IRC

WORKING PAPER

Building strong WASH systems for the SDGs

Understanding the WASH system and its building blocks

Angela Huston and Patrick Moriarty

Supporting water sanitation and hygiene services for life

With the IRC WASH systems series we explore and connect you to the latest thinking around safe water, sanitation and hygiene services that last.

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This paper presents current thinking within IRC, which has emerged and developed over time with significant contributions from IRC colleagues past and present, as well as other sector colleagues with whom we have collaborated. Many of their names appear in the references for specific building blocks.

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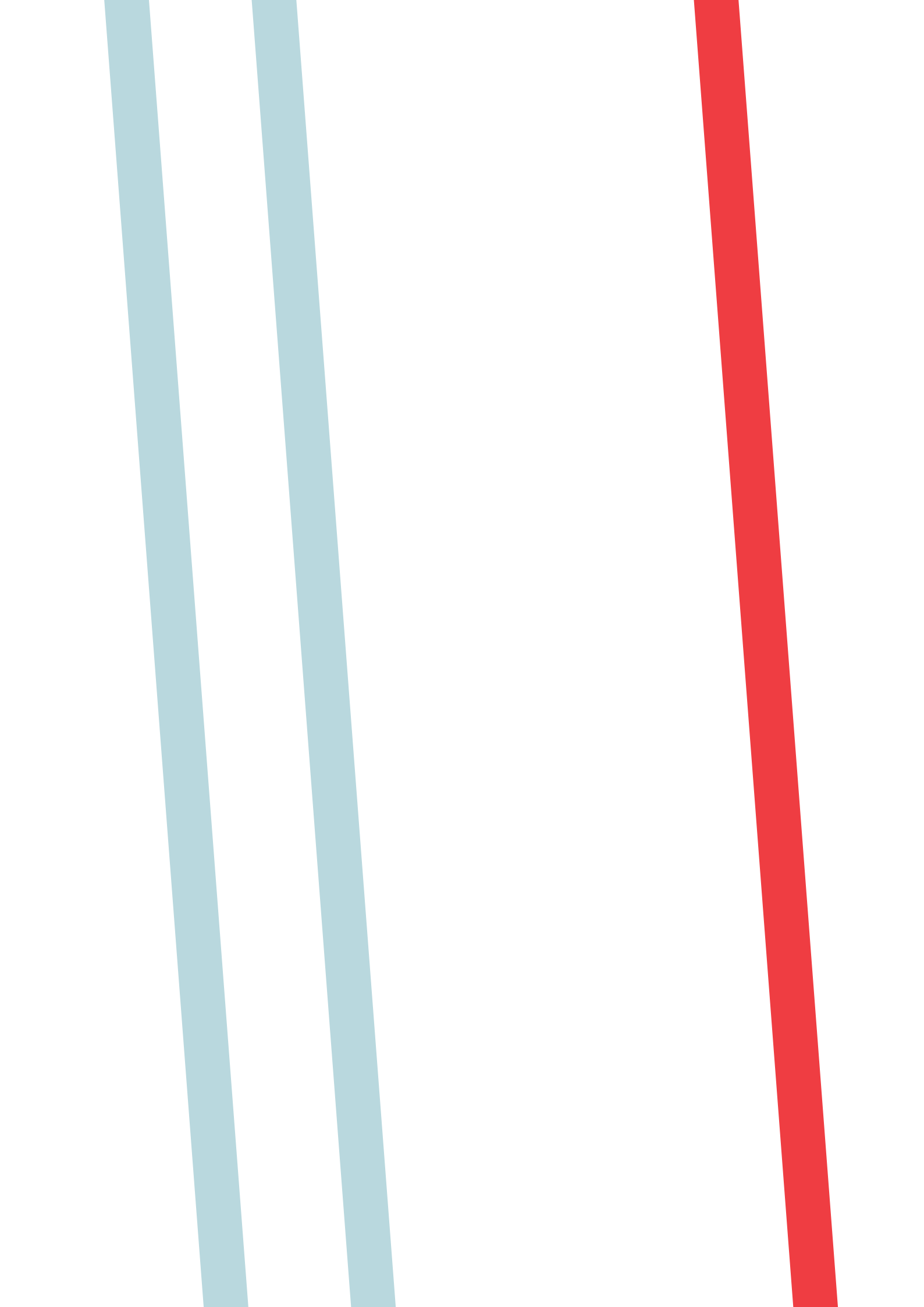

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Abbreviations

AMCOW	African Ministers Council on Water
CapManEx	capital maintenance expenditure
DfID	Department for International Development
FSG	a consulting firm
IRC	WASH think-and-do tank based in The Hague
NGO	non-governmental organisation
O&M	operation and maintenance
OpEx	operation and maintenance expenditure
QIS	qualitative information system
SDG	Sustainable Development Goal
SDM	service delivery model
SuSanA	Sustainable Sanitation Alliance
SWA	Sanitation and Water for All
TrackFin	tracking financing (to WASH)
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WASH	water, sanitation and hygiene
WASHBat	WASH Bottleneck Analysis Tool
WatSan	water and sanitation
WRM	water resource management

Glossary

Different definitions of these terms can be found in academic literature. The definitions below are those we work with in IRC.

actors and factors the complex network of human and non-human elements that make up a system. See actors, factors.

actor a stakeholder that directly or indirectly influences the WASH system. Actors may be specific individuals or organisations (e.g., water operators, health extension workers, water committees, non-governmental organisations and government agencies) or international entities with less direct links to the local system. See factors.

complex adaptive system a system in which independent agents (actors and factors) interact in such a way that the outcome is difficult or impossible to predict. A system is complex if the interactions are dynamic, and it is adaptive if it responds to changing stimuli. There is some debate as to whether (rural) WASH is really a complex adaptive system or just complicated. See Cynefin framework.

Cynefin framework a structure developed by Dave Snowden that distinguishes amongst complex, complicated, obvious and chaotic systems.

downtime the time that a WASH facility or scheme is non-functional.

facility infrastructure for collecting, treating, distributing and using water or for containing, collecting, transporting, treating and disposing or reusing faecal waste. Facilities include pumps, pipes, wells, tanks, toilets and septic tanks.

factor a non-human element, aspect, or component of a system that directly or indirectly influences system functioning or outcomes. See actor.

feedback loop the amplification or reduction of an effect that results from interactions amongst different parts of a system. For example, poor service reduces people's willingness to pay, which in turn leads to further deterioration in the service. Another example is pure information feedback, through analysis and reflection on data, lead to results based decision making that effect action in the system. Feedback loops may be positive or negative.

leverage point a conceptual place in a system where a small action or change can be expected to trigger a major shift.

political economy used broadly here to describe the driving forces and power dynamics within which a system operates. The term emphasises the fundamental link between politics and economics in determining what is possible in a given context. Of course, the political economy of a country is itself a system.

praxis practice that is informed by theory, and vice versa. The term suggests the necessity (when operating within a complex-adaptive system) of continually adapting theory in the light of practice, whilst using theory to attempt to predict possible outcomes of practice.

scale the temporal or spatial boundaries within which decisions are made. For example, a river basin, a country, a district and the coverage area of a water supply scheme are all different (and overlapping) spatial and administrative scales.

scaling the horizontal or vertical expansion or application of an idea, programme, solution or concept.

scheme a combination of facilities and their management. For example, a water supply scheme may consist of pumps, pipes and taps managed by a board and an operator.

service authority the entity legally responsible for WASH services in a defined area. A service authority must ensure the quality of the service and the performance of the service provider; it may hold delegated functions of regulatory power.

service delivery model the legal and institutional setup for the provision of WASH services. A service delivery model includes all links in the value chain, the method of provision, the end use of services and the level of service delivered. Examples include a community water supply, a utility's sewerage service, and water kiosks managed by a small private provider.

service level the quality or standard of service, measured by criteria set by national standards and/or the norms for Sustainable Development Goal 6. The

criteria for water include quantity, quality, reliability and accessibility; for sanitation, they are accessibility, use, reliability and environmental protection.
service provider the entity responsible for day-to-day management of WASH services, including operation and maintenance.

socio-technical system an arrangement that comprises social interactions and technical components. A socio-technical system can be viewed as technical resources embedded in a social network, or as social elements existing in a technical system. For example, a water supply scheme has technical components (e.g., pumps and pipes) and social aspects (e.g., citizen demand, competing priorities of different users).

sub-system a small system that is part of a larger system. See system-of-systems.

system of systems an arrangement consisting of small sub-systems that together perform a complex function. Whether actors and factors are viewed as a system or sub-systems often depends on the scale. See scale.

systems thinking seeing and understanding systems as wholes, paying attention to the complex and dynamic interactions and interdependencies of its parts. Systems thinking is an alternative to reductionist approaches that focus on individual components of a system.

WASH system all the social, technical, institutional, environmental and financial factors, actors, motivations and interactions that influence WASH service delivery in a given context.

wicked problem a complex, persistent situation with no obvious solution and whose boundaries, scale and outcomes are difficult to determine. Wicked problems are common in socio-technical systems.

Executive summary

This working paper is one of a series that explains IRC's emerging praxis for working with and strengthening WASH systems. It describes our action-informed understanding of what is needed for a strong and healthy WASH system.

The working paper focuses on the 'what' of IRC's praxis: our understanding of what a healthy and effective WASH sector looks like and the building blocks that are foundational for improving and sustaining WASH service delivery.

We use WASH system to describe all the people, components and functions that are needed to deliver WASH services. The WASH system includes all the actors (people and institutions) and all the factors (infrastructure, finances, policies and environmental conditions) that affect and drive the system.

A systems approach is not a specific intervention type. It is a philosophy of action, a way of working that recognises the complexity and fundamentally inter-linked nature of the real world. Instead of trying to ignore complexity – for example, by focussing on a specific, time-limited project – a systems approach engages with it in the belief that doing so will lead to solutions that are more meaningful and more sustainable.

Engaging with this complexity requires the ability to break it down, make it manageable and simplify it to a practical level that can support action, whilst still maintaining a whole system perspective.

By combining tools from complexity science with our knowledge and experience of the WASH sector, we can improve our way of working.

This paper presents a set of nine building blocks of WASH systems intended to reduce complexity to a manageable level, enabling and supporting action whilst neither oversimplifying reality nor losing sight of the entirety of the broader WASH system.

By assessing the condition of each of the building blocks – institutions, policy and legislation, finance, regulation and accountability, monitoring, planning, infrastructure, water resource management, and learning and adaptation – and of the linkages between them, WASH practitioners can identify weak points and target their interventions for greater effect.

