued evolution. Furthermore, engaging in a broad consultation and endorsement process to develop a more unified CWIS framework, accompanied by actionable guidelines, will be essential for effective on-the-ground implementation.

Abbreviations

ADB	Asian Development Bank
BMGF	Bill and Melinda Gates Foundation
CAPEX	Capital Expenditures
CBO	Community-Based Organisation
CBS	Container-Based Sanitation
CWIS	Citywide Inclusive Sanitation
DFI	Development Finance Institution
Eawag	Swiss Federal Institute of Aquatic Science and Technology
ESAWAS	Eastern and Southern Africa Water and Sanitation
FS	Faecal Sludge
FSM	Faecal Sludge Management
IFI	International Finance Institution
O&M	Operation and Maintenance
OPEX	Operational Expenditures
OSS	Onsite Sanitation System
PPP	Public–Private-Partnership
SDG	Sustainable Development Goals
WASH	Water, Sanitation and Hygiene
WSUP	Water and Sanitation for the Urban Poor

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Special thanks

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The document presents a comprehensive overview of where the development community stands today on the issue of CWIS. Its conceptual design and the language used in the document is reflecting a synthesised vision of how development experts support the implementation of CWIS. The authors are, however, aware that the CWIS approach may further need to be adapted to the concepts and language used by local authorities and utilities, and this will be a step that the development community will need to make in the future.

1.

Introduction

In the dynamic landscape of contemporary urban environments, the imperative for inclusive and sustainable sanitation practices has become more pronounced than ever. As cities burgeon with increasing populations, the need for a comprehensive, citywide and equitable approach to public services has emerged as a critical aspect of urban planning and development.

Urban sanitation is critical to both public and environmental health (Beard et al., 2022; Mills et al., 2018). There have been numerous advances in the urban sanitation agenda since the turn of the millennium. This includes the Human Right to Sanitation, which was adopted by the UN General Assembly in 2010 as well as the changes from the Millennium Development Goals, which aimed at providing access to toilets, to the Sustainable Development Goals (SDGs), that shifted the focus on service provision across the whole value chain. Additional advances in sanitation planning include community inclusion (Lüthi et al., 2009) and pro-poor approaches (Hawkins et al., 2013); consideration of the political sanitation economy (Abeysuriya et al., 2019); clarity on costs and financing mechanisms (Daudey, 2018; Hutchings et al., 2018); knowledge of non-sewered solutions (Strande, 2024); adoption of circular economy principles and resource recovery models (Mallory et al., 2020); and decision-support tools for urban sanitation planning (Spuhler & Lüthi, 2020). The Citywide Inclusive Sanitation (CWIS) approach builds on these advances and aims at redefining how we conceptualize, implement and sustain sanitation solutions across diverse urban settings. Rooted in decades of urban sanitation experience and lessons learnt, the CWIS principles provide a broad, experience-based vision for sustainable and inclusive urban sanitation, recognizing the need for context-specific solutions. By embracing an inclusive and integrated approach that acknowledges the multifaceted challenges that cities face, the framework seeks to bridge the existing gaps in sanitation planning. The term ‘inclusive’ encompasses all urban areas, including informal and peri-urban settlements, involves the entire service chain, promotes a diverse range of service models and technical solutions, whether they are onsite or sewered, centralised or decentralised, and envisions a city where every individual has access to safe, affordable, and dignified sanitation services, irrespective of socio-economic status, gender or physical abilities (Narayan & Lüthi, 2019).

CWIS is intricately linked to Sustainable Development Goal 6 on clean water and sanitation, and it contributes to other goals like health and wellbeing (SDG3), gender equality (SDG5), reduced inequalities (SDG10) and sustainable cities (SDG11) (Narayan, 2022). In response to the SDGs, key players across various sectors have embraced the CWIS approach. The CWIS concept is under constant evolution with research and practice taking place simultaneously. Perhaps the most influential insight reflected in the CWIS literature landscape is that insufficient focus has been placed on the supportive framework of policies, governance, institutions, regulations and funding necessary for ensuring the sustainable provision of services (Gambrill et al., 2020). It is widely acknowledged that achieving targeted outcomes relies heavily on an 'enabling environment'. There is increasing agreement on the components of an enabling environment for sanitation, which typically include policy and strategy, institutional arrangements, sector planning and monitoring, budgeting and finance, and capacity development (Scott & Cotton, 2020).

By weaving together the threads of social, environmental, intra- and intergenerational justice as well as economic viability, CWIS aims to transform urban sanitation into a driver of sustainable development and to contribute to the broader global agenda of creating cities that are resilient, inclusive and environmentally responsible. Ultimately, CWIS will serve as a blueprint to guide municipalities and urban planners toward the adoption of inclusive policies that not only address basic sanitation needs but also foster dignity, equity and environmental sustainability.

1.1. Objectives of the Paper

CWIS is a relatively new approach that has gained significant acceptance in the urban sanitation domain in less than a decade. So far, it has focused on providing urban areas with access to equitable and sustainable sanitation services, through sewered and non-sewered technologies at the centralised and decentralised scale, ensuring safe management of faecal waste along the entire sanitation service chain. Since its inception in 2016, several frameworks and interpretations of these concepts have emerged.
While the underlying principles among these frameworks are similar, there is still some noticeable divergence between them. Furthermore, there has been significant development in each of the CWIS principles including tool developments, operational experience and contextual analysis. To take stock of these developments, understand the divergences and support the creation of an actionable guidance for applying the CWIS approach, a review of the state-of-the-art of the CWIS framework is valuable. Therefore, this discussion paper will explore the evolution of CWIS, depict key principles and components of the emerging CWIS framework(s), review the relevant scientific and grey literature published since the advent of CWIS and identify gaps for future research. The following were the guiding questions for this review:

- What are current interpretations of CWIS as principles, approaches and frameworks?
- What are key components similar and different among these CWIS approaches?
- What are current actionable/operational guidelines for CWIS principles?
- What are practical experiences in operationalising CWIS principles and frameworks?
- What are main bottlenecks, drivers and barriers to the successful implementation of CWIS?

1.2. Scope and Methodology

Delineating the scope for the CWIS literature review was a challenge since the concept has been widely influenced by several developments in urban sanitation as a whole domain. However, since the objective of this discussion paper is to review the various interpretations and the uptake of the CWIS approach, and not on the overall developments in urban sanitation that may be connected to individual CWIS principles, this review is restricted to only those contributions that are explicitly linked to CWIS.

Data Collection

Considering the focus of our review, in our search we included academic and grey literature which explicitly mentioned CWIS terminology either in the article title, the abstract or in keywords. It is important to acknowledge here that highly relevant papers may have been omitted in this review because of the restriction in scope for the benefit of being consistent and systematic.

For academic publications Scopus and Google Scholar were used, and for grey literature, Google search and in some instances, word of mouth (including through social media). Since CWIS was introduced only in 2016, only publications in the period from 2016 to 2024 were considered. As search terms for Scopus and Google Scholar the Boolean operators (citywide AND inclusive AND sanitation) OR (citywide AND inclusive AND sanitation) were employed. The Google search was conducted using the same search terms.

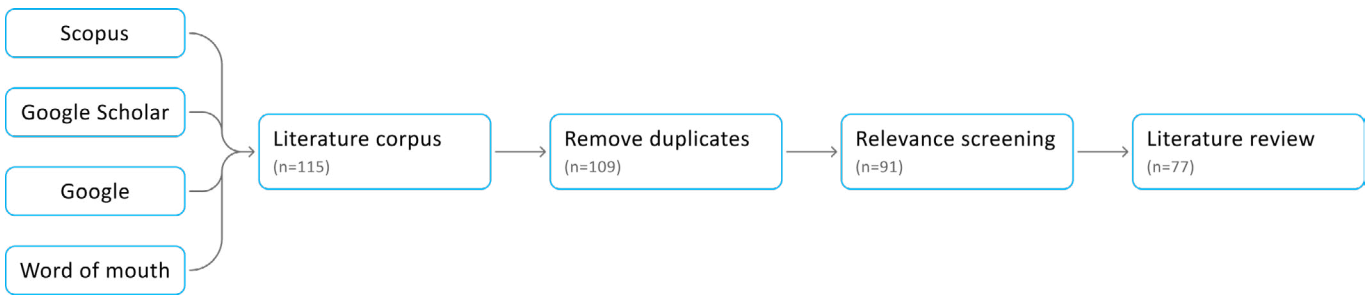

Figure 1: Overview on search strategy for finding relevant CWIS literature.

The corpus of literature was complemented by internal topic experts including from the Inclusive Urban Sanitation Task Force ('word of mouth'). A total of 115 documents were collected and after removal of duplicates and screening on relevance, 91 publications remained, of which 77 publications were used for the final report.

Methodological Approach

Literature was collated in an Excel file and categorised according to the thematic content. The categories were selected through applying directed and inductive content analysis according to Mayring (2015). Directed content analysis requires a predefined set of codes, that is a label that captures a certain theme with a descriptive code. This allows for validation and comparison with previous topic-related research findings. In inductive content analysis, first, narrow codes representing, for example, the content of statements or articles content are assigned and through refinement, themes are inductively captured. This allows direct information to be gained from the data. Labelling literature with codes that thematically capture their contents (or message) allows sorting and structuring items into meaningful

Table 1: Overview of the codes and sub-codes (in alphabetical order).

Sl. Nr	Code	Sub-codes
1	Capacity Development	Trainings, Outreach/Advocacy/Awareness Raising, Behaviour Change, Sanitation Marketing, Innovation, R&D
2	Equity & Inclusion	Stakeholder Engagement, Gender, Limited Mobility, Elderly / Children, Pro-Poor, Shared Toilets (Public, Shared), Institutions (Health Care, Schools), Unserved/Underserved Areas, Informal Settlements, Land Tenure Insecurity
3	Financial Arrangements	Public Financing, Private Sector/Business Models, Public–Private Partnerships, Tax, Subsidies, Tariff
4	Institutional & Government Arrangements	Policy/Legislation, Regulation, Institutions, Governance, Enabling Environment, Performance Targets/Indicators, Monitoring & Accountability, Enforcement/Sanctions, Clear Roles & Responsibilities
5	Planning	Evidence-Based/Strategic Planning, Bottom-up, Top-down, Incremental, Planning, Participative Planning, Integrated Planning, Technology Selection, Decision-Making, Tools
6	Safety	Environmental Health, Public Health, Climate Change/Resilience
7	Sanitation Service Chain	Containment, Emptying / Transport, Treatment & Disposal, Reuse, Design Criteria, Operation and Maintenance
8	Service Approach	Sewered, Non-sewered, Onsite, Decentralised, Faecal Sludge Management, Container-Based Sanitation

and comparable data clusters, for example, using a tree diagram. Codes can be organised in code-groups, which contain thematically related sub-codes (which in turn can consist of further sub-codes).

