

Sustainable WASH Systems Learning Partnership

USING SOCIAL NETWORK ANALYSIS IN WASH PROGRAMS

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**SUSTAINABLE
WASH SYSTEMS**
A LEARNING PARTNERSHIP

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Front cover: WASH network member in Kamuli, Uganda, indicates his network interactions through a visual mapping exercise. Photo credit: WHAVE

About the Sustainable WASH Systems Learning Partnership: The Sustainable WASH Systems Learning Partnership is a global United States Agency for International Development (USAID) cooperative agreement with the University of Colorado Boulder (UCB) to identify locally driven solutions to the challenge of developing robust local systems capable of sustaining water, sanitation, and hygiene (WASH) service delivery. The consortium of partners—Environmental Incentives, IRC, LINC, Oxford University, Tetra Tech, WaterSHED, Whave, and UCB— are demonstrating, learning about, and sharing evidence on systems-based approaches for improving the sustainability of WASH services in four countries.

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Acronyms

DWTT	District WASH Task Team
IFML	Iterative Factor Mapping and Learning
LOE	Level of Effort
MEL	Monitoring, Evaluation, and Learning
RuSH	Rural Sanitation and Hygiene
SNA	Social Network Analysis
SWS	Sustainable WASH Systems Learning Partnership
UCB	University of Colorado Boulder
USAID	United States Agency for International Development
WASH	Water, Sanitation, and Hygiene

Executive Summary

The Challenge of Sustainable WASH: Development partners and governments have made significant investments in water, sanitation, and hygiene (WASH) infrastructure in low- and middle-income countries over the past decades, yet sustainable service delivery still remains out of reach for many, in part because, although donor funds have increased access to services, maintenance and sustainability of those services have faltered. To better address WASH service sustainability, approaches require a more in-depth understanding of key stakeholders and their relationships. WASH services involve a range of actors and dynamics representing public, private, civil society and communities, and users. The flow of information and resources through the network and the ability of stakeholders to coordinate action and address challenges are critical to the effectiveness and sustainability of WASH services.

SWS Learning Partnership: The United States Agency for International Development (USAID)–funded Sustainable WASH Systems Learning Partnership (SWS) applied social network analysis (SNA) in Ethiopia, Kenya, Uganda, and Cambodia. SNA provides an effective approach to better understand the relationships and dynamics that make WASH sustainability a persistent problem. The network visualizations and metrics produced through SNA can identify opportunities to improve cooperation and collaboration and to develop network capacity in ways that improve collective results. By documenting the application of SNA in different SWS geographic