An accompanying paper focusses on the 'how' of systems strengthening; how the different actors within the WASH system can be supported to take part in collective action that leads to strengthening the system. The building blocks support this action, particularly at the stage of initial analysis. A third paper discusses how to monitor and measure the strength of the WASH system, a critical step in assessing the effectiveness of systems strengthening work.

Also relevant is the Agenda for Change district roadmap to universal access to sustainable services that provides a more applied approach to strengthening the WASH system and its building blocks at the district level.

1. Introduction

IRC's vision is of a world in which everyone has access to water, sanitation and hygiene (WASH) services. This vision is given expression in the Sustainable Development Goals, particularly Goal 6, to 'ensure availability and sustainable management of water and sanitation for all' by 2030.

IRC believes that the delivery of safe and sustainable WASH services to everyone requires strong WASH systems, nationally and locally. Our mission is to drive the creation and/or strengthening of those systems in the districts and countries where we work, and to stimulate their creation everywhere through the sharing of knowledge and practical experience.

IRC's approach is rooted in a constantly evolving 10-year praxis: an approach and way of working that continually iterates between applying theoretical understanding to practice and adjusting theory based on experience.

This working paper introduces both our understanding of systems thinking as it applies to WASH, and the building blocks that we have adopted as a way of understanding and tackling the complexities of the WASH system. Strengthening the WASH system is integral to delivering safe and sustainable WASH services.

1.1. OBJECTIVES, SCOPE AND AUDIENCE

This working paper is part of a series that presents the foundations of IRC's approach to strengthening WASH systems[1]. It sets out IRC's understanding of systems thinking as it applies to WASH and to the WASH system. It introduces and explains the nine building blocks that IRC uses to reduce the complexity of the WASH system to allow for effective prioritisation and engagement with actors in the system and for monitoring of progress in strengthening the system. It describes how we use our theoretical understanding of the WASH system to structure our interactions with the system's actors and factors. It considers aspects of systems thinking, such as boundary and scale, but it is not a scholarly piece.

The primary audience is WASH sector professionals who are currently applying or interested in adopting a systems approach in their work.

This document is part of a series of documents that outline IRC's approach to strengthening the WASH system. A second paper focuses on how IRC approaches supporting and strengthening the WASH system, and a third paper focuses on approaches to monitoring WASH systems. Additionally, the Agenda for Change roadmap to universal access to sustainable services offers more specific guidance on improving WASH systems at district level.

1.2. STRUCTURE OF THE PAPER

Section 1 provides the background to IRC's approach to strengthening WASH systems.

Section 2 presents an overview of IRC's approach and the building blocks. It introduces both systems approaches and the WASH system. It explains IRC's emerging praxis and the key concepts for applying a systems approach to WASH. It introduces the concept of building blocks as a practical tool for engaging with the complexity of the WASH system.

Section 3 describes each of the nine building blocks.

Section 4 offers examples of how the building blocks approach can be used to plan, analyse and reflect on initiatives to strengthen WASH systems.

Section 5 looks at next steps for this evolving body of work.

Section 6 lists sources and provides links and references to additional information for each building block.

1.3. BACKGROUND TO IRC'S WASH SYSTEMS PRAXIS

IRC's approach is informed by our understanding of WASH services and their sustainability (Lockwood & Smits, 2011). We refer to this approach as a praxis (meaning the application of theory in a practical way) to underline how, in our work, theory informs practice and lessons from practice are used to adapt theory.

Three decades of international investment in infrastructure-driven solutions has failed to produce the anticipated benefits, and WASH services in most

[1] The terms WASH systems and the WASH system are used interchangeably in this document. The latter is defined as a system of systems, composed of multiple systems. It is part of the nature of a systems approach that boundaries are ultimately determined by context.

lower-income countries are hardly worthy of the name: they are characterised by low reliability, lack of quality and intermittency (Schouten & Moriarty, 2013; Foster, 2013; RWSN, 2010). Problems include poor planning, inadequate financing for maintenance and inappropriate infrastructure (Lockwood et al., 2016; Burr & Fonseca, 2013; Butterworth et al., 2010). Decisions made in the sector at both local and international levels may be based on insufficient evidence or implemented without a systematic consideration of the context (Braimah et al., 2010). Since monitoring of new infrastructure often ends shortly after project completion, long-term data on the sustainability of the outcomes are limited.

For decades, IRC witnessed the persistent failure of a WASH paradigm that ignored difficult areas of the WASH system, such as institutional reform (Lockwood et al., 2016). External providers of WASH infrastructure may recognise the need for strong institutions, but building new infrastructure is far easier (and more amenable to being bundled into projects) than strengthening the broader system.

Recently, however, there has been a shift in approach – from building infrastructure to providing water, sanitation and hygiene services, defined in terms of quality, quantity, reliability and cost. This more human-centred understanding emphasises improving livelihoods and requires a more holistic understanding of the many actors and functions that must work together to build and sustain the infrastructure and WASH services (Lockwood & Smits, 2011).

Service provision is more complicated than one-off projects or programmes and is difficult to plan and finance through a series of projects (Burr & Fonseca, 2013). It involves not just recurrent maintenance costs but also consideration of other sector dynamics that affect sustainability: amongst them, legislation, institutional performance, information systems and environmental conditions. The interactions and collective performance of all these aspects lead us to the understanding that WASH provision takes place in an undeniably complex system. For services to be provided and maintained, every actor and every aspect of the system need to function, be effective and be adaptable.

Figure 1 illustrates the complex web of actors at different institutional levels dealing with different elements of WASH, all of whom need to function smoothly and align their efforts so that WASH services can flow (IRC, 2015).

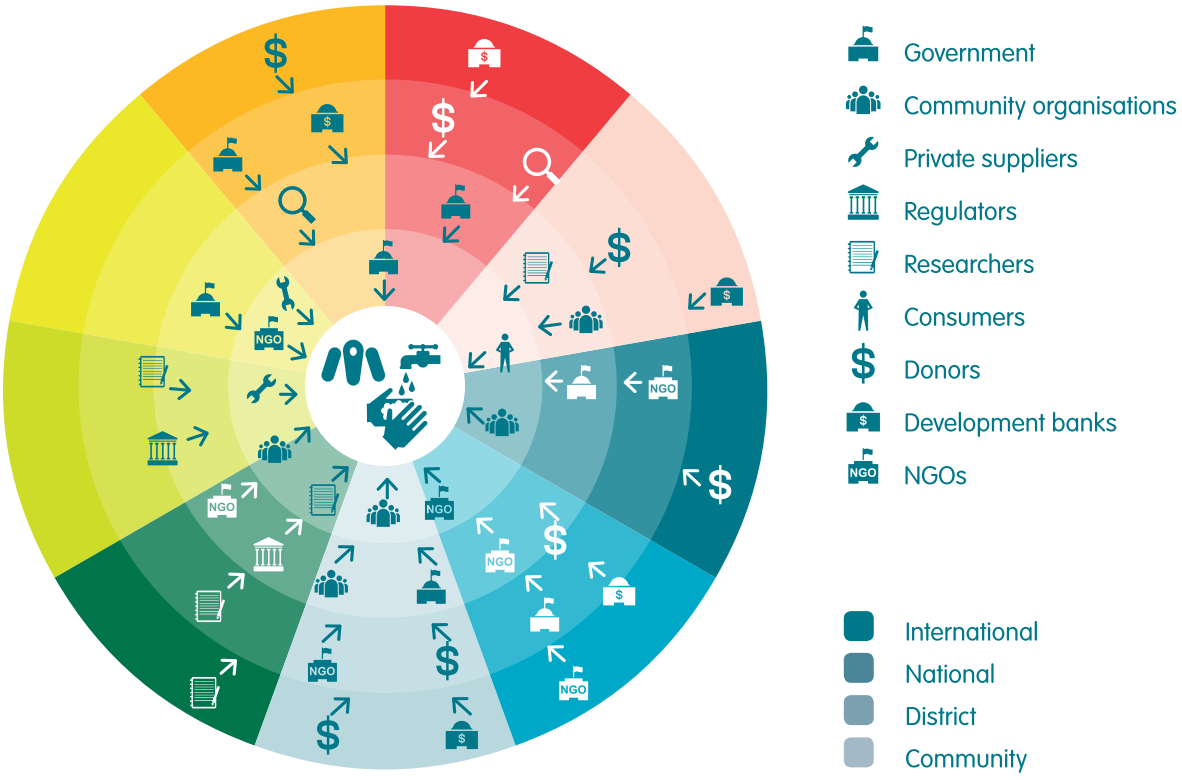

FIGURE 1 ACTORS (AND FUNCTIONS) REQUIRED TO DEVELOP AND MAINTAIN WASH SERVICES AT DIFFERENT ADMINISTRATIVE LEVELS. THE SPECIFIC STAKEHOLDERS MAY DIFFER WITH EACH WASH COMPONENT, BUT ALL SUCH NETWORKS ARE COMPLEX.

Over the past decade IRC has developed its praxis to building strong national and local WASH systems in response to perceived failures and challenges of WASH services. IRC's work is based on experience in stable states with 'good enough governance' (De la Harpe, 2007). Figure 2 shows how we seek to act as a change hub to strengthen WASH systems to improve service levels and achieve impact.

Initially, IRC championed service delivery as a competing narrative to the infrastructure-based paradigm of the Millennium Development Goals. Today, IRC emphasises the need for strong WASH systems to deliver lasting WASH services and meet the Sustainable Development Goals[2].

FIGURE 2 IRC'S HIGH-LEVEL THEORY OF CHANGE FOR STRENGTHENING WASH SYSTEMS TO IMPROVE LIVES.

[2] For IRC's more detailed theory of change, please see IRC Strategy Framework 2017-2030. Available at: https://www.ircwash.org/sites/default/files/084-201706strategy_doc_v1.0defprint.pdf.

2. Systems approaches and WASH

This section introduces concepts from systems theory and shows how they can be applied to the WASH sector. In particular, it introduces the WASH sector as a *complex adaptive system*, composed of multiple actors and factors, all of which must be aligned to a set of agreed outcomes.

Our understanding is that the delivery of WASH services relies on an entire, complex and interlinked WASH system, and that WASH sector reform requires the ability to engage with and strengthen that system as a whole (Schouten & Moriarty, 2013).

The rapidly advancing science of systems offers tools and solutions for unpacking and dealing with complexity (Burns & Worsley, 2015; Casella et al., 2015; Trémolet & Prat, 2017).