Coding

For the directed content analysis, we used the four existing CWIS Frameworks as a starting point (ADB, 2021c; Gambrill et al., 2020; Narayan, 2022; Schrecongost et al., 2020). If no existing code from the list could be assigned to an identified publication, the entry in the Excel file was complemented with a new code as an inductive approach. Throughout the exercise, emerging codes were refined, merged or deleted and already reviewed literature updated according to the new coding scheme. A total of eight code groups consisting of 54 sub-codes were finally identified and literature categorised accordingly. In addition, the literature was characterised according to the year published, authors, broad topics covered and the country/region that the content refers to according to expert review.

Subsequently, code groups were divided into sub-codes to provide more granular insights. Table 1 provides an overview of all the codes and sub-codes used in the review to classify the literature reviewed.

Analysis

After coding all identified literature, we merged existing code-groups into six broad categories, which ultimately served as themes for the detailed content review (Institutions & Regulations; Service Models & Financial Arrangements; Planning; Mix of Technologies; Public & Environmental Health; Capacity Development & Decision Support Tools). In addition, there is an introductory as well as a concluding section (Conceptual Development, CWIS Implementation Experiences). Each section was reviewed based on the respective publications on their relevant contents and contributions. The final literature review draft was peer-reviewed by internal and external experts and finally the feedback was integrated.

2.

CWIS History & Frameworks

This chapter briefly recapitulates the history of CWIS, introduces the four most relevant frameworks and summarises general observations including the main principles identified across the four CWIS frameworks.

2.1. Evolution of CWIS

The evolution of discourse on Urban Sanitation from the 1960s to the present and approaches and tools developed during this period are published in detail in Schertenleib et al. (2021).[1] The evolution of CWIS has been comprehensively summarised in Schrecongost et al. (2020) and Narayan (2022).

In a nutshell, originating from a 2016 sanitation conference in Atlanta (USA), CWIS gained momentum with a Call for Action in 2017 at the Stockholm World Water Week (see Figure 2; BMGF et al., 2017), and financial commitments at the Beijing Toilet Expo in 2018 (WorldBank, 2018). Building on several years of urban sanitation implementation experience and the Call for Action, more specific CWIS principles were first formulated in the Manila Conclave on CWIS convened by the Bill and Melinda Gates Foundation (BMGF) in 2019. Many versions of these were then built on by different leading organisations involved in CWIS research and implementation. These are presented in the following section.

Since 2017, public authorities, policymakers and development banks are increasingly embracing CWIS's core principles. Multilateral development banks like the World Bank, the Asian Development Bank (ADB) and the African Development Bank have committed substantially to integrating CWIS into their investment portfolios which have amounted to over 6 billion USD (Narayan, 2022). UN agencies including UNICEF and UN Habitat have adopted CWIS as a key initiative in their new game plans for safely managed sanitation (UNICEF, 2022), and urban sanitation strategies (UN-HABITAT, 2021). While these principles are still valid today and embraced by and incorporated into different CWIS Frameworks, these frameworks and principles continually evolve with growing experience. According to this review, today four key documents provide conceptual advances in drafting a CWIS 'framework' (ADB, 2021c; Gambrill et al., 2020; Narayan, 2022; Schrecongost et al., 2020).

[1] To facilitate reading, we follow Schertenleib et al. (2021) and their definition of three key terms used in this publication (1) A Principle is defined as a fundamental proposition accepted by the international community. Thus, it is of overarching nature and provides basic guidance (e.g. environmental security, universal access, inclusive participation); (2) An Approach is defined as a framework or methodology that aims at putting principles into action; (3) A Tool is defined as an instrument that supports the operationalisation of an approach. A tool can be applied in the context of one or more approaches (e.g. Life-Cycle Costing for WASH, Shit Flow Diagram).

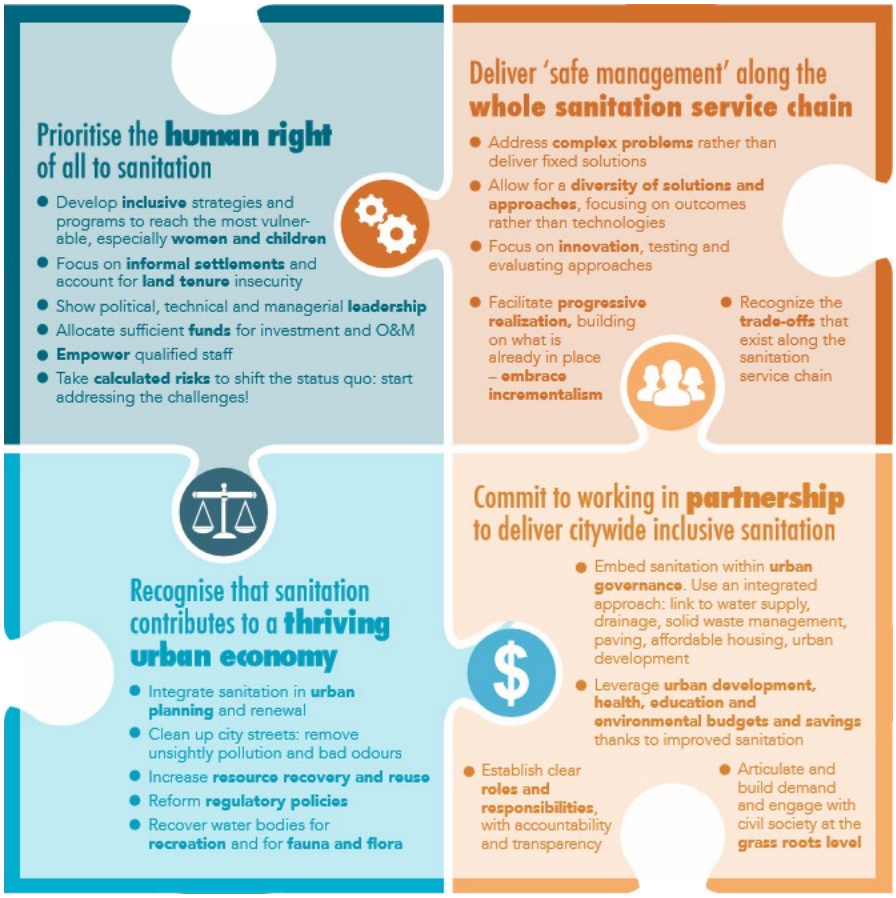

Figure 2: Guiding CWIS themes from the 2017 Call to Action (BMFG et al., 2017).

In the following, after outlining some general advances and emerging CWIS focal points, we briefly outline their distinctive features and main similarities.

2.2. CWIS Frameworks

Four publications provide conceptual advances in drafting a CWIS 'framework' (ADB, 2021c; Gambrill et al., 2020; Narayan, 2022; Schrecongost et al., 2020).

Arguably the most influential CWIS framework stems from the BMGF, as described in Schrecongost et al. (2020). Derived from seven CWIS principles, their CWIS service framework is organised along three system functions (responsibility; accountability; resource planning and management) that guide the process design to achieve three targeted outcomes (equity; safety; and sustainability).

The World Bank's approach, according to Gambrill et al. (2020), formulates eight principles that should guide CWIS promotion within World Bank operations. However, this framework does not provide an actionable framework in itself. The development of specific operational planning tools that followed

assisted the World Bank project teams and their government counterparts in designing and implementing CWIS projects.

Strongly influenced by the BMGF and World Bank approach, the ADB's 'CWIS house' comprises four elements – capable institutions; safety and reliability; equity and inclusion; and sustainability – with associated actions to achieve the desired outcome (ADB, 2021c). CWIS programmes embrace seven characteristics, which are distributed across the CWIS house (foundation, pillars, built up floor and roof).

The Swiss Federal Institute of Aquatic Science and Technology (Eawag) CWIS Framework for comprehensive planning used the Manila Principles to derive operational outcomes and functional linkages. In addition, four guiding pillars are incorporated to bridge top-down and bottom-up planning approaches. While this provides more conceptual clarity on planning for CWIS, there is little operational guidance on the framework, and therefore has been limited uptake.

In the following, the frameworks are introduced in more detail.

The BMGF CWIS Framework

The BGMF CWIS Framework is based on the outcomes of the Manila Conclave of 2019 and provides seven principles:

1. Everyone in an urban area, including the urban poor, benefits from equitable, safe sanitation services.
2. Gender and social equity are designed into planning, management and monitoring.
3. Human waste is safely managed along sanitation service chain, starting with containment.
4. Authorities operate with a clear, inclusive mandate, along with performance targets, resources and accountability.
5. Authorities deploy a range of funding, business and hardware approaches—sewered/non-sewered—to meet goals.
6. Comprehensive long-term planning fosters demand for innovation and is informed by analysis of needs/resources.
7. Political will and accountability systems incentivise service improvements in planning, capacity, and leadership.

Following seven CWIS principles, Schrecongost et al. (2020) define three service outcomes that are promoted/achieved via three system functions (see Figure 3).

Departing from the recognition that managing urban human waste involves inherent market failures, the system functions focus on organising waste management as a public service, with targeted involvement of the private sector. Thus, the framework mainly refers to political decision-makers, service providers (municipal government, utility, private sector) and regulators.

Service Outcomes	**EQUITY** 'Fairness' in distribution and prioritisation of services, service quality, service prices, and use of public finances/ subsidies	**SAFETY** All human waste is managed to protect public goods for customers, workers and all communities	**SUSTAINABILITY** Management of revenues and resources – financial, labour, energy, water – sustain performance
System Functions	**RESPONSIBILITY** Authority or authorities execute a clear mandate to ensure inclusive, safe sanitation services	**ACCOUNTABILITY** Performance is monitored and managed with transparency, data, incentives and penalties	**RESOURCE PLANNING & MANAGEMENT** Resources are managed to support implementation of mandate and achieve goals across time/space

Figure 3: The CWIS Framework as defined by Schrecongost et al. (2020).