BOX 1. SYSTEMS THINKING IN WASH: A GROWING MOVEMENT

IRC is not the only organisation in the WASH sector talking about systems approaches. The Sanitation and Water for All partnership is rooted in systems thinking and champions an approach based on building blocks and behaviour change. IRC and other organisations participating in the Agenda for Change have adopted systems approaches. The Conrad N. Hilton Foundation's new Safe Water Strategy is equally grounded in systems thinking, as is the Sustainable WASH Systems Learning Partnership and the USAID Local Systems Framework, both developed by the US Agency for International Development (USAID). The World Health Organization's progressive work on health systems strengthening has also influenced the approaches being used in sanitation and hygiene. UNICEF has explored systems thinking in the arena of child protection (Wulczyn et al, 2010) and through initiatives like UNICEF's WASHBat (a bottleneck analysis tool) and the World Health Organization's TrackFin (for tracking financing for WASH). The Department for International Development (DfID) and the World Bank have also made efforts to align their strategies with systems thinking.

See also IRC blog: http://www.ircwash.org/blog/cautiously-optimistic and SuSanA Thematic Discussion: http://forum.susana.org/forum/categories/218.

2.1. COMPLEX ADAPTIVE SYSTEMS

Some systems are linear and mechanistic: one action is certain to lead to a specific chain of results. Others are non-linear: behaviour is not predictable, and any given action could cause an indefinite number of reactions.

The WASH system, a *socio-technical system*, exhibits non-linear behaviour. This, amongst other characteristics, has led IRC and many others to refer to WASH as a complex adaptive system (Casella et al., 2015). Complex adaptive systems theory has been used as a framework to understand community local development as a whole (Neely, 2015) and the WASH system specifically (Butterworth et al., 2010).

The WASH system, like other complex adaptive systems, is made up of multiple actors, or *agents*, who are capable of learning and adapting to new information. Control of a Complex Adaptive System is dispersed amongst these agents, and although the system overall is resistant to directed change, evolutionary change is possible and even likely over time as the actors alter their behaviour and adapt in response to changes in environment or incentives (De Savigny & Adam, 2009; Sterman, 2006; Meadows, 2008).

Viewing WASH, and in particular rural WASH, as a complex adaptive system is central to IRC's praxis. Complex adaptive systems are notoriously difficult to describe, and they can change in unpredictable ways (Casella et al., 2015). They do not necessarily reach an equilibrium; rather, they are characterised by constant change and evolution over time in response to internal and external drivers. They may achieve periods of temporary stability but they retain the potential to adapt when the context changes.

This kind of evolutionary change is different from mechanistic change because the final result cannot be predicted based on knowledge of the present.

This does not mean that change cannot be achieved: far from it. But it does mean that change is not linear. One cannot simply write a new policy and watch the effect cascade through the entire system in a predictable way. Rather, one introduces a new policy, monitors the results and, when these deviate (as they will) from what was intended, makes adjustments – or perhaps shifts attention from the policy itself to incentives linked to the policy[3].

The point about nurturing change in complex adaptive systems is that the process never ends (Burns & Worsley, 2015). This understanding

[3] The complementary working papers on monitoring the WASH system and using learning alliances to stimulate change go into more detail about how to do this in practice.

underpins IRC's focus on learning, feedback and reflection mechanisms that allow for continual course correction.

System complexity is not unique to WASH service delivery; the way of thinking about it is relevant for dealing with public service provision more broadly and for addressing other socio-technical systems.

Supporting the WASH system and its core elements, particularly through a multi-stakeholder, learning-oriented approach, can serve as an entry point for improving other public services and functions.

Because of shared characteristics, learning about change in other complex systems such as health or education, can inform our study of the WASH sector (Casella et al., 2015).

BOX 2. WASH: ONE SYSTEM, OR THREE?

WASH: water, sanitation and hygiene.

The acronym, adopted in the early 2000s to replace the more prosaic WatSan, unites the three linked aspects of health- and water-related social services. This conveys the message that achieving health benefits depends on three mutually reinforcing aspects: clean water, safe sanitation, and changed hygiene behaviours.

In reality, however, the WASH system involves actors working in separate silos. Particularly in rural areas, drinking water and sanitation have often followed quite different development paths, to the extent that they are hardly linked at all. This is most visible in service delivery models that take a communal approach for water but a household approach for sanitation.

IRC's building blocks speak to all of WASH, and not just because of Sustainable Development Goal 6's focus on universality and safety along the entire service delivery chain, from river or aquifer to household for water, and from latrine back to the environment for sanitation. In practice, we are far from achieving the integrated service delivery chains demanded by the SDGs, and differences between the application of building blocks in WASH sub-sectors remain. Sub-sector differences of emphasis are highlighted in Section 4.

Concepts critical to working with such systems – *leverage points* and *outcomes*, *actors* and *factors*, and *boundaries* and *scale* – are discussed in the next sections.

2.2. LEVERAGE POINTS AND OUTCOMES

Two basic steps to achieving meaningful change are agreeing on the desired outcome and identifying leverage points that may help to get there. Leverage points are places where a small action can be expected to trigger a major shift, even though the chain of reactions cannot be predicted or monitored precisely (Meadows, 1999). A leverage point may be at the intersection of several seemingly unrelated issues. For example, insufficient local government capacity might be a leverage point for addressing inadequate operation and maintenance, poor performance and regulation of service providers, and general inequality and the absence of a pro-poor policy.

Leverage points are not to be confused with 'root causes' in complex adaptive systems, since many factors are interlinked and there is no central control mechanism of the system (Burns & Worsley, 2015). Long (1995, p. 127) writes, 'Planned intervention is an on-going, socially constructed and negotiated process, not simply the execution of an already specified plan of action with predictable outcomes'. Finding leverage points and targeting them can offer logic and a more systematic approach to the negotiation.

Commonly, for example, WASH investments are repeatedly made in the same district or community whilst neighbouring areas remain underserved. This behaviour may conflict with the desired outcome of equity of access to services. One leverage point may be the annual budget allocation process at the national level. We could seek to exploit this leverage point by publicly sharing data or evidence of the inequality to help decision makers see the problem or apply political pressure for more equitable allocations. An unintended consequence may be that a budget sufficient to provide services to one area cannot cover additional areas with more people, leading to poorer services for all (a form of equity – but not the one desired!). This in turn would lead to a search for leverage points to increase funding, and so on.

That is a very simple example of using a leverage point to change planning and budgeting practices. In WASH systems, one action is usually inadequate to change the final service delivery outcome, but knowledge of leverage points can identify major roadblocks to change and help prioritise actions.

The system itself is blind to outcome. If the current rural WASH sector provides outcomes that are unsatisfactory, the challenge is to shift the system towards a state that provides better outcomes. Understanding WASH as a complex adaptive system helps us understand our experience in attempting system-wide change and provides insights on how to trigger a shift.

IRC's desired outcome is sustainable service delivery for all. Other actors, however, may be driven by other outcomes. For example, for some, the WASH system may be a source of income, a way to win an election, or an opportunity to finance development; for them, improved services could in fact be a secondary outcome. Even IRC has other related goals that influence our behaviour in the system: as a non-profit organisation, we also have a need to secure funding and maintain our ability to function as resource centre and change hub for the sector.

Perhaps the most important implication of seeing WASH as a complex adaptive system, with an inherent lack of predictability, is the centrality of monitoring and information sharing to achieving progress.

Only by being clear on the desired outcome and constantly monitoring progress towards that goal can we make the necessary adaptations to achieve it. Thus monitoring for learning and adaption becomes critical and requires not only evaluative processes but also a continual cycle of reflection and response (Burns, 2007).

Learning to understand the current state or behaviour of the system, and agreeing on the desired outcome are essential first steps toward transforming it. (Burns & Worsley, 2015)

As in all change processes, it is essential to develop a vision for the desired future state and then work backwards to identify possible pathways to that outcome[4]. To do this, we need agreed benchmarks or indicators that help us assess progress and observe how the system is shifting.

IRC's learning alliance approach, which is a mechanism for achieving collective impact[5], is our way of stimulating this change (Lockwood & Duti, 2015).

IRC emphasises monitoring not only for evaluation but as an essential part of the process that helps multiple stakeholders align their thinking and understanding to more effectively achieve a collective vision. In a learning alliance, stakeholders agree on a joint vision and plan, then identify progress markers to guide observation. They reflect on the data and eventually adapt or improve the concept behind the plan. Successful efforts are scaled up. Thinking in systems terms, we work with stakeholders to develop an underlying logic about how interventions might influence the factors that contribute to persistent issues (e.g., non-functionality of rural handpumps).

BOX 3. LEARNING ALLIANCES: A TOOL FOR DRIVING SYSTEMS CHANGE

IRC's approach is to work with broad partnerships of diverse stakeholders – learning alliances – with whom we have developed concepts and tools that underpin our approach to strengthening WASH systems, including life-cycle costing, service level monitoring and models for post-construction support.

Learning alliances were an outcome of our work in the early 2000s on strengthening community management. From 2008 to 2015, the WASHCost and Triple-S programmes, amongst others, allowed for further development and documentation of this way of working (McIntyre et al, 2014).

Bringing together actors from multiple levels (local, sub-national, national) shortens communication and information feedback loops and enables effective collective action. Learning alliances use a continual cycle of planning-acting-observing-reflecting to improve WASH systems while building a rich library of experience and good practice (Smits et al., 2007).

Learning alliances (or similar forms of collective action) and how to support their inception and effective working are the subject of a companion working paper in this series.

2.3. ACTORS AND FACTORS

Delivering universal access to sustainable WASH services requires a strong and capable national WASH system, one with the actors and factors needed to develop and maintain services over time (Figure 3). Actors range from individuals in a rural household to large national institutions, including the private sector, civil society and public agencies, all of which play a part in delivering or using WASH services and thus in achieving the goal of universal access. Factors are system elements and influences: technologies, markets, cultural and social norms, and aid mechanisms, all of which are complex and interlinked.

Tools for studying the dynamic interactions in complex socio-technical systems include organisational network analysis and agent-based models (Casella et al., 2015). For guidance in using them, see Walters and Javernick-Will, 2015, and Boulten et al., 2015.

[4] Global statements of intent like the SDGs help define agreed outcomes and avoid 'wicked problems', issues that are extraordinarily difficult to address because even the desired outcomes are contested. A good example is climate change: some people deny it altogether, and there is little agreement on what a desirable end-state looks like.

[5] Collective impact is a framework for change articulated by FSG (www.fsg.org) and used for structuring collective action to motivate change in complex social environments. See http://www.ssireview.org/articles/entry/collective_impact.