In this sense, the three system functions are geared towards authorities that execute a clear mandate (clearly defined role and responsibilities) with verifiable objectives (for service providers) that are transparently assessable (by a regulator) via key performance indicators (accountability). The resource management and planning refers to adequate human and financial means and which reflect the authority's mandates, priorities and performance accountability across time and place. The BMGF CWIS approach is implemented with seven local partners in eight cities and accompanied by several resources such as assessment, planning and training tools available online.[2]

[2] https://www.cwiscities.com

The World Bank Principles for CWIS

The World Bank publication formulated eight principles for their interpretation of the CWIS approach (Gambrill et al., 2020). These principles are organised around two fundamental paradigm shifts, that is, considering more holistic sanitation solutions and ensuring access for all.

1. Everybody benefits from adequate sanitation service delivery outcomes that meet user aspirations and that protect the health of users.
2. Human waste is safely managed along the whole sanitation service chain ensuring protection of the environment and human health.
3. A diversity of appropriate technical solutions is embraced, combining both on-site and sewered solutions, in either centralised or decentralised systems, with consideration of resource recovery and reuse.
4. Cities demonstrate political will, technical and managerial leadership, and identify new and creative long-term funding options for sanitation.
5. Institutional arrangements and regulations, with well-aligned incentives, are in place for the Operation and Maintenance (O&M) of the full sanitation service chain.

6. Funding is allocated for non-infrastructure aspects of service delivery, such as capacity building, household engagement and outreach, and sanitation marketing.
7. Complementary urban services, including water supply, drainage, greywater management and solid waste management, are incorporated into sanitation planning.
8. Activities are included to target specific unserved and underserved groups, such as women, ethnic minorities, the urban poor and people with disabilities.

In terms of operationalisation, the World Bank's CWIS team is implementing this strategy through four primary pillars of support: (1) providing direct operational support to Bank investment projects; (2) creating and distributing tools and resources to aid in project design and implementation; (3) hosting knowledge and learning events; and (4) establishing partnerships with external stakeholders. Specific operational CWIS tools are available online, including terms of reference, guidance notes, technical manuals and planning tools. Curated resources to support government counterparts in considering alternative approaches accompany these tools.[3] The World Bank CWIS team presently supports urban sanitation initiatives in more than 30 countries.

[3] https://www.worldbank.org/cwis

The ADB CWIS Framework

Although different in design, the ADB CWIS Framework (ADB, 2021c) appears to be strongly influenced by Schrecongost et al. (2020) and Gambrill et al. (2020). Again having the shape of a CWIS house (see above, and Figure 4), it essentially adopts the same 'principles'. Although intuitive at first glance, it is less clear on input, process and outcome elements when explored in depth. The seven characteristics of the ADB CWIS framework are:

1. They are evidence-based; health, social, economic outcomes drive the design and implementation approach.
2. Institutional arrangements, regulations and accountability are backed by incentives and established for the management, operation and maintenance of the sanitation service chain.
3. They include a mix of diverse technical solutions that build on existing sewered and non-sewered sanitation systems and incorporate resource recovery and reuse where feasible.
4. City leaders demonstrate the political will to prioritise investment in sanitation, technical and managerial leadership, and arrange long-term funding for sustainability.
5. Non-infrastructure service delivery components are funded, including essential capacity building, household outreach and engagement, and sanitation marketing.
6. Complementary essential urban services are integrated with sanitation planning. These include water supply, drainage, greywater management and solid waste management.

7. Activities and funding target unserved and underserved groups, including women, minorities, informal settlements and persons with disabilities.

The envisaged impacts (roof) result from 'health, social, economic (and environmental)' outcomes. The targeted outcomes (built up floor) are universal access to 'sustainable' sanitation services that are safely managed along the service chain. The process elements, which outline 'how-to-get-there', are organised around evidence-based decision-making and adopt a long-term, incremental, adaptive, integrated and participative planning approach. This is accompanied by capacity building programmes to establish and sustain knowledge and skills among public and private sector actors. Four pillars carry the roof. These are capable institutions (which refer to political prioritisation (funding), responsibility and accountability mechanisms); and services that are safe and reliable (achieved via a mix of technologies and monitoring and enforcements (i.e. again accountability) mechanisms); equitable and inclusive (i.e. affordable and socially and gender inclusive); and sustainable (capacity development ('socially'), viable service providers ('economically') and resource recovery ('environmentally').

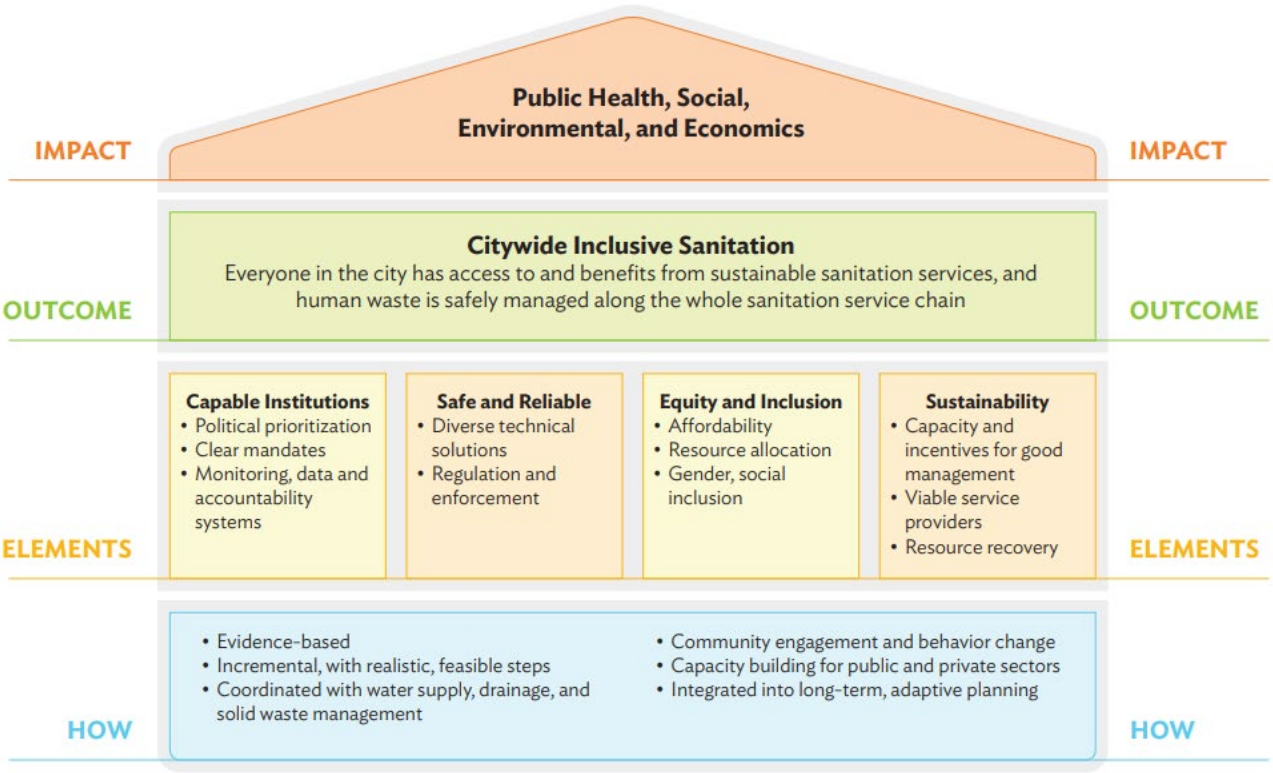

Figure 4: The CWIS Framework as defined by ADB (2021c).

The Eawag CWIS Framework

The Eawag CWIS Framework builds on initial publications on the topic (Narayan & Lüthi, 2019) and is based on the outcomes of the Manila conclave to then launch the six Manila Principles for CWIS (Narayan & Lüthi, 2020). The first draft of principles was clarified and endorsed at the Sustainable Sanitation Alliance's annual meeting in 2020, and subsequently used as the six Manila Principles for CWIS:

1. Equity – Everyone in an urban area – including communities marginalised by gender, social and economic reasons – benefit from equitable, affordable and safe sanitation services.
2. Environment and Public Health – Human waste is safely managed along the entire sanitation service chain, starting from containment to reuse and disposal.
3. Mix of Technologies – A variety of sewered and non-sewered sanitation solutions coexist in the same city, depending on contextual appropriateness and resource recovery potential.
4. Comprehensive Planning – Planning is inclusive and holistic with participation from all stakeholders including users and political actors – with short- and long-term vision and incremental perspective and is synergistic with other development goals.
5. Monitoring and Accountability – Authorities operate with a clear, inclusive mandate, performance targets, monitoring requirements, human and financial resources, and accountability.
6. Mix of Business Models – Sanitation services are deployed through a range of business models, funding sources and financial mechanisms to reach all members equitably.

Furthermore, the Eawag CWIS research was developed further to focus on planning for CWIS (Narayan et al., 2021). Figure 5 illustrates the CWIS Planning Framework, where comprehensive planning takes centre stage and incorporates four operational outcomes directly derived from the Manila principles on CWIS: (i) Public Health, (ii) Environmental Health, (iii) Mix of Technologies, and (iv) Mix of Business Models. The operational outcomes are intricately connected as follows:

1. Safety relies on the management of the entire sanitation value chain, connecting (i) and (iii) to ensure public and environmental health.
2. Sustainability links (ii) and (iii), emphasising the need for sanitation systems to endure both environmentally and financially. A contextual mix of technologies allows for incremental improvements, ensuring financial viability, while environmental health outcomes contribute to overall sustainability.
3. Accountability connects (iii) and (iv), addressing the increased operational and governance complexity inherent in a mix of technologies

and business models. Clear accountability mechanisms are crucial for ensuring the long-term functionality of diverse sanitation services.

4. Equity links (iv) and (i), underscoring that equitable sanitation requires uniform public health outcomes for all city residents. This ensures equal quality and affordability of sanitation services across various operating business models.

In addition to these operational outcomes and their linkages, the Eawag CWIS Planning Framework incorporates the conceptualised four 'S' pillars of comprehensive planning (Narayan et al., 2021):

1. Situation analysis,
2. Stakeholder participation,
3. Synergies with other sectors, and
4. Strategy for the long term.

These 4S pillars aim to bridge top-down and bottom-up approaches, with top-down approaches offering advantages in exploring synergies with other public services and long-term strategies, while bottom-up approaches encourage detailed situational analysis through co-production of knowledge and meaningful stakeholder participation.

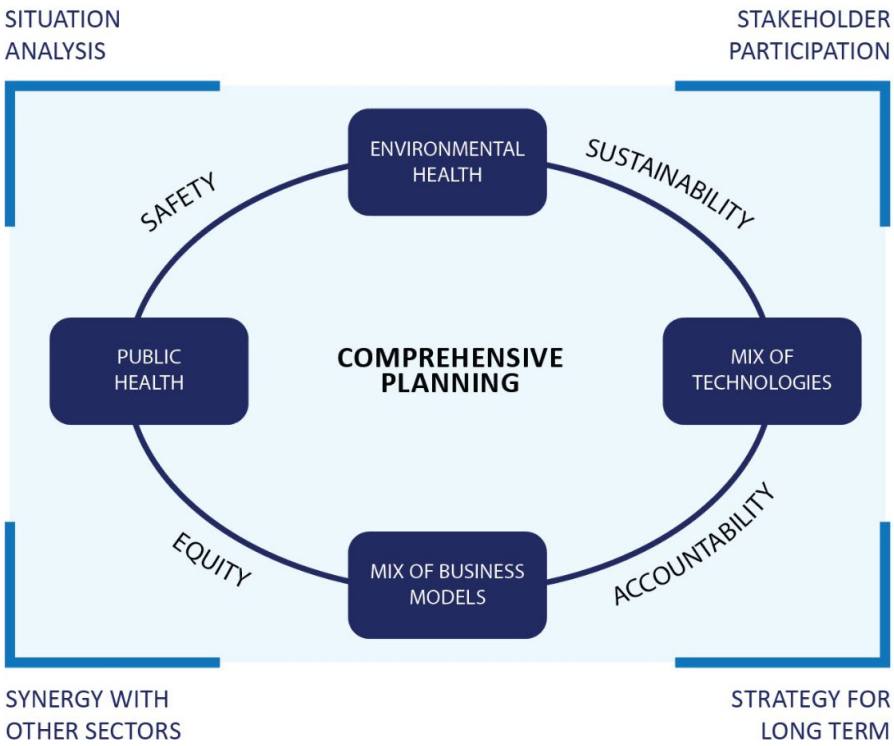

Figure 5: The CWIS Planning Framework as defined by Narayan et al. (2021).

2.3. Preliminary Observations

A notable characteristic shared by the four conceptual publications is their emphasis on adopting a holistic perspective since CWIS must comprehensively consider and address a large number of inter-linked factors and actors. All four frameworks emphasise process-oriented approaches and outcome-focused perspectives. While the outcome and the 'What-to-achieve'-question is still of major importance (i.e. universal and equitable access to adequate and safe Water, Sanitation and Hygiene (WASH) services), the 'How-to-get-there'-question (i.e. process) has clearly gained in prominence. However, given the relative novelty of CWIS, conceptually it remains rather generic ('principles', 'framework'), with specific actionable guidelines and tools on 'how-to-get-there' under development.

At the same time, the general difference between the four CWIS frameworks is that they can be divided into more practical–implementing and more academic–theoretical groups. On one hand, given their practical experience, the philanthropic BMGF and the development banks (ADB, 2021c; Gambrill et al., 2020; Schrecongost et al., 2020) emphasise institutional strength, effective governance and political leadership as foundational inputs, supported by robust regulations, policies and regulators with a focus on monitoring and enforcement. Clearly defined roles and responsibilities, accountability, transparency and reliability serve as essential mechanisms in the overall process. Financial arrangements, financing models and business structures, considering both capital (CAPEX) and operational expenditures (OPEX), are critical components, being addressed through public provision or support for market approaches. While participative 'bottom-up' elements such as stakeholder engagement and household demand are essential components according to their CWIS strategies, the predominant focus on 'regulation' and 'institutional' issues suggests a mere top-down approach. On the other hand, departing from an arguably more theoretical standpoint, the academic faction (Narayan, 2022; Scott & Cotton, 2020) puts more emphasis on user-centred ('bottom-up') and participative planning approaches. Narayan (2022) emphasised that the advantages of both types of approaches, that is inclusion of related sectors and stakeholders, are necessary to ensure that the multi-dimensional CWIS targets are achieved.

As a preliminary finding, while there are four different interpretations of CWIS, with each framework emphasising different key aspects, there is considerable overlap and commonality between them. In this sense, CWIS does the following:

1. Redefines sanitation from a service delivery rather than an infrastructure viewpoint.
2. Emphasises a long-term (process) perspective that guides evidence-based, strategic and incremental improvements towards the outcomes of equity, safety and sustainability.

3. Considers the entire sanitation value chain and promotes the coexistence of sewered and non-sewered technologies to protect public and environmental health.
4. Depends on political will, comprehensive regulation with clearly defined institutional roles and responsibilities.
5. Is deployed through a range of funding sources and business models with performance tar-gets, monitoring and enforcement serving as accountability mechanisms.
6. Fosters active engagement of relevant stakeholders.

While the frameworks do not explicitly contradict each other's principles, they do attach different importance to the relevance of the following:

1. Capacity development to establish knowledge and skills in both the public and private sector.
2. The importance of public sector mandate for provision of safely managed sanitation.
3. Innovative financing mechanisms for increasing private sector involvement where applicable.
4. Adopting user-centric approaches to increase service adequacy for marginalised people.
5. Integration of or at least coordination with other basic urban services such as water supply, greywater management, drainage and solid waste, among others.

3.

Review of Advances on CWIS Themes

Based on the corpus of over 100 publications published between 2016 and 2024 (see Figure 6) and of which 77 were reviewed, a few themes stood out prominently. These emerged as code groups and provided the basis for analysis (see chapter 1.2 Scope and Methodology, p. 6). This chapter is organised accordingly.

While conceptual developments have mostly been summarised throughout chapter 2, the most prominent themes identified throughout the review included institutions and regulations (governance), service models and financial arrangements (funding), planning and capacity development. Additional categories identified (as reflected in the coding) were mix of technologies as well as public and environmental health (see Table 2). These are all deemed essential for ensuring the sustainable provision of CWIS services. The review below analyses important contributions in these themes, highlights trends and gaps, and closes with a section on implementation experiences.

It should be noted, however, that here is a breadth of other work (research, practice etc.) in each of these domains that is not explicitly referring to or titled 'CWIS' and hence has not been included in our review.

Table 2: Summary of CWIS themes and the numbers of papers and literature covering the corresponding theme.

	CWIS themes	Number of publications
1	Conceptual Development	13
2	Institutions & Regulations	37
3	Service Models & Financial Arrangements	19
4	Planning	33
5	Mix of Technologies	5
6	Public & Environmental Health	3
7	Capacity Development & Decision Support Tools	24
8	CWIS Implementation Experiences	16

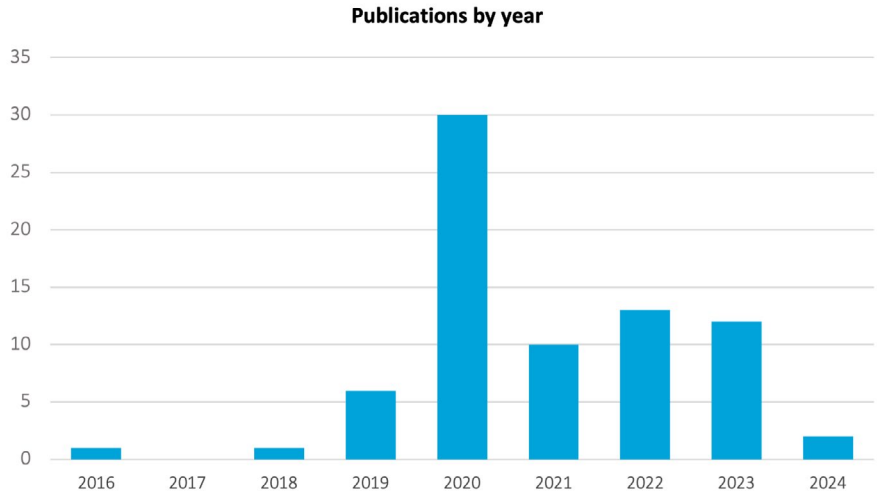

Figure 6: Publications on CWIS by year 2016-2024.

3.1. Institutions & Regulations

Across the reviewed literature, the importance of a well-defined institutional and regulative setting was considered the essential precondition for implementing CWIS – and is arguably the most discussed topic (see Table 2). This chapter briefly summarises the most frequently mentioned aspects thereon.

A well-defined institutional and regulative setting includes clear laws, policies and standards ('policy framework'). Clearly defined institutional roles and responsibilities are essential to effective coordination and to generate accountability among involved actors. Together with adequate human and financial resources, this enables rigid monitoring and enforcing CWIS. Ultimately, it enhances efficient financial, human, and infrastructure resource allocation and increases adaptable, flexible and, thus, resilient systems. The difficulty is that these elements are interconnected and need a key system integrator/coordinator, which the literature identifies in the regulatory authorities. These are thus the entry point for effectively coordinating policies, standards and service provision towards CWIS (ESAWAS, 2021a, 2021b, 2021d; IWA, 2021, 2022). Whether low, middle or high-income economies, the task of regulating appears to be the same: "to be the nudger, facilitator, interlocutor, the 'referee', the integrator but also, the cases suggest, the promoter, the mobiliser of change, who acts as the intermediary between policy-makers and service providers and citizens 'to make things happen fairly'" (IWA, 2022).

However, particularly in the case of non-sewered sanitation, mandates are often fragmented and unclear, and can include multiple mandate structures with no single entity clearly responsible (ESAWAS, 2020b, 2021d).[4] To support regulators towards 'active regulation', ESAWAS proposes a Regulation

[4] Utilities focus on specific service mandates, ring-fenced sanitation budgets and set cost goals. Conversely, local governments have a broader public service remit, incorporating sanitation funds into general city budgets, potentially leading to looser accountability.