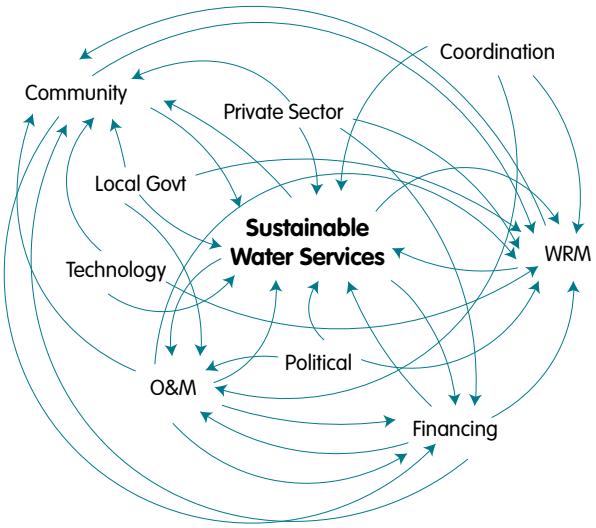

FIGURE 3 MODEL OF THE INTERACTION OF ACTORS AND FACTORS THAT INFLUENCE WATER SERVICE SUSTAINABILITY. SOURCE: VALCOURT ET AL., 2018. O&M = OPERATION AND MAINTENANCE. WRM = WATER RESOURCE MANAGEMENT.

We believe that although modelling complex systems may be useful, it is not essential to reach a full understanding of the system in order to effect change.

System complexity is not unique to WASH service delivery; the way of thinking presented in this paper is relevant for dealing with public service provision more broadly or addressing other desired or undesired outcomes observed in socio-technical systems. Supporting the WASH system and its core elements, particularly through a multi-stakeholder, learning-oriented approach, can serve as an entry point for strengthening society's ability to provide and maintain other services and functions.

2.4. BOUNDARIES AND SCALE

A system is, in essence, defined by its boundaries – what is part of the system and what is not. Embracing a systems approach means being comfortable with the concept of boundaries, and equally with the idea that these are seldom hard or clearly defined.

At its simplest, the boundary to the WASH system can be defined as all the actors and factors (people, organisations, actions and functions) that work collectively to produce the most important system behaviour – the provision of sustainable services that meet agreed national or global standards.

Boundaries are useful for partitioning sections of the overall complexity and simplifying the system to a manageable level. Boundaries can help distinguish WASH from broader national systems (such as health or education) or focus on certain parts of the WASH system (the building blocks). Boundaries can also be geographic or administrative and are thus closely related to the concept of scale (Figure 4).

BOX 4. SYSTEMS THINKING: WHY DID THE HANDPUMP FAIL?

The immediate cause of a broken handpump may be an exhausted piston valve. Applying a first layer of systems thinking at the community scale, we may find that the pump is broken because nobody is responsible for maintaining it, or that too many people are using this pump because there are not enough water sources.

Thinking at the village scale, we might determine that handpump mechanics are available, but there is no money to pay them for the work because somebody has been stealing money from the village savings account. Or perhaps no quality spare parts are available because this handpump was made abroad and the only stockroom of parts is in the capital city, 4,000 km away.

Reflecting on the national and regional systems, perhaps we recognise that the regional government, which owns the water schemes in this village, is unaware that the handpump has failed because staff do not communicate with the local water users association. Or perhaps the district water office spent its budget on building new schemes to increase coverage, leaving nothing for repair of hardware that has already been counted towards national coverage goals. Or perhaps international NGOs had frequently visited this village and repaired or replaced the handpump, so villagers have become accustomed to waiting for someone to come and repair it.

A broken piston indeed caused the handpump failure, but systems thinking reminds us to consider all possible actors and factors when trying to resolve the issue and plan schemes that do not fall into the same failure trap.

The magnitude of the challenges faced by the WASH sector means that major change must be achieved at scale. For the WASH system, scale may be geographic or administrative (e.g., watersheds and aquifers, or districts and regions). Although WASH services are ultimately delivered locally, many of the functions that enable and facilitate service delivery occur at the sub-national, national and even international levels.

In our work, we have found the district or its equivalent (e.g., commune in Burkina Faso, woreda in Ethiopia, municipality in Honduras) to be a useful scale and a critical boundary: it contains key administrative functions and increasingly has primary decentralised accountability for delivering services yet is also small enough for directly engaging decision makers and inciting change.

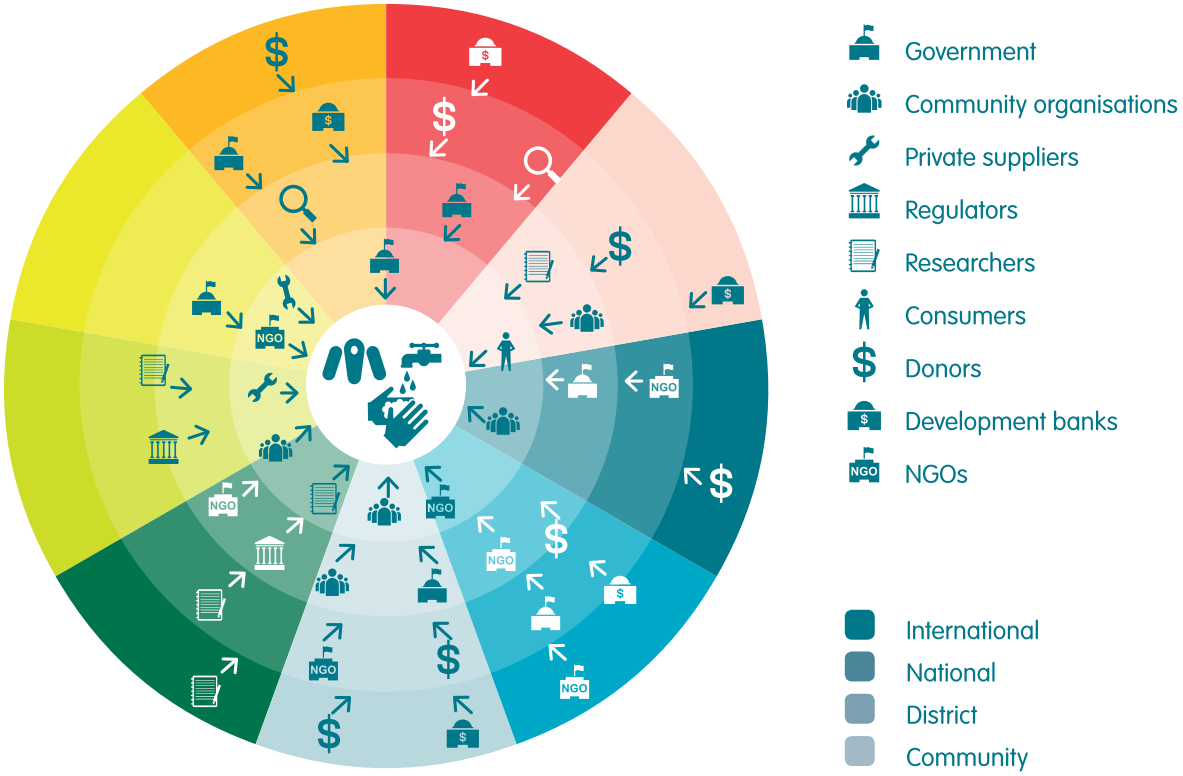

FIGURE 4 BOUNDARIES DRAWN BETWEEN ACTORS AND FACTORS AT DIFFERENT ADMINISTRATIVE LEVELS. BOUNDARIES HELP SIMPLIFY COMPLEXITY TO A MANAGEABLE LEVEL AND CAN BE CHANGED OR USED DIFFERENTLY DEPENDING ON THE GOAL OF THE DISCUSSION OR ANALYSIS. BOUNDARIES COULD ALSO BE SET BY TYPE OF WASH SERVICE (E.G., PIPED DRINKING WATER).

At the same time, our experience tells us that certain factors must be addressed at the regional or national level, and we have found the national level to be particularly important, as it is where policies are developed and major financial decisions are made.

Geographic boundaries within the natural system – and particularly the hydrosphere – are equally crucial, since WASH services are intrinsically linked to natural systems. The water basin or catchment area serves as a natural division that is important to understand, and in recent years the development of integrated water resource management has led to increased recognition of the water basin as a boundary for planning and decision making.

An organisation seeking to support systems change therefore needs to conceptualise and work across a range of scales and boundaries – whether geographic, institutional or disciplinary. It should be a 'spider in the web' (see Figure 4, above) to facilitate knowledge exchange between scale and across boundaries, to prepare the national environment to scale up successes from districts, and to build district capacity to implement national plans and policies.

IRC also engages at international levels to facilitate sharing of success more widely and to identify and bring best practices and knowledge from various contexts into our focus countries and districts.

In this, we recognise the influence of international actors and funding on the WASH systems of developing countries and advocate for those actors to adopt more sustainable and systems-based approaches.

IRC's district-centred ('district wide') approach seeks to engage and improve the WASH systems by dedicating resources to specific districts and countries that can then serve as nuclei for change in neighbouring districts and countries.

2.5. SYSTEMS FOR WASH SERVICE DELIVERY

Although it may seem obvious, the most important function of a WASH system is the sustainable delivery of safe WASH services that are used by everyone. This means that water is available at the pump or tap and in the household when needed; that all people have a safe place to defecate; that there are adequate facilities for the washing of hands and other domestic hygiene practices. The definition of the WASH system

is based on understanding what it takes to make service delivery possible and sustainable.

There are a multitude of models (service delivery models) for delivering WASH services, each using different sets of actors and infrastructure schemes to procure, develop and maintain the facilities and human resources that ultimately provide the service (Adank & Tuffuor, 2013; Bey et al., 2014).

BOX 5. SERVICE DELIVERY MODELS

A service delivery model (SDM) has the following components:

- policy and legislation at national level;
- the service to be delivered (level of quality, quantity, reliability, accessibility);
- the infrastructure used to deliver the service;
- a management system that operates and maintains the infrastructure;
- a revenue mechanism that will make the service financially sustainable; and
- support to providers at the local level.

SDMs are always country-specific and guided by the country's existing policy and legal frameworks.

These frameworks define the norms and standards for WASH services; the roles, rights and responsibilities of the providers and users of the service; and financing mechanisms at the national level. SDMs thus cut across different institutional levels. They differ by level of service delivered, type of infrastructure, asset ownership and management arrangements.

Source: Bey et al., 2014

Examples of service delivery models (SDMs) for sanitation range from household-owned pit latrines emptied by local entrepreneurs to flush toilets connected to a publicly owned and managed sewer and treatment system. Similarly, examples of service delivery models for water range from community-managed handpumps to utility-provided taps in houses.

To meet the UN's Sustainable Development Goal of *safely managed* service delivery, all SDMs must involve a chain that stretches from the individual in a household to some form of communally or professionally owned and managed infrastructure (Figure 5).

Each step along the service delivery chain may involve multiple actors, whether public, commercial or private. In practice, many people are served by a mix of SDMs. Understanding the differences is important for determining who and what is involved in improving and maintaining robust services that reach everyone.

2.6. THE CONCEPT OF BUILDING BLOCKS

Building blocks are the fundamental components that make up something larger and more complex, in this case the WASH system.

In the context of systems thinking in WASH, we use the term 'building block' to mean a sub-system of the larger WASH system.

In IRC's approach, we use the building blocks as a tool to help reduce the complexity of the WASH system. Some building blocks (e.g., monitoring) can themselves be seen as systems, in line with the understanding of WASH as a system of systems. The building blocks are a pragmatic way both to understand the inherent complexity of the WASH system and to use that understanding to develop solutions and take action.

We find the nine building blocks to be adequately broad to help us make sense of the system without attempting to overly define all detailed sub-components. The building blocks define and describe key components to serve as a framework for how we understand, assess, and identify strategic priorities for systems strengthening. Critically, identifying and working with building blocks of the system makes it possible to prioritise actions and measure progress over time at a point upstream of the ultimate goal of improved service delivery. It allows us to test and refine our understanding of how WASH systems work – and to define and evaluate the relations between aspects of the system and service delivery.

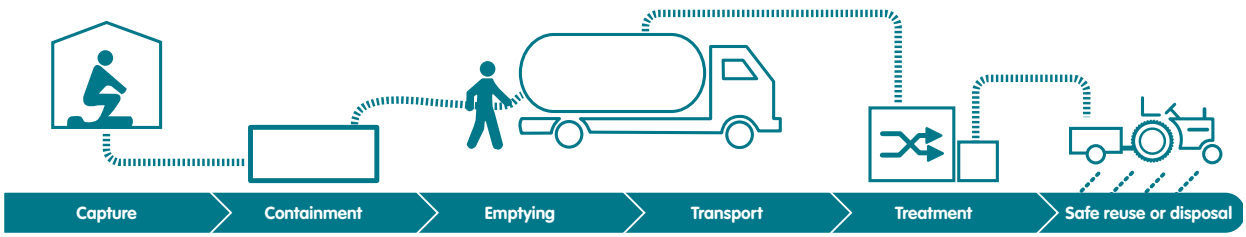

FIGURE 5. CHAIN OF FUNCTIONS IN A SAFELY MANAGED SANITATION SYSTEM. A SEPTIC TANK OR PIT IS EMPTIED BY A VACUUM TRUCK, WHICH DELIVERS WASTE TO A TREATMENT PLANT FOR EVENTUAL REUSE IN AGRICULTURE. SOURCE: BAETINGS, 2018.

Another way to think of building blocks is to visualise windows looking onto a complex scene, each offering a different perspective and insight. The views from these windows thus overlap considerably.

We first used the concept of building blocks in 2008, when we found service levels and building blocks useful for breaking up the complexity of WASH service delivery. Each building block includes the actors and factors that must work together to perform a function or series of functions; the same actor may contribute to the functioning of multiple building blocks. The nine building blocks we work with are now central to our WASH systems praxis, giving IRC a manageable way to discuss the critical elements of a strong and robust WASH system (Figure 6).

The sub-systems of WASH are defined in other ways by other sector actors, including Sanitation and Water for All and UNICEF (Harvey & Reed, 2004; AMCOW, 2011; SWA, 2016; Tsetse et al., 2016). Our definitions are not absolute; the approach is adaptable and building blocks should be defined in a way that makes sense to those involved. What we can say is that the building blocks as defined here have proven to work well for us and our partners.

Over the years, IRC has developed considerable knowledge about what these building blocks are, how to strengthen them and crucially, how to measure their strength. Section 4 introduces several applications of the building block methodology, and a separate paper will discuss our methodology of using building blocks to monitor WASH system strength.

2.7. THE WASH SYSTEM IN CONTEXT

The WASH system (and its building blocks) exists in a larger context that influences and conditions it. Strengthening and improving the building blocks should lead to improved services, but the WASH system is an open system: external factors influence its behaviours and the possibilities for scaling up and sustaining improvements.

FIGURE 6. NINE ESSENTIAL BUILDING BLOCKS OF THE WASH SYSTEM, AS DEFINED BY IRC

BOX 6. WASH BUILDING BLOCKS

A building block is a recognizable (and widely recognised) sub-system within the larger WASH system whose actors and factors work together to perform a key function. Analysing a WASH system in terms of building blocks reduces its complexity. The precise number of building blocks and their definitions are subjective. Most important is that individual building blocks make sense for the local WASH actors who work with them, and that the complete set captures all functions and relationships (actors and factors) required for a sustainable and effective WASH system.

IRC's building blocks:

- *Institutions:* the structural arrangements that define the roles and responsibilities of different actors
- *Policy and legislation:* the defining vision for the sector, and the rules of the game that define how to achieve it
- *Finance:* the fuel that makes the entire system run
- *Regulation and accountability:* the mechanisms that ensure adherence to the rules of the game and hold service providers to account on behalf of service users
- *Monitoring:* the ability to measure progress against plans
- *Planning:* the ability to set out pathways to achieving policy goals
- *Infrastructure:* the hardware that underpins all services and the ability to develop, maintain and manage it over time
- Water resource management: the source of all water services and the sink to which waste water is returned
- *Learning and adaptation:* the ability to adapt in the face of change: to monitor and maintain progress towards a vision

Financial and political pressures, major environmental shifts and public health outcomes may have enormous influence on the WASH system but are not considered building blocks of the WASH system and are arguably outside our scope (recall here the importance of boundaries for navigating complexity). This broader context is often referred to as the enabling environment, a nebulous term for the 'everything else' affecting WASH services.

Since IRC's definition of the WASH system includes elements of service delivery that other sector actors may consider part of the enabling environment (e.g., finance, legislation), in IRC we specifically describe the broader context as the political economy, and we avoid use of the term 'WASH enabling environment'. Political economy refers to the political context, national economy, effectiveness of governance, demographic pressures and other influences outside the scope of the WASH system that we engage with directly (Figure 7). The influence of the political economy is paramount, and though these factors often lie outside our sphere of influence, our approach is to understand the context and to learn to function effectively within in it.

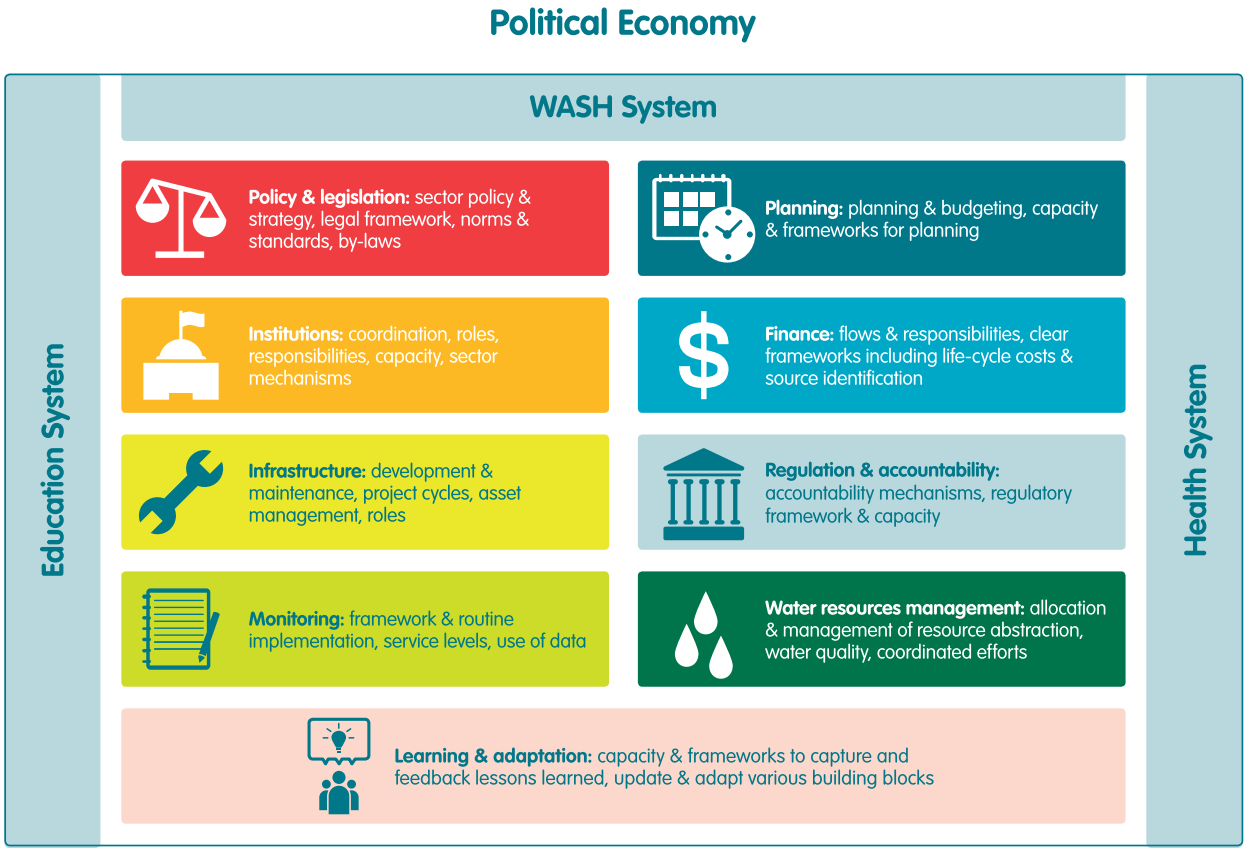

FIGURE 7. CONTEXT OF A WASH SYSTEM. WITHIN THE BROADER CONTEXT OF POLITICAL ECONOMY, WASH SYSTEMS OVERLAP AND INTERACT WITH EDUCATION AND HEALTH.

3. The nine building blocks, defined

This section describes each of the nine building blocks and how they function. Since the boundaries between building blocks can be fuzzy, we discuss how each links to other blocks. We then consider the variations and commonalities of roles at different administrative levels. Literature citations and tools for each building block are given in Section 6.

The importance of the interactions amongst building blocks cannot be overstated, and some tools focus on a specific set of these interactions. For example, the life-cycle costing tools [6] look at the links between planning, budgeting and infrastructure maintenance as they affect outcomes for service provision.

To learn more about how the building blocks methodology can be used and applied in practice, see Section 4.

3.1. INSTITUTIONS

3.1.1. Description

The *institutions* building block refers to the formal organisational arrangements in a country and its WASH sector; the capacity and resources that each organisation has to perform its role, and the coordination mechanisms amongst the organisations. Institutional arrangements vary significantly. Most important is that the actors have clarity about their roles and their interactions with others, and that there be no major gaps. The institutions building block needs to support all of a country's service delivery models[7], from self-supply to utility provision.