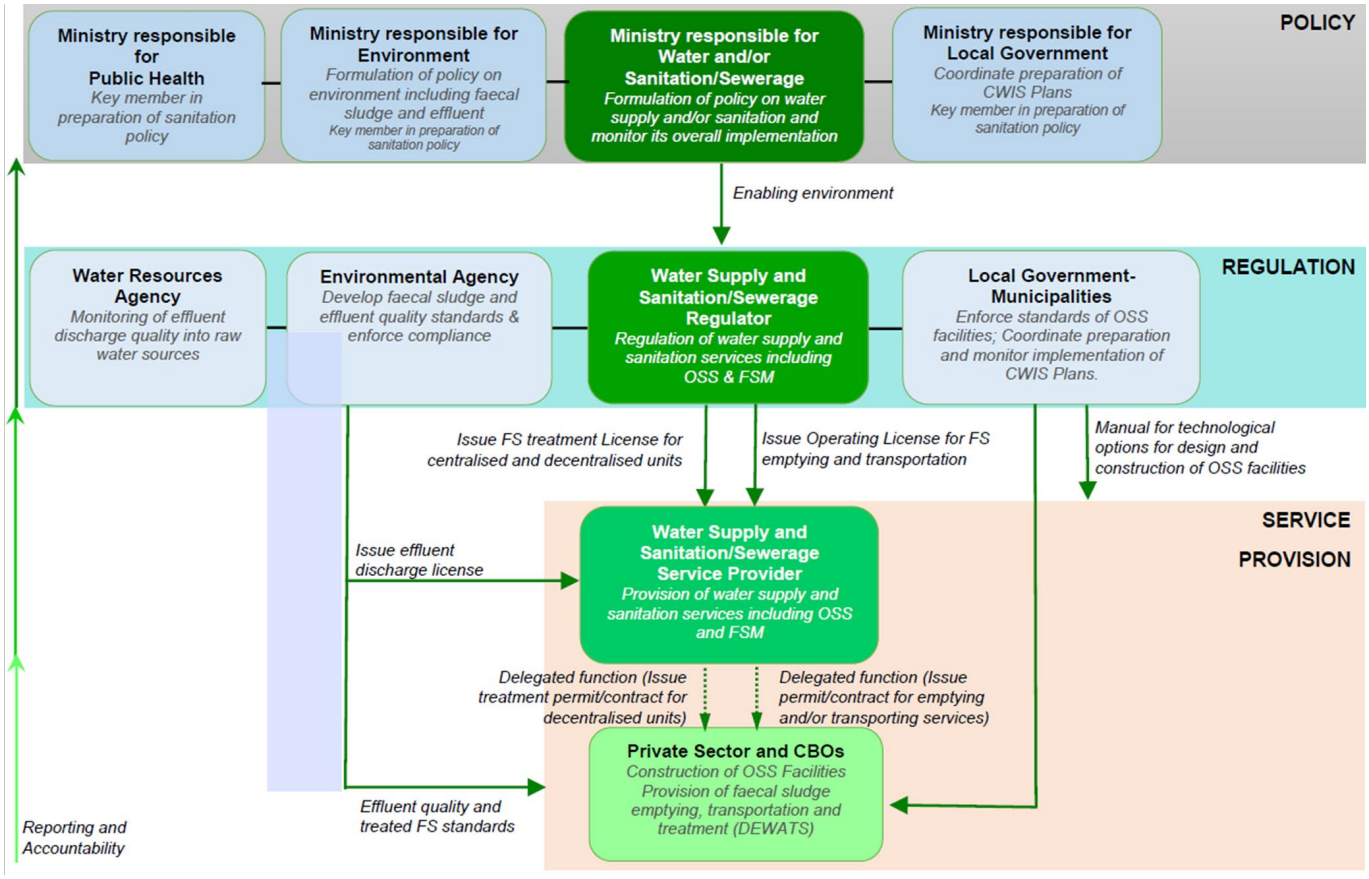

Figure 7: Recommended roles and responsibilities of institutions on the sanitation agenda (Source: ESAWAS (2019)).

Framework and Strategy for Inclusive Urban Sanitation Service Provision (Figure 7, ESAWAS, 2019). Complementary publications support policy and decision makers, regulators, public and private service providers, and other relevant sector stakeholders in planning for CWIS (emphasising technical, institutional and financial aspects, ESAWAS (2020c)) and service provision (emphasising e.g. cost-effectiveness, appropriateness, progressive realisation, gender and social inclusion, ESAWAS (2020d)).[5]

'Active regulation' emphasises pragmatic, incremental regulatory reforms (e.g. 'Regulating Ladder') underpinned by extensive stakeholder coordination (WSUP & ESAWAS, 2020). Ultimately, the regulator will establish accountability and responsibility among all stakeholders and across the entire sanitation service chain. Accountability and responsibility are closely linked key functions of the BMGF CWIS Framework: only if the roles and responsibilities as well as the boundaries are clearly defined can one be held accountable. However, a major issue has been the requirement for municipalities to act both as service provider and the enforcer of regulations. This makes them, figuratively speaking, both a player and the referee – a clear conflict. Therefore, clearly distinguishing between a policy, regulation and service provision level with different actors/entities responsible for the respective tasks is advisable (ESAWAS, 2019; see Figure 7). Heidler et al. (2023) criticises this understanding of accountability as technocratic, as it is limits

5 The vast majority of CWIS publications in the field of regulation are published by ESAWAS together with WSUP with funding support from BMGF. Three specific case studies are organised along the BMGF CWIS Framework's system functions, i.e. accountability ESAWAS (2020a), responsibility (ESAWAS, 2020b) and resource planning and management (ESAWAS, 2021c). ESAWAS is the Eastern and Southern Africa Water and Sanitation (ESAWAS) Regulators Association, i.e. a network of regional water supply and sanitation regulators. ESAWAS fosters regional cooperation and coordination on regulatory issues in order to improve the effectiveness of water and sanitation regulation in the region and enhances the regulative capacity of by facilitating information sharing and skills training. WSUP stands for Water and Sanitation for the Urban Poor. It is a not-for-profit company working in urban low-income areas to increase access to water and sanitation for the urban poor. The organisation works alongside local providers, enabling them to develop services, build infrastructure and attract funding so that they can reach low-income communities.

the perspective to formal ('top-down') regulatory frameworks instead of synergistic co-production to address context-specific pro-poor concerns and priorities.

3.2. Service Models & Financial Arrangements

A second, frequently mentioned decisive factor for the ability to 'actively regulate' CWIS, are adequate funds and, thus, viable business models and financial arrangements (ESAWAS, 2021a; Mitra et al., 2022). Closely linked is the discussion about the necessity and degree of involvement of (or even outsourcing to) the private sector for (parts of) service provision and how this affects service access/availability, depending on whether the issue is approached from a public sector/regulatory, a private sector or a household point of view. This chapter briefly outlines the main findings and lines of arguments.

Despite manifold efforts, understanding successful financing and business models, particularly for non-sewered solution, is still inadequate, with poor data management and fragmented governance structures being the main barriers (ESAWAS, 2021b; Schaefer et al., 2020).[6] The struggle to establish comprehensive cost analyses (life cycle costs) results in a continued emphasis of infrastructure CAPEX over OPEX and sewered over non-sewered solutions – partly because costs are better known and predictable for the former (Bhalaki et al., 2020; ESAWAS, 2021b; IWA, 2022; Mansour et al., 2020; Schaefer et al., 2020). Non-sewered sanitation keeps being perceived as a private good with low political prioritisation (ESAWAS, 2021b). In effect, insufficient financial resources are budgeted and allocated for OPEX in general and non-sewered services particular. This intensifies service access inequity, as the urban poor heavily rely on non-sewered services (Grisaffi et al., 2022; Heidler et al., 2023). There is, thus, a need to increase efforts to monitor (identify) sanitation lifecycle costs to determine the financial needs of 'soft infrastructure' for both sewered and non-sewered solutions to enable planning stability (ESAWAS, 2021c): only then regulators can effectively fulfil their regulative mandate and hold utilities and private actors accountable (ESAWAS, 2021c).

Given limited public financial resources, bureaucratic hurdles, capacity constraints and political instability, private sector involvement and Public–Private Partnerships (PPPs) are expected to support CWIS service provision. In theory, a 'waste management' problem turns into a business opportunity, with Development and International Finance Institutions (DFIs/IFIs) providing the funds to kickstart the sanitation economy, expecting that entrepreneurs can run their businesses profitably afterwards. The government's responsibility shifts from service provision to incentivising, regulating and ensuring fair competition, along with enforcing environmental and safety standards.

6 To support resource-planning and decision-making, three 'products' are available: (1) Guidelines for Sanitation Services Tariff Setting (ESAWAS, 2020e) that provides guidance to regulators in determining cost reflective tariffs, for developing tariff-setting models and monitor the implementation of tariff decisions for sewered and non-sewered services. (2) The EquiServe tool (previously Citywide Inclusive Sanitation Services Assessment and Planning (CWIS SAP)), which enables decision-makers to compare sanitation interventions or investments and design creative service models that advance CWIS services. (3) The CWIS Planning and Costing Tool from the World Bank that should support planners and consultants to determine costs at the technical component, the system as well as the city level. Each of these resources have their own advantages and limitation in terms of applicability, data demands, proof of concepts (Bhalaki et al., 2020; Mansour et al., 2020; Schaefer et al., 2020).

In practice, however, simply outsourcing 'the problem' does not (currently) work. In service chain 'terms', only containment (and partly treatment) have received public funding, however often supported by DFIs/IFIs, donors, Non-Government Organisations and Community-Based Organisation, since the significant costs (e.g. for establishing and maintaining faecal sludge treatment plants) are usually overwhelming for private actors (Singh & Sauer, 2020; Zhang et al., 2023). Yet, external funding is often programme-linked, CAPEX–focused and, thus, unsustainable (Zhang et al., 2023). Emptying and transport (and treatment) see major funding gaps, which is why a largely market-based 'approach' is adopted (e.g. Grisaffi et al., 2022; Mehta et al., 2019; Singh & Sauer, 2020). However, several barriers to private sector market development continue to exist, usually originating from institutional and regulative inadequacies (Gambrill et al., 2020; Singh & Sauer, 2020; WSUP, 2022).[7] To date, success stories in terms of private sector involvement for CWIS remain externally financed 'pilot projects' (ASCI, 2020a, 2020b; CEPT-CEWAS, 2019, 2020; IIHS, 2020; Mehta et al., 2019; SNV, 2020). In this sense, Grisaffi et al. (2022) and Heidler et al. (2023) challenge the increasingly widespread view that private sector delivery is the preferred way to move forward. While outsourcing service chain segments to private businesses may reduce the public sector's risks and costs, it may also impede expanding service delivery to low-income areas (Grisaffi et al., 2022; Heidler et al., 2023).

In summary, from a regulatory (public sector) standpoint, ensuring accountability of service providers demands sufficient resources for effective monitoring and enforcing CWIS (ESAWAS, 2021b). From a private sector point of view, they grapple with investment constraints due to high costs and low returns, particularly for capital-intensive infrastructure setups. From a household perspective, approaching sanitation with a market-based lens can overshadow citizens' rights to safe water and sanitation (Kennedy-Walker et al., 2020), advocating for public investments, targeted subsidies and for co-producing sanitation services (Bateganya et al., 2023; Grisaffi et al., 2022; Heidler et al., 2023). Scott and Cotton (2020) provide a conceptual CWIS framework that pays respect to these claims and is organised around the living environment of people. It departs from the household's decision-making sphere, highlighting the significance of demand and behaviour.

3.3. Planning: Incremental, Integrated & Participative

While within CWIS the 'What-to-achieve' question is still of major importance (i.e. universal and equitable access to adequate and safe WASH services), the 'How-to-get-there' question (i.e. process) has clearly gained in prominence (see also Table 2). Strategic, evidence-based, incremental (i.e. step-wise long-term), integrated (across sectors and public and private spheres) and participative planning processes are the new process-related buzzwords.

[7] This includes e.g. denying private FSM actors official/formal recognition, which thus remain part of the informal sector (Gambrill et al., 2020; Singh & Sauer, 2020; WSUP, 2022). Formalisation, in turn, would foster market development and allow official collection of fees (Singh & Sauer, 2020). Further recommendations include introducing performance-based contracts (WSUP, 2022). Contrary to private sector development, Grisaffi et al. (2022) suggest incorporating e.g. pit emptying as a utility service.

This section quickly elaborates on these concepts and situates them within the wider CWIS literature.

Planning must be evidence-based as this enables informed-decision making to foster contextualised, needs-based solutions that are affordable, equitable and, ultimately, sustainable (Scott, Ross, et al., 2019). Evidence-based means collecting and analysing contextual data ('diagnostic') to develop holistic solutions that address interlinked causes, not isolated symptoms. The reviewed CWIS publications focus on or provide inputs on what data collect for different areas such as the institutional setup and governance structures for CWIS service provision (Blackett & Hawkins, 2020; Narayan et al., 2020; Narayan et al., 2021), regulations (Bhalaki et al., 2020; Blackett & Hawkins, 2020; ESAWAS, 2019, 2020d; Mansour et al., 2020; Schaefer et al., 2020; WSUP & ESAWAS, 2020), financial resources (ADB, 2021b; ESAWAS, 2021b; Wibowo et al., 2023; Zhang et al., 2023), (mix of) business models and market aspects (Singh & Sauer, 2020) as well as (mix of) technologies (Spuhler & Lüthi, 2020; Vazquez et al., 2021).

CWIS emphasises a process-perspective. Thus, the notions of incremental, integrated and participative planning are fundamental to all CWIS Frameworks (ADB, 2021c; Gambrill et al., 2020; Narayan et al., 2021; Schrecongost et al., 2020). However, these deal with CWIS at a mere generic level. Among other reviewed literature, the level of detail varies greatly, but some can be categorised to put more focus on incremental planning, that is emphasise focusing on realistic improvements with smaller steps that are achievable (Bateganya et al., 2023; Bhavsar et al., 2022; Blackett & Hawkins, 2020; ESAWAS, 2020a; Scott, Ross, et al., 2019; Scott, Scott, et al., 2019; WSUP & ESAWAS, 2020) integrated planning, that is planning that cuts across sectors such as water, sanitation, solid waste, transport, energy, as well as public and private spheres (IWA, 2022; Mitra et al., 2022; Narayan, 2022; Narayan et al., 2021; Saker et al., 2022; Scott, Ross, et al., 2019; Scott, Scott, et al., 2019; Sundar Navamany et al., 2022) and/or participative planning, that is planning through stakeholder participation or engagement (ADB, 2021a; Bateganya et al., 2023; Heidler et al., 2023; Narayan et al., 2020; Scott, Ross, et al., 2019).

Incremental planning is emphasised given long-lasting experiences from decades of (failed) sanitation planning, highlighting a long-term perspective that allows adaptation, which strategically pays respect to dynamic, ever-changing contexts. Integrative planning aims at holistic solutions that break sectoral siloes and creates and harnesses synergies. In doing so, it acknowledges the enabling environment required to establish a reliable, functional sanitation service chain and not only increases sustainability, but also resource efficiency. However, clear guidance and successful examples on how to achieve this are still lacking/scarce. Participative planning shall enable contextualised solutions developed with local knowledge, which increases adequacy,

ownership and overall legitimacy, thus shall foster responsibility and accountability, and, ultimately, equity and sustainability. Depending on the task at hand, it emphasises, for example, interdepartmental exchanges (governance, institutional & regulative improvements, e.g. Reymond et al. (2020); Saker et al. (2022); WSUP and ESAWAS (2020)), private sector engagement (PPPs, outsourcing and mix of business models, e.g. Singh & Sauer (2020); Wibowo et al. (2023)) and/or community engagement and/or co-production (addressing gender equality and social inclusion, e.g. ADB (2021a); Bateganya et al. (2023); Heidler et al. (2023)). Narayan, (2022) brings these aspects of planning together in the CWIS-focused planning approach called 'Bridged Approach to Inclusive Sanitation' (BAIS) that provides 10 steps towards a incremental, integrated and participatory CWIS plan.

3.4. Equity, Social Inclusion & Gender

While all CWIS frameworks reference equity either as 'element', 'link' or 'outcome' (ADB, 2021c; Gambrill et al., 2020; Narayan et al., 2021; Schrecongost et al., 2020), only a few publications explicitly focus on these (CSEI, 2023; Luwe et al., 2022). This section briefly clarifies potential reasons and outlines gaps and inconsistencies.

The lack of publications is at least partly due to the fact that equity is not (only) perceived as a mean to achieve CWIS, but as an end: Equity must be reflected in the 'who' being addressed, that is explicitly focus on social inclusion of marginalised and disadvantaged communities, such as poor households living in informal and insecure land tenure settlements (ADB, 2021b), and address the diversity of race, ethnicity, age, gender and ability (ADB, 2021a). In addition, equity must be reflected in the 'how', that is the process design to establish equitable outcomes. Through cooperation/coproduction, stakeholder engagement aims to provide and access information (e.g. local knowledge) as well as resources (e.g. local skills), thereby addressing power imbalances, promoting equitable outcomes and sustainability (Bateganya et al., 2023; Heidler et al., 2023).

Nonetheless, despite the global push and manifold use, 'equity', 'inclusive' and 'sustainable' are not unambiguously defined but remain fluffy yet frequently used umbrella terms (Luwe et al., 2022). This is reflected in how the different CWIS Frameworks refer to equity and how it is assessed. For example, in the BMGF CWIS Framework, 'equity' is assessed along five indicators, (i) and (ii) relating to low-income areas, (iii) costs and financing, (iv) gender and (v) security and health of sanitation workers (BGMF, 2021; BMGF, 2021a, 2021b).[8] Adopting 15 indicators, CSEI (2023) assesses the hard ('infrastructure') and the soft ('O&M, institutional & regulative) components of a city's sanitation services to evaluate their safety, equity and justice.[9] The ADB CWIS Framework, in turn, does not provide clear indicators, but 'equity' refers to

[8] % safely managed sanitation in low income areas; Women's participation in sanitation related matters; Gender friendly public toilet/ community toilet design, % of sanitation workers covered by social security and health insurance.

[9] Using a laddered approach, a city receives either one ('functional'), two ('sustainable') or three ('inclusive') stars that should support decision-makers in identifying priorities and actions to 'climb up the CWIS ladder'.

affordability/resource allocation and social inclusion/gender.[10] In other CWIS frameworks, equity links public/environmental health and business models, since all urban dwellers need affordable sanitation services and profit from resulting public health outcomes (Gambrill et al., 2020; Narayan et al., 2021; Sundar Navamany et al., 2022).

In short, the reviewed CWIS Frameworks all make (generic/strategic) references to 'equity' and promote 'universal, equitable, affordable, and safe access to sanitation services' as do strategies for a given context (e.g. ESAWAS, 2020d; GGGI, 2022; KCCA, 2020). However, a shared understanding of what it entails and how it is implemented (and monitored/assessed) is lacking. Overall, 'equity' experiences different interpretations depending on actors and context (Luwe et al., 2022). Vague terms such as 'everyone' or 'for all' are not straightforward, which can have 'unequitable' effects on service delivery itself (Strande et al., 2023). In effect, practitioners implementing CWIS following, for example, the BMGF CWIS Framework would not be able to compare their appraisal on progress, for example, with practitioners following ADB's. Consequently, there is a need for an unambiguous, and globally relevant terminology including clearly identifying (and naming) specific groups needing attention for inclusion (Luwe et al., 2022; Strande et al., 2023). Likewise, without standardised metrics and evaluation methods, it is challenging to determine which strategies are most successful in addressing inequities in access to sanitation services.

3.5. Mix of Technologies

From a technology perspective, CWIS emphasises both sewered and non-sewered as well as onsite, decentralised and centralised solutions. While publications on regulation and financial arrangements dominate the reviewed CWIS literature landscape, technology only plays a minor role. This is surprising and promising at the same time. Surprising because sanitation is to a large part still about infrastructure and technology and the sector has been heavily infrastructure/engineer dominated. Promising because apparently the service – and thus the software – component is supposed to gain in prominence.

The consideration of both sewered and non-sewered solutions and finding an adequate mix of technologies is referred to within the wider frame of evidence-based, contextual planning publications (Blackett & Hawkins, 2020; Mitra et al., 2022; Scott, Ross, et al., 2019) and is part of general CWIS planning guidance documents (ESAWAS, 2020d, 2020e). Given the need to find complementing alternatives to centralised solutions, the majority of reviewed CWIS publications that more specifically refer to (mix of) technologies deal with non-sewered, that is onsite and decentralised solutions and Faecal Sludge Management (FSM) (except for Kennedy-Walker et al. (2020)).