Main institutional roles in WASH. All aspects of WASH service delivery require defining three critical roles: (1) service authorities (or holders of regulatory power); (2) service providers; and (3) service users. Other actors with institutional roles in WASH include financiers, statistics agencies and universities. Service delivery models and the roles of service provider and service authority are typically, although far from universally, better defined for water than for sanitation or hygiene. This is in part due to the different paths that service delivery for these sub-sectors have followed in rural areas, with communal solutions for water and an individual and household approach to sanitation and hygiene. To achieve the SDGs, institutions that oversee and deliver services all along the chain must exist for all WASH sub-sectors.

WASH in institutions. In schools, hospitals and other public settings, institutional responsibility typically rests with the host institution (and its parent ministry or agency) – something that may be overlooked by regulatory bodies, leading to poor service. An improved engagement of these actors, clear role setting and identification of joint activities and visions may be helpful for strengthening the institutional building block of WASH services outside the household.

Institutional capacity. All actors must have sufficient resources and capacity to execute their functions. This is especially the case for decentralised organisations. WASH in many countries has undergone a process of decentralisation or deconcentration that has devolved responsibility from central to local government and other local actors. To be successful, decentralisation requires significant capacity building, restructuring of financial flows and indefinite support for the local actors who have assumed new institutional roles. In many cases, however, the process is incomplete, leading to unclear responsibilities or inadequate coverage of sector activities. Decentralisation has affected both the service authority's role, which has increasingly been delegated to local governments, and the service provider's role, which has become the responsibility of community managers or private-sector providers (Lockwood & Le Gouais, 2015).

Coordination platforms. The complex nature of WASH requires coordination mechanisms and structures for its multiple actors. Clearly defined roles and relationships must be supported by communication and coordination platforms that facilitate joint work and transmit information through the sector. This may be through working groups, technical meetings or joint sector review processes that increase interaction and ensure that institutional actors understand their roles in the WASH system and are working together effectively.

[6] https://www.ircwash.org/projects/life-cycle-costing-tools.

[7] A service delivery model includes specifications for each of the building blocks (e.g., legislative mechanisms, management model, financing scheme, infrastructure type) and information about the level of services provided. See Section 2.5, above. For more information and examples of service delivery models, see Adank & Tuffuor, 2013, and Bey et al., 2014.

3.1.2. Critical links to other building blocks

- *Policy and legislation.* Institutional arrangements are typically spelled out in policy and framed in legislation at the national and local levels.
- *Finance.* As applied by IRC, the institutional building block means not only the existence of the institution but also its capacity and ability to fulfil its role – and is thus closely linked to finance.
- *Regulation and accountability.* Each institution's regulatory roles need to be clear to all other actors. Regulation and backstopping for each actor should be clearly indicated in an institution's mandate.
- *Learning and adaptation.* Coordination mechanisms are critical for identifying core challenges and adapting institutional arrangements to respond to emergent needs.

3.1.3. Implementation at different administrative levels

Even under decentralisation, the WASH system is unavoidably multi-scale. Overall policy, legislation and oversight typically remain with national ministries of water and health, supported by specialised agencies, such as regulators. At the district level, lead responsibility for the service authority can be devolved to offices of the main ministries, or directly decentralised to the local government. Policies, decrees and government contracts can be set at the national or local level, although the boundaries of what can be done locally will be determined by national authorities. Local actors and the private sector may have a big role in service provision but often operate in a policy grey zone and may be overlooked in assessments of institutional arrangements and capacity – a significant handicap for financing. Communities or users that are heavily involved in WASH service provision also need clear roles and responsibilities as well as capacity support.

3.2. POLICY AND LEGISLATION

3.2.1. Description

The *policy and legislation* building block comprises the mechanisms by which a government sets out its vision for the sector (policy) and determines the legal framework for achieving that vision (legislation). To address the challenge of the SDGs, national policy must identify targets for improving WASH services and then provide guidance on the institutional arrangements and strategies for achieving these targets – for example, by identifying the permissible service delivery models. Legislation needs to be linked to and supportive of policy and provide a clear framework for the interaction of actors in the WASH institutional setting. Legislation is particularly important where non-state actors (e.g., communities, the private sector) are service providers.

Ownership and management of WASH infrastructure and services. Because WASH requires infrastructure, policy and legislation must be clear about who owns and manages WASH assets. In practical terms, this might mean describing in detail the limits of private operators' authority. Using this building block to analyse a WASH system involves ascertaining the extent to which the service delivery models specified in the WASH policy are supported by legislation.

Accountability for service provision. The more clearly rights and responsibilities are defined in policy and legislation, the easier it is to monitor service provision and determine accountability. Clarity is required on the services to which users are entitled and the payments they are expected to make for those services. Tariff setting is typically the domain of WASH regulators, whose role it is to find a balance between the rights and accountabilities of service users and service providers.

Beyond WASH. The WASH sector is often reliant on, and bound by, policy and legislation from other sectors. This is particularly the case for pollution caused by faecal waste and for water withdrawals from aquifers and rivers.

Institutional WASH. Policy and legislation for WASH in healthcare facilities and other institutions should typically be included in the overall policy frameworks for those institutions. However, in practice this is often overlooked.

3.2.2. Critical links to other building blocks

- *Institutions.* The institutional arrangements for a sector need to be enshrined in policy, and legislation needs to provide a framework for actors to play their roles.
- *Regulation and accountability.* Regulators (and service authorities) both rely on enabling policy and legislation and in some cases can adapt legislation in the form of local bylaws or ordinances.
- *Finance.* Clarity on service delivery models in particular for asset ownership and defining permissible types of concessions and permits are critical to drawing in (especially private) finance. Tariff setting in particular needs solid underpinning in both policy and legislation. Clarity on asset ownership and permits for service provision are critical to making the sector attractive for private and public investment.

3.2.3. Implementation at different administrative levels

In general, sector policy is set by national ministries (e.g., water, health and local government), preferably in consultation with other actors, and then underpinned by legislation. Under decentralisation, local entities have some latitude to develop their own policies and subsidiary legislation (e.g., bylaws). Local implementation, however, often lags national – for example, permitted bylaws may not be promulgated – and local actors' legal rights and constraints may be poorly understood.

3.3. FINANCE

3.3.1. Description

Central to the *finance* building block is the understanding that sustained service delivery requires all the elements of a WASH service to be funded over their entire life-cycle. This is true whether the money comes from user fees, government subsidy, development grants or private sector investment.

The finance building block deals with identifying the costs of service delivery, the sources of funding, the roles of different actors in providing finance, effective mechanisms for long-term financial procurement and channels for getting the money where it is needed.

Planning, forecasting, budgeting and sourcing of finance. Funding universal services requires mechanisms for forecasting and projecting the costs of service delivery and adapting to changing demographic, economic and environmental conditions. Although finance can come from any of the 'three Ts' of finance (taxes, transfers and tariffs) and be supplemented by credit, the critical point is that the funds must be sufficient to cover current and anticipated costs.

The ability to accurately project all costs over the entire service life-cycle, which can exceed 20 years for some investments, and to match projected costs with different sources of funding calls for considerable specialist knowledge and appropriate tools. In many cases, especially in rural areas, current levels of funding are largely inadequate.

Strengthening the finance building block, therefore, means both improving existing financing mechanisms and increasing the overall flows into the sector through national and international advocacy efforts.

3.3.2. Critical links to other building blocks

Finance (particularly private finance) tends to flow to where it can generate the highest return for least risk. Almost all building blocks contribute to some part of this calculus. Some of the most important are:

- *Institutions.* WASH institutions are often weak in accessing finance, and actors often lack the knowledge or language to engage effectively in finance discussions for WASH.
- *Policy and legislation.* A strong policy and legislative environment is essential for enforcing tariff regulations and attracting private funds into the sector by ensuring security and clarity of contracts. The legal framework must define permissible service delivery models and precise terms for contracts and concessions.
- *Monitoring.* A clear asset inventory is essential for managing assets and planning future financing needs. Information about actual use of services is required for accurate billing.
- *Planning.* Financing needs to be closely linked to planning and budgeting mechanisms and cycles.
- *Regulation and accountability.* Tariffs are one of the two main mechanisms (the other is subsidy) through which finance can be repaid. Setting financial benchmarks and tariff policy that balance the needs and rights of consumers, service providers and financiers is central to the job of regulators.
- *Infrastructure.* Finance is needed for infrastructure as it is essential to ensuring sustainable services. Clarity of ownership of infrastructure must be clearly defined, particularly to attract private capital.

3.3.3. Implementation at different administrative levels

Responsibility for financing spans all levels: setting the framework for sector financing is largely the role of the national level, whilst cost recovery through tariffs involves the individual users and their service provider. The framework should define roles and responsibilities for all aspects of financing and cost recovery, including development of mechanisms to cover capital investments. Funds for both direct and indirect support costs typically come from the national budget, often channelled to local governments.

Planning and budgeting take place at all levels, but at the district and sub-national levels it is particularly important to budget and obtain funding for all key cost components. Operational costs and minor maintenance are typically the responsibility of local actors, who must develop sustainable mechanisms to pay for them.

In general, financing structures and responsibilities are typically more developed for drinking water provision than for sanitation and hygiene. This is particularly true for sanitation, which is chronically under-funded by governments. Reliance on household contributions, community management and, more recently, small-scale 'bottom of the pyramid' approaches has tended to shift attention away from the need to support many aspects of service delivery.

3.4. REGULATION AND ACCOUNTABILITY

3.4.1. Description

Good policy and legislation are effective only if they are applied and enforced. The *regulation and accountability* building block covers formal regulatory mechanisms and enforcement processes as well as other mechanisms to hold decision makers, service providers and users to account and ensure that the interests of each group of actors are respected (Trémolet, 2015). It also includes accountability that goes beyond formal mechanisms to include behaviour of different actors and their obligations in civil society. Governments are accountable for their formal commitments under their signed human rights accords, which include a process of systematic follow-up and review of implementation.

Regulation. Both the service provider and the service itself must be regulated. The regulatory framework should include detailed explanations of tariff collection, service quality, environmental protection and equity issues across different administrative levels.

Since the responsibilities for WASH are often delegated to various ministries, a lack of adequate (and coordinated) monitoring and reporting presents a major challenge for regulation. The efficacy of regulatory mechanisms tends to be linked to the wealth of the state and the government, as regulatory capacity requires significant long-term resources.

The regulatory framework should also define the mechanism for enforcement at each level. Regulation may take place through a single formal regulating body (e.g., an independent regulator or a designated government structure) or through contracts. This mechanism is particularly important for public-private partnerships, where a private profit-making enterprise may largely control services, service quality and decisions about expanding coverage.

The framework should also include practical procedures for holding users to account to pay for services received and to act responsibly according to local or national guidelines.