[10] This is further specified in their concise guidance notes on Inclusive Financial Mechanisms: Improving Access to Sanitation Services for Poor Households (ADB, 2021b) and on Addressing Gender Equality and Social Inclusion in Urban Sanitation Projects. (ADB, 2021a). While these are certainly extremely helpful to understand the breadth of the topic and emphasise essential key points and strategies to improve inclusive financial mechanisms, gender equality and inclusion, they ultimately remain general suggestions. How these suggestions are used and integrated will depend on the local context of each project.

These usually refer to/deal with specific links of the sanitation service chain such as containment/treatment process (Vazquez et al., 2021), emptying/transport (Mehta et al., 2019; Singh & Sauer, 2020), resource recovery (Ddiba et al., 2023) or deal with particular services such as Container-Based Sanitation (VanRiper et al., 2022). 'Only' Spuhler et al. (2020) have made a technology-specific CWIS-contribution that entails both sewered and non-sewered solution and covers the entire sanitation service chain. Spuhler et al. (2020) developed an open-source decision support tool that proposes a set of locally appropriate sanitation system options that are manageable in size while considering trade-offs.[11]

[11] https://www.sanichoice.net

3.6. Public & Environmental Health

Sanitation has been established primarily for public health reasons, driven by the recognition of the link between poor sanitation and disease transmission. However, except for Sundar Navamany et al. (2022) – who identify pollution pathways and identify three levers for change (coordination of government entities, adequate FSM and strong citizen involvement) – no publication explicitly contributed in this area. It is likely that those dealing specifically with health-related aspects of sanitation do not explicitly refer to 'CWIS' or use respective terminology.

On the other hand, it is surprising that the issue of climate change and related mitigation and adaptation strategies within the CWIS literature landscape is scarce. Effects of climate change are expected to present great sanitation related-risks (e.g. flooding events) for public and environmental health. Climate change will disproportionally affect low-income settlements and vulnerable communities, which evidently requires addressing inequalities and prioritising vulnerable communities, not just for equity but for public health as well (Mills et al., 2020). Mills et al. (2020) and Willetts, Priadi, et al. (2022) have provided foundational contributions on this topic. Other significant publications linking sanitation and climate change already exist but not included in the review as they did not meet our sample criteria (e.g. Howard et al., 2021; Mikhael et al., 2021; Willetts, Kumar, et al. 2022).

3.7. Capacity Development & Decision Support Tools

For adequate planning for and widespread adoption of CWIS, appropriate decision-making tools and capacity development are essential (Narayan & Spuhler, 2021). The numbers of papers and literature covering the corresponding theme reflects this (see Table 2). This section explains why and how, outlines the breadth of current initiatives and gives an overview on CWIS decision support tools.

Capacity development establishes the knowledge and skills basis. It can include advocacy and awareness raising (e.g. for political decision-makers), behaviour change and sanitation marketing campaigns (e.g. targeting urban dwellers) and CWIS training (e.g. for city planners/authorities, private consultants, FSM operators). Tools, in turn, can support stakeholders in strategic decision-making throughout various stages: advocacy, diagnostic, design, implementation, and operation and monitoring. Recent global capacity development initiatives include institutional development, strengthening existing sanitation networks (e.g. FSM Alliance, African Water Alliance, Sustainable Sanitation Alliance), academic programmes (e.g. Global Sanitation Graduate Schools, IHE Delft), training for private sanitation consultants (e.g. ConCaD[12]), capacity building initiatives for public sector professionals (e.g. Sanitation Capacity Building Platform at NIUA in India[13] or the BMGF funded CWIS trainings led by ITN-BUET et al. (2023) and the ADB Institute (Parekhelashvili et al. (2024) for the ADB as well as IDB (2023) for the African context) as well as massive open online courses (e.g. Eawag's Water, Sanitation, and Solid Waste for Development[14] online course (Suter & Lüthi, 2021) and IHE Delft's online course on CWIS[15]).

12 https://www.sandec.ch/concad

13 https://scbp.niua.org

14 https://www.eawag.ch/de/abteilung/sandec/e-learning/moocs

15 https://cwis.online

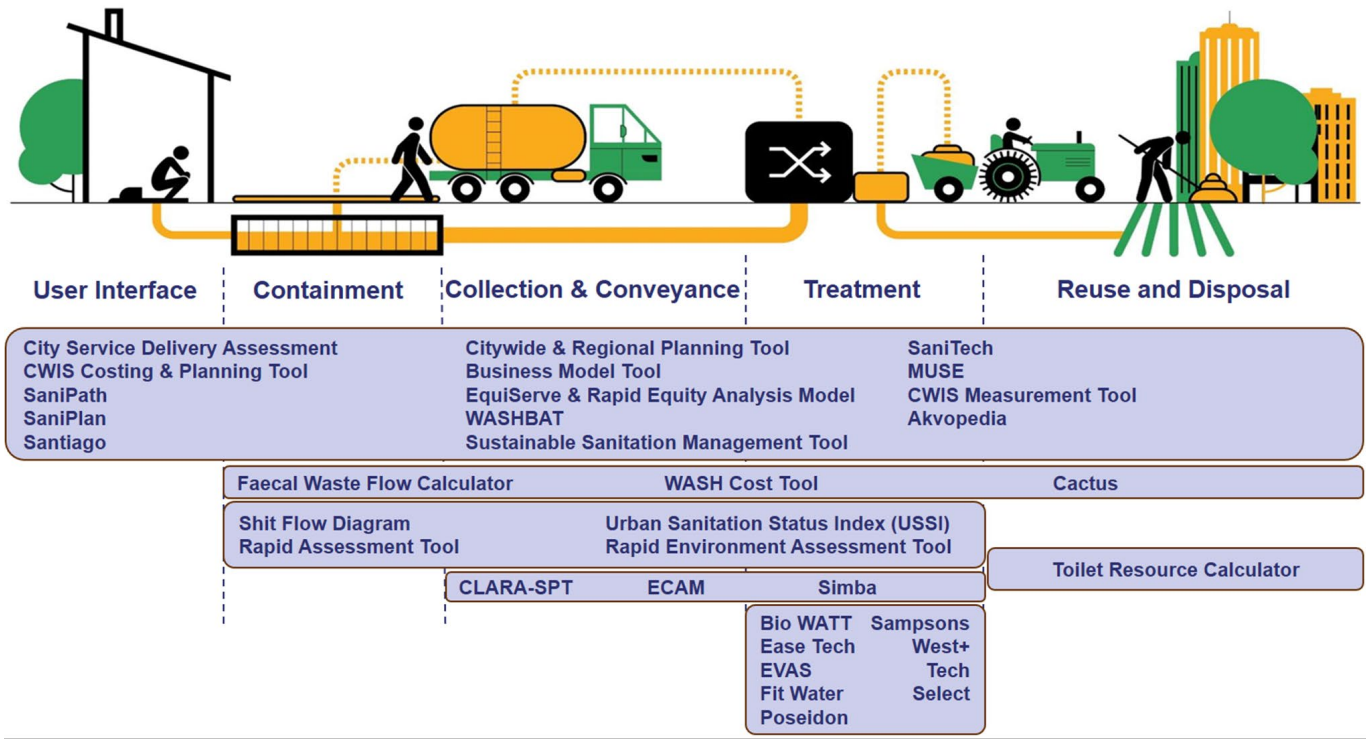

Figure 8: Overview on CWIS decision support tools alongside the sanitation service chain (Source: Athena Infonomics (2023)).

In the sanitation sector, there is a plethora of decision-support tools available (Schertenleib et al., 2021). Organised along the sanitation service chain, Athena Infonomics (2023) compiled an overview document with 29 publicly available CWIS decision support tools (see Figure 8). In addition, published

reviews identified essential quality criteria for planning tools (Spuhler & Lüthi, 2020), organising some of them according to the complexity (need of data input) and time of application throughout different project phases (Narayan & Spuhler, 2021), or reviewed some of them on their actual use and impact (Mugendi et al., 2023). Obviously, the tools differ in their sophistication. Some are focused on specific issues, like sizing septic tanks (e.g. Vazquez et al., 2021), while others take a broader approach, such as covering infrastructure system design (Spuhler et al., 2020), institutional ('non-infrastructural') service delivery environment assessment (Blackett & Hawkins, 2020) or cost analyses (e.g. World Bank costing tool[16] or EquiServe (previously CWIS SAP, Bhavsar et al., 2022).

In general, the more sophisticated a tool, the more comprehensive data is needed (Bhalaki et al., 2020; Mansour et al., 2020; Schaefer et al., 2020). Consequently, the main challenges involve gathering the necessary data and establishing the skills for data analysis and effective use of tools. While various CWIS capacity-building initiatives are underway (IDB, 2023; ITN-BUET et al., 2023; Parekhelashvili et al., 2024), training evaluations highlighted the need for improving skills on gathering, managing and analysing data. Valid and reliable data is the basis for adequate strategic decision-making and formulation of effective policies, interventions and financial considerations. Further recommendations refer to creating internationally recognised certification/diploma standards[17], increasing cross-country networking as well as intensifying in-country collaboration to reach local audiences, providing tailor-made self-paced online and blended learning formats with local content and, last but not least, strengthening inclusion and equity, particularly by improving the current gender imbalance of learners (IDB, 2023; Parekhelashvili et al., 2024; Suter & Lüthi, 2021).

16 Only available as a beta version and it does not appear to be user-friendly, as it seems to require detailed contextual data. There are no evaluation reports accessible (Public Sector: Resource Planning & Management, p. 19 et seqq.).

17 Standardisation and verified labelling not only of technical components but of human resources are essential in creating a viable market environment as well.

3.8. Implementation Experiences

With a growing understanding of its multi-dimensional aspects, implementation experiences offer empirical evidence and invaluable insights for scaling CWIS within and across contexts. Documentation of successes currently remain, however, limited. This section briefly summarises those available. In doing so, it rounds off chapter 3 and thus creates the basis for concisely summarising lessons learnt, trends and recommendations in chapter 4.

This literature review collated and organised various experiences and challenges with regard to CWIS. However, a comprehensive and concise review and analysis spanning the entire CWIS cycle from planning to implementation is still lacking. To do the same would have exceeded the scope of this review.