Accountability. Accountability means that those who are responsible accept responsibility for their actions and omissions and can be called upon to explain how they have acted or why they failed to act. Accountability mechanisms are considered effective if they are transparent, engage a diversity of stakeholders, facilitate and encourage critical reflection on progress and both respond to and anticipate stakeholders' issues. More than just seeking to correct past wrongs, accountability mechanisms should be forward looking and influence current and future government decisions. Typical components of a well-balanced accountability mechanism are (1) procedures for users and citizens to hold service providers to account (through the local service authority); (2) procedures for users and citizens to hold service authorities to account (through elections or higher-level government action); and (3) procedures for regulators and service authorities to hold service providers to account (through binding contracts and defined penalties). Citizens may be involved directly or may be represented through civil society organisations or users' groups.

3.4.2. Critical links to other building blocks

- *Institutions.* Regulatory and accountability mechanisms require clear definitions of institutional roles and an agreed organigram for the sector. Regulation is possible only if there is a degree of separation between service authority and providers.
- *Policy and legislation.* Regulation presupposes policy and legislation. The degree of decentralisation within a country may determine how regulation takes place.
- *Finance.* Regulation is an ongoing expenditure and must be budgeted as an indirect support cost for WASH. Establishing and enforcing tariffs that are both equitable and sufficient to recover investments is essential for attracting new finance into the sector and assuring sustainability of current investments.
- *Monitoring.* Data serve as the basis of regulation. The information must be validated and appreciated by all actors to serve as a foundation for action.
- *Infrastructure.* The responsibilities for regulation change with the life-cycle stages of the infrastructure (e.g., construction versus capital maintenance) and its type (e.g., rural handpump versus urban piped supply).

3.4.3. Implementation at different administrative levels

The policies that determine responsibilities are defined at the national level, whereas the actual regulation of service provision may be through a single national regulator or by contract. Regulation by contract can take place at multiple levels but ultimately requires local action and oversight at the level where services are delivered. In some cases, regulation is the direct responsibility of the local government.

Regulation of sanitation and hygiene services is often dispersed, since responsibility for building codes may lie with the health regulator, and that for the containment and disposal of waste may rest with the environmental or agricultural regulator. Since many households construct their own facilities or hire a private artisan, it is difficult to regulate construction quality or design; however, technician certification and regulation of artisans and materials are ways to ensure that minimum safety standards are met.

3.5. MONITORING

3.5.1. Description

Up-to-date information is a prerequisite for improving both day-to-day management of service delivery and long-term policy or investment decisions. It is essential to know what services are being delivered to whom, at what level of quality. The monitoring building block covers the capture, management and dissemination of the information required to effectively manage WASH services at all levels. Monitoring is the basis for the information feedback loops that ensure effectiveness and allow adaptive change. Monitoring also supports both regulation and planning. It should be both systematic and reliable so that it is accepted by different sector actors and can be used for decision making.

Monitoring is more than a set of indicators and a database. There must be a systematic way of analysing data and actually using it to inform action and decision making at multiple levels. Monitoring requires multi-actor and multi-level coordination, and the information needs vary for each actor and each level. Local actors need live information on facility functionality so that repairs can be made quickly; national actors need a higher-level synthesis of trends to inform strategic policy making and planning. A monitoring framework, with guidelines for each level, is critical to effective data management and use.

In WASH, monitoring data are usually collected from both infrastructure and users (the latter, often through household surveys). Infrastructure data typically show what is needed for asset management. Infrastructure data serves as the basis for routine operational monitoring and should be collected by service providers, in line with agreed national monitoring standards. Household data are used for estimating the level of service being received by the population (where this is not measured directly by service providers), and are useful for generating policy-level snapshots of the WASH service levels in a country or region. Household-level WASH data is typically part of a larger data collection activity led by the national ministry of health or demographics or a census bureau and is not necessarily aligned with routine operational WASH monitoring.

The monitoring building block of the WASH system must be distinguished from project monitoring. The former is the systematic, routine monitoring of services and service delivery. Project monitoring and external evaluations may provide interesting insight, but because of their time-bound nature and tendency to align to third party interests, they are fundamentally different.

3.5.2. Critical links to other building blocks

- *Regulation and accountability.* Monitoring data are needed for auditing, measuring the quality of services and assessing the performance of service providers. Civil society advocates also need data to provide evidence for their claims.
- *Planning.* Planning and budget allocation should be done on the basis of evidence. Monitoring processes should take into consideration planning and decision-making cycles.
- *Infrastructure.* Monitoring of infrastructure is critical for operation and maintenance and should include routine monitoring of asset status, ownership, parts specifications, design life and anticipated capital maintenance costs.
- *Finance.* Monitoring of expenditures helps make service providers and local governments accountable and improves governance and efficiency.
- *Learning and adaptation.* Sector learning and review processes benefit significantly from monitoring data, and qualitative information coming from joint sector reviews and multi-stakeholder dialogue processes should ideally be documented and included in the sector monitoring framework.

3.5.3. Implementation at different administrative levels

The same raw data can often be processed and repackaged to meet the needs of different actors at different administrative levels, depending on how the data were collected and what sampling processes were used. For example, many health surveys are done on a nationally representative sampling basis to support national-level planning and decision making; such information is less valuable for decision making at the sub-national level. Conversely, some real-time monitoring data on WASH facilities, such as functionality and production data, are useful locally but may need to be converted to percentages or more aggregated indicators to be meaningful at a national level.

3.6. PLANNING

3.6.1. Description

The *planning* building block is the foundation for implementation of policies to achieve universal access to sustainable services. Plans must include costs and details on financing and may involve multiple phases.

Budgeting – the allocation of funds for planned activities or known cost categories – is central to realistic planning. Funds must be available on an annual or quarterly basis to support regular operations and project cycles, but financing may be needed for specific projects as well. Long-term plans should be linked to known or anticipated finance sources and to project cycles in order to capitalise on a series of projects as a means toward reaching the long-term vision.

WASH systems require three types of planning.

Strategic planning. This management activity is critical for any institution. It takes long-term high-level goals and identifies a clear path to achieve them over time. Many tools exist, particularly for stimulating reflection and organising thoughts, but it nevertheless requires high capacity for thinking strategically and synthesizing large amounts of information about both past and present. Strategic planning looks towards the future and aligns activities, employees and other stakeholders towards the desired outcomes and activities. Strategic planning can be done at an institutional as well as sectoral level.

Annual planning. The format of annual planning may vary, but it always involves financial planning to ensure that the annual budget is sufficient to cover planned activities and routine costs. Every institution and structure should have an internal annual planning mechanism. A multi-actor approach may be used for planning joint efforts, such as implementation of a national development plan, and should identify expected sources of funding as well as all anticipated costs. An annual plan may be updated over the year, and a review of the previous year's plan and outcomes can inform planning for the following year.

Project planning for infrastructure development: A WASH system should plan and budget for new infrastructure, with mechanisms to identify, acquire, implement and follow up on these assets. This type of planning is further discussed in the infrastructure building block and should be linked to plans for maintenance and broader support (including human resources) to ensure sustainability.

3.6.2. Critical links to other building blocks

- *Finance.* Both strategic and annual plans must be based on the availability of financial resources. Finance experts may be invited to join and comment on planning and budgeting processes to help identify gaps and potential sources of funding.
- *Monitoring.* Planning needs to be done on the basis of evidence, so easily accessible, detailed data are extremely helpful.
- *Water resource management.* Planning for WASH requires consideration of natural resources, and effort should be made to ensure alignment and communication with natural resource managers.

3.6.3. Implementation at different administrative levels

Planning requires coordination across administrative levels. National-level plans are typically broad and may cover activities linked to long- and medium-term development strategies. National planning should reflect both national strategy and the actual situation across the country as reflected in sub-national annual plans and through monitoring data. Sub-national plans should match projects and activities to local needs; they must be realistic and nested into broader regional and national plans. Budget allocations from national to decentralised level must take into account heterogeneity as well as equity.

3.7. INFRASTRUCTURE

3.7.1. Description

Infrastructure is the essential physical component that actually delivers the service. It comprises not only hardware but also the mechanisms and processes for developing new infrastructure and maintaining existing facilities.

Infrastructure development. New infrastructure is a capital investment. A capital investment cycle should be defined and standardised to coordinate the many actors involved, including international donors and private operators, and support the efficient procurement, construction and management of assets. Because these mechanisms are also important to ensure equity and strategic placement of new infrastructure, this building block is closely related to monitoring, finance and planning. New infrastructure is often financed from the national level but may be implemented through local processes. Ownership and responsibility for assets should be clear at the time of implementation; a structured process for registering, regulating and establishing long-term asset ownership and operations is critical.

Infrastructure maintenance. Many countries have clear processes for infrastructure development but inadequate systems for maintaining assets post-implementation. With decentralisation, responsibility for maintenance is often left to districts, which may not have adequate systems or capacity. All infrastructure requires both ongoing routine maintenance (operation and maintenance expenditure, or OpEx) and occasional major replacement or rehabilitation (capital maintenance expenditure, or CapManEx). The roles and responsibilities for these different tasks must be clearly defined, and the boundary between operation and minor maintenance and major replacements and rehabilitation should be delineated. The setup for infrastructure management varies widely by region and between urban and rural areas, but what is important is that the process be understood and linked to other building blocks, such as finance and regulation, and that what is on paper be followed in practice.

Infrastructure maintenance depends on effective asset management, which in turn depends on three pillars of competence: engineering, business management and information management (Boulenouar & Schweitzer, 2015). These competencies must be present at conception of the asset management plan, and the actors involved in implementing the plan and earmarking funds must respect one another's competencies. A register of all infrastructure assets, including age and condition, should be updated regularly.

3.7.2. Critical links to other building blocks

- *Monitoring.* Registering and monitoring asset conditions are critical for ensuring sustainable service. Monitoring in real time identifies service breakdowns; over a longer period it can identify trends and issues and support planning for replacement and renovation.
- *Planning.* Clear, transparent and efficient mechanisms are needed for project acquisition and implementation.
- *Finance.* Linked to planning, effective and well-understood financing mechanisms are important for both infrastructure development and maintenance.
- *Water resource management.* An environmental survey is needed to ensure that the design and location of new assets are appropriate and feasible for long-term sustainability. Consultation with water resource experts is a critical first step in planning large infrastructure schemes.
- *Regulation and accountability.* Throughout the life-cycle of infrastructure, those responsible must be held to account.

3.7.3. Implementation at different administrative levels

The responsibility for infrastructure development and long-term maintenance is frequently housed at different administrative levels. Infrastructure development plans may become complex if non-governmental actors (e.g., external aid agencies) are initiating large projects. Regardless of the level at which plans are developed, registration of assets is the responsibility of the service authority. The transfer of responsibility during project implementation is critical for sustainability and should be overseen by the project lead and the responsible local government authority.