While documentation of several implementation projects is anticipated, there are a few notable publications that have effectively captured imple-

mentation experiences. The IWA CWIS Stories[18] section provides a series of implementation experience with 35 short publications. Although not exhaustive, it offers diverse yet insightful perspectives on each case alongside direction for further information. Noteworthy other examples include WSUP's work in Malindi, Kenya (WSUP, 2022), SNV's efforts in Khulna, Bangladesh (SNV, 2020), PSI's work on sanitation markets in Bihar, India (Singh & Sauer, 2020), CEWAS's study on scheduled desludging in two small towns in India (Mehta et al., 2019), IIHS's initiatives on CWIS especially focusing on community access and sanitation workers in Trichy, India (IIHS, 2020), GGGI's publication of inclusive planning in Itahari (GGGI, 2022), the Kampala Capital City Authority's documentation of the creating an enabling environment for CWIS in Kampala, Uganda (Bateganya et al., 2020), as well as ASCI's documentation of CWIS regulatory and service provision success in Narsapur and Warangal, India (ASCI, 2020a, 2020b).[19] Last but not least, in the study on Pathways to Inclusive City-Wide Water and Sanitation Services, USAID (2023) evaluates 11 successful CWIS cities and identified three primary pathways to progress, depending on the leading actor: Utility-driven, Regulator-supported and Municipality-driven. Practical suggested entry points relate to governance, actors and service delivery that will promote favourable enabling environments, which differ depending on whether efforts are focused on the utility, municipality or regulator.

18 https://iwa-network.org/projects/inclusive-sanitation/#inclusive_urban_sanitation_stories

19 SNV = Netherlands Development Organisation; PSI = Population Services International; CEWAS = Center for Water and Sanitation (CEPT University); IIHS = Indian Institute for Human Settlements; GGGI = Global Green Growth Institute, ASCI = Administrative Staff College of India.

4.

Lessons Learnt, Trends & Recommendations

This section figures as concluding chapter, summarising overarching reflections, quickly recapitulates identified gaps and/or shortcomings as well as emerging issues throughout the previous sections and closes with a short suggestions on how to continue evolving a CWIS framework.

4.1. Overarching Reflections

In the past eight years, CWIS as a concept has gained significant attention. The slightly varying interpretations of CWIS have led to different sets of principles and frameworks. The underlying aspects of CWIS within these, however, remain mostly similar.

Publications on CWIS range from original research articles, guidelines, policy briefs, to case studies, calls for action, reports and CWIS implementation plans. Only 27 of the 77 are research articles, and the rest are grey literature. The diverse set of authors of these publications show that CWIS has had organic uptake. Yet, most of the prominent publications have received direct funding or have been written in collaboration with the major proponents of CWIS, including BMGF, World Bank, ADB and others.

The topics covered by these publications are wide ranging and include conceptual development, institutions and regulations, service models and financial arrangements, equity, social inclusion and gender, planning, mix of technologies, public and environmental health, capacity development and decision support tools, and implementation experiences. Across the reviewed publications, the following pattern is visible: concept-wise, the BMGF CWIS Framework is the most influential/represented. Content-wise, institutions and regulations and planning have the major share of publications, while technologies, and public and environmental health have the least. This is not to claim that CWIS sees the latter as less important, but simply that the latter have had major coverage in conventional urban sanitation literature, and CWIS seems to have given an impetus for focus on the 'software' of urban sanitation. Author- and target-audience-wise, the majority of the 'actionable' publications are written by and intended for practitioners working in the institutional and regulative setting of water and sanitation service provision (government officials, public administrators, regulators and utilities).

It is widely acknowledged that achieving targeted CWIS outcomes relies heavily on an 'enabling environment'. A well-defined institutional and regulative setting was considered the essential precondition for implementing CWIS – and is arguably the most discussed topic. There is increasing agreement on the components of an enabling environment for sanitation, which typically include policy and strategy, institutional arrangements, sector planning and monitoring, budgeting and finance, and capacity development. While participative 'bottom-up' elements such as stakeholder engagement and household demand are essential components, particularly for equity, the predominant focus on 'regulation' and 'institutional' issues gives the impression that CWIS currently is still implemented as a top-down approach.

A parallel focus in the reviewed literature is directed to business/financing models and private sector involvement, which are expected to lead to more equitable and sustainable services while at the same time fostering resource efficiency and innovation. Ironically, the main reported barriers to private sector involvement were identified in a lack of clarity in institutional and regulatory roles and responsibilities, which results in poor coordination among the public and private actors involved. Furthermore, scaling the CWIS approach requires recognition that public investments and targeted subsidies are integral to equitably distribute costs between socioeconomic groups and generations. Therefore, there is consensus in the literature that a twin pronged approach of private sector involvement in a fostering regulatory environment including sustainable financing for the overall sector through (a mix of) taxes, transfers and tariffs (3Ts) is essential for CWIS as otherwise private sector roles can also not be sustained.

4.2. Gaps and Emerging Issues

Despite having the bulk of the literature on institutions and regulations, the CWIS literature landscape does not bring together coherent policies, governance, institutions, regulations and funding necessary for ensuring the sustainable provision of services. For a policymaker wishing to adopt the CWIS approach, there is insufficient evidence and practical guidance on effecting holistic change. However, the World Bank's recent report on policies, institutions and regulations for water supply and sanitation provides a roadmap for sector reform in providing safely managed services, albeit not using a CWIS lens (Bank, 2022).

Integration and coordination of efforts with other related sectors, including water supply, storm-water and solid waste management among others, to address circular economy principles is increasingly emphasised. However, there is still a clear lack of data and guidance on how such an integration should take place and how scale of integration is determined by the context in question.

The reviewed CWIS Frameworks all have endorsed equity in their principles but lack a shared understanding of what it encompasses and how it is operationalised. There is a need for an unambiguous and globally relevant terminology and guidelines for including specific groups needing attention. The Assessment on Health, Safety and Dignity of Sanitation Workers, the resource page on Disability-Inclusive WASH[20] and the insights on Strengthening Gender Integration in Sanitation Programming and Policy are valuable starting points (Bank et al., 2019; Kumar et al., 2023; UNICEF, 2020).

[20] https://www.internationaldisabilityalliance.org/DisabilityInclusiveWASH

Climate change exacerbates the sanitation crisis (Hyde-Smith et al., 2022) and vice-versa (Johnson et al., 2022). Despite the link of mitigation and adaptation between sanitation and climate change, the CWIS landscape barely covers climate change and its adverse effects on public/environmental health and (infrastructure) resilience/vulnerability. Yet, literature on climate resilient sanitation is growing with a landscape study on various developments in the sectoral intersection (Willetts, Kumar, et al., 2022) and new assessment frameworks (Howard et al., 2021; Mikhael et al., 2021; Willetts, Priadi, et al., 2022).

Lastly, while capacity development has been integrated in CWIS implementation examples, the social and behavioural change aspects at the user and practitioner level remain limited, which represent a barrier to strengthening bottom-up operationalisation of CWIS. Various planning frameworks and decision-support tools for CWIS are available. However, for informed decision-making and effective use, tools demand valid and reliable data and require high levels of skills for data analysis. There are not enough theories of change or empirical evidence to make most of these tools worth learning and using for practitioners. Thus, increasing cross- and in-country networking/collaboration to support capacity development with tailor-made learning formats (self-paced, on/offline, blended) for public and private actors are essential, including internationally recognised certification/diploma standards.

4.3. Evolving the CWIS Framework

As outlined during the preliminary observations (see chapter 2.3), a shared understanding on several ‘foundational CWIS elements’ across the reviewed frameworks exists. Redefining sanitation from a service delivery rather than an infrastructure viewpoint, the CWIS frameworks target equitable, safe and sustainable service provision. Emphasising a long-term (process) perspective that guides evidence-based, strategic and incremental improvements, the frameworks consider the entire sanitation value chain and promote the coexistence of sewered and non-sewered technologies to protect public and environmental health. Adequate implementation and political prioritisation depends on political will, comprehensive regulation with clearly defined institutional roles and responsibilities as well as a range of funding sources and business models with performance targets, monitoring and enforcement

serving as accountability mechanisms. By fostering active engagement of relevant stakeholders, contextualised solutions developed with local knowledge should increase adequacy, ownership and overall legitimacy, thus foster responsibility and accountability, and, ultimately, promote equity and sustainability.

In consequence to the previously identified gaps and emerging issues, there is a need for a globally unambiguous terminology in general and for 'equity' in particular. Moreover, and addressing the aspiration to be a holistic concept and addressing circular economy principles, the critical link between climate change and sanitation must be conceptually recognised and the need for integration of/coordination with other basic urban services included.
In addition, while innovative financing mechanisms for increasing private sector involvement may be a solution applicable in specific contexts, there is a need to strengthen the importance of the public sector mandate, which requires clearly delineated institutional roles and responsibilities and advocates for public investments and targeted subsidies, including establishing transparent accountability mechanisms for effectively monitoring and enforcing CWIS. This requires capacity development in both the public and private sector. At the same time, there is a need for strengthening bottom-up operationalization and adopting user-centric concepts as approaching sanitation with a market-based lens can overshadow citizens' rights to safe water and sanitation.

Following these conclusive remarks, there is scope to strengthen the existing CWIS principles and their accompanying frameworks in two important ways:

1. Address and incorporate the major gaps identified through this review, preferably by evolving towards a single, 'unified' CWIS framework and highlighting their significance at the principle level.
2. Create an actionable framework that guides implementation on the ground. This has to cater to a variety of actors, including the major service providers, that is water and sanitation utilities.

Such a framework needs to be built on a wide consultation and endorsement. It must not reinvent the CWIS wheel but rather build on the existing foundations presented in the landscape of CWIS literature available and curate the relevant knowledge products in alignment to the revised CWIS principles that would be developed in future.

5.

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About the IWA Inclusive Urban Sanitation Initiative

The initiative responds to a huge and growing public need – safe sanitation in combination with access to safe drinking water and hygiene underpins good health. The aim of this initiative is reshaping the global urban sanitation agenda by focusing on inclusive sanitation service goals and the service systems required to achieve them – rather than the traditional singular focus on expanding sewer networks and treatment works. This forms part of IWA's larger agenda to promote inclusive, resilient, water-wise, and sanitation-secure cities. This initiative is being progressed through a dedicated campaign #SanitAction to garner support and collaborative action.

About the Inclusive Urban Sanitation Discussion Papers

The initiative aims to produce a series of publications – books, position papers, and discussion papers. The discussion papers present analyses and findings from research and/or reports of projects, and programmes of the sanitation sector to instigate discussion among the sanitation community.

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