3.8. WATER RESOURCE MANAGEMENT

3.8.1. Description

At the most basic level, drinking water, sanitation and hygiene services rely on an adequate supply of fresh water. In many cases water resources are managed by agencies other than those responsible for WASH, so coordination and communication between these groups is important. The water resource condition should be considered from the very beginning of any infrastructure development project and be regularly assessed to ensure sustainability of the facilities. For IRC, the water resource management building block refers to the coordination and control of how water is allocated to different sectors. A strong system includes methods or protocols for addressing conflicts and encouraging cooperation. Both the abstraction of fresh water and the disposal of used water should be controlled, managed, monitored and enforced.

How water resources are managed affects how WASH activities and planning can be integrated. Management may take place at the drainage basin level or follow administrative boundaries; it may proceed according to traditional practices or be a top-down policy. In general, integration of WASH and water resource management should be problem-driven rather than forced so that collaboration and coordination can be tailored to the situation. Regardless, sustainable water service provision requires a recognition of the vital link between WASH and the natural environment.

Human waste must be contained and treated to protect water resources. The choice of technology and treatment processes should take into account natural resources, seasonality, climate change, projected demographic change, and emerging demands from industry and population. This consideration requires multi-stakeholder dialogue amongst people who have a deep knowledge of the institutional, legal, and regulatory framework for water resource protection.

3.8.2. Critical links to other building blocks

Water resource management is a slightly different type of building block because it underlies the entire sector's existence: the natural environment is the very foundation of WASH availability and sustainability. In practice, water resource management is far more than a natural system; it is its own complex enviro-socio-technical system with multiple interacting factors and actors. Water resource management should be considered in the framework for all the other building blocks, and relevant actors from the ministry responsible for water resources should be included in most sector dialogues.

3.8.3. Implementation at different administrative levels

The policy, legislation and institutional responsibilities for water resource management are generally defined at the national level and may include environmental research and decision making for major water extraction for development However, implementation occurs at sub-national levels because the protection of streams, surface water and water basins requires district and local engagement. Administrative levels are not always clearly defined because natural boundaries, such as drainage basins, may necessitate some decision making and action with regional or international actors. National development interests must be in balance with sub-national concerns. Clear delineation of roles and responsibilities within the natural resources sector enables a more effective conversation and planning around WASH-related issues.

3.9. LEARNING AND ADAPTATION

3.9.1. Description

The ability to adapt based on experience and changing circumstances is an essential characteristic of any robust system. This is even more so in complex adaptive systems like WASH, where the outcomes of policy action are difficult to predict. A 'learning sector' is one 'that engages in continuous learning and reflection and is thus able to adapt to changing circumstances and demands.'[8] The *learning and adaptation* building block presumes inclusive platforms for the regular sharing of information and use of data for critical analysis, with insights from multiple stakeholders, including civil society. The stakeholders then respond to the learning through adaptation, changing their policies and practices: they are willing to address failure and work with others to do things differently. Thus, this building block may alternatively be considered readiness for innovation and a way to drive change in the other building blocks.

Learning. In WASH, learning must take place both informally and formally. Learning alliances are one way to ensure both horizontal and vertical exchanges and to feed lessons from diverse experiences into policy guidelines. Such alliances can facilitate passage of legislation, adoption of tools by practitioners and the scaling up of effective approaches. Participants in learning alliances need resources, so sector resource centres or libraries that are accessible to local and national actors are an important aspect. 'Pairing' and 'peer learning' are valuable mechanisms of exchange whereby people with similar functions or posts in different contexts can share experiences and ideas horizontally.

Adaptation. Because the WASH system is 'open' – it interacts with and is influenced by its surroundings – and because the political economy is dynamic, it must be able to adapt to the changing environment. Population growth, urbanisation and environmental change are examples of persistent challenges that require service provision to be adaptive to achieve sustainability. Policies, technologies and regulatory mechanisms need to be updated and changed to

[8] Definition from IRC Triple-S Building Blocks for Sustainability Series, summary sheet, Learning and Adaptive Management.

remain effective. Ideally, these changes do not take place ad hoc but instead are determined through regularly scheduled, funded, formal mechanisms. Annual or semi-annual joint sector reviews are an excellent mechanism that provides a participatory and inclusive platform for assessing sector performance.

Learning and adaptation are needed not only at a sectoral level but also internally in each institution and structure. Becoming a learning institution is not an easy task, but an engaged sector with a vision of continual improvement requires that individual actors be willing and able to self-assess their performance and innovate.

3.9.2. Critical links to other building blocks

- *Monitoring.* Monitoring provides the information needed for learning and reflection. Service level or other performance data can serve as the basis for deeper reflection.
- *Planning.* Sector reviews and learning processes can be built into annual planning processes or can provide insight into strategic planning.
- *Water resource management.* The process of integrating WASH and water resource management requires inclusive, multi-stakeholder dialogue to reconcile differing priorities and re-think challenging issues.

3.9.3. Implementation at different administrative levels

A critical element of learning and adaptation is horizontal and vertical exchange. Platforms are needed at all levels – district, regional, national, international – so that the different actors can contribute. A true learning alliance also has a hub, or 'spider in the web': a mechanism or actor responsible for linking the platforms and facilitating learning across groups so that solutions can be scaled up. National-level learning platforms are a fertile ground for developing new legislation, policy and reforms. Local learning platforms can evaluate policy implementation and reflect on new ideas and models that, if effective, can be scaled to the regional or national level.

4. Applying the building blocks

The previous section described the building blocks of the WASH system as IRC understands and defines them. This section looks briefly at how IRC uses the building blocks.

The building blocks can be used as diagnostic tools to identify areas in need of further support, or as a holistic framework for structuring a series of interventions. A separate paper focuses on how we use building blocks as a conceptual framework for sector analysis and tracking change at different administrative levels.

IRC seeks to apply the systems (or building block functions) that are good, change the systems that are weak, and help build the systems that are non-existent.

Because of the complexity of the WASH system, it can be difficult to identify the most persistent or underlying issues that give rise to chronic problems. The building blocks help us take stock of the crucial elements of a WASH system and identify which components are most in need of support. They provide a conceptual framework to consider what is happening at different levels, what might be changing and what might be new or noteworthy in the system (Boulton et al., 2015).

Building blocks can be used in various ways. They can be evaluated qualitatively or semi-quantitatively, using QIS tables[9] or other tools. They can also be used qualitatively in facilitation – for example, by inviting stakeholders to discuss the challenges and progress of elements affecting service level outcomes. A combination of quantitative and qualitative approaches is also possible – for example, a third-party quantitative analysis may be followed by a reflection and validation workshop with a broader stakeholder group.

A building blocks assessment should be accompanied by a general analysis of the broader political economy and the WASH service levels produced by the system.

Assessment of the current state of the system and progress towards the vision of universal access is thus set in context, with a realistic understanding of the major drivers and constraints (e.g., availability of funds). This rich, broad picture can serve as a foundation for discussion with different stakeholders and help identify priority areas for action. Monitoring of progress in individual building blocks at national and district levels provides a basis for iterative reflection. For example, the national monitoring system can be assessed, and then, after a revised monitoring framework has been developed and indicators have been updated, it can be re-assessed to see whether the critical aspects of monitoring have improved. Taken together with monitoring of service delivery, this allows progress in both systems to be tracked over time – and for action to be taken and adapted.

In IRC's work we are using the building blocks methodology as part of our annual monitoring, helping to develop and track progress against annual and multi-year strategies in each country.

Building such monitoring into multi-year plans acknowledges that it is typically not possible or desirable to work on everything at the same time. That is not to say that we must simply prioritise and work only on the 'weakest' building block, but rather, that the broad picture helps us see possible leverage points for change and maintain a holistic perspective even whilst focussing on priority areas.

Engaging in systems strengthening may mean focussing on two or three building blocks at a time (whilst never losing sight of the whole), followed by assessment and reassessment of the system and identification of new areas of focus or emerging opportunities. Because the building blocks are interconnected, a focus on one may have foreseeable or unforeseeable (hopefully positive!) implications for another. Perhaps the most obvious example is that of developing national monitoring systems that, but making the current state of service delivery clear to policy makers, can trigger investment into other parts of the system such as increased capacity and finance for operation and maintenance.

In many cases a particular building block is well developed at the national level and in sector

[9] A qualitative information system (QIS) is a methodology for quantifying non-numeric information using a series of scales: the information is scored based on a ladder of benchmarks. For more information, see Sijbesma & Ahmed (2013).

frameworks but remains poorly applied at the district level. For example, a district may be unable to fulfil its role in implementing a national monitoring framework. We then work with our partners in the district to build capacity and develop the requisite mechanisms.

The nine building blocks must be functional at both national and sub-national administrative levels.

In other cases a building block may be relatively undeveloped at the national level. Our approach of working with a small number of districts allows us to experiment with tools and mechanisms for addressing these weaker building blocks, and then take the lessons learnt to the national level.

Finance is an excellent example. In most countries, financing for rural WASH is inadequate and poorly targeted. National financial policy frameworks typically address only capital investment costs and minimize or ignore direct support costs (the 'soft' costs for personnel or monitoring) or capital maintenance. IRC collects evidence on the implications of such frameworks, experiments with ways to budget for these costs in the districts, and uses regional or national learning or advocacy platforms to shed light on the issue or support scale-up and uptake of the district experience. A learning and reflection platform in the district helps us collect balanced perspectives from multiple stakeholders, refine the approach and build momentum.

5. Next steps

IRC developed its WASH sector building blocks as part of its work on WASH system strengthening over the past decade. We are currently incorporating them into our training materials and monitoring frameworks, even as we continue to use them in our district and national work in collaboration with our partners. Through our ongoing work they will continue to be tested and refined.

The building blocks have been most thoroughly tested in our work on rural water. In the past two to three years we have begun to apply them to sanitation and hygiene. Although some modifications may be made, they appear useful for the other WASH sub-sectors. The work of testing and adapting the definitions for sanitation and hygiene is in early stages and requires further development.

In the medium term, the monitoring framework for our 2017–2030 strategy fully integrates the building blocks. Their deployment should allow us to develop a more fine-grained appreciation of how they affect service delivery and perhaps even rank them in priority or consolidate any redundancies.

That said, at heart we remain committed to the central insight of systems theory – that WASH services are a product of the whole WASH system and that building blocks are, in essence, windows for framing and engaging with its different aspects. The question, then, is not so much whether one building block is more important than another, but rather, does one provide a better perspective? This question is one that we will ask, and continue to ask, as we test and refine our approach in the years to come.

6. References and resources

References are listed in alphabetical order as well as per building block in a separate section below.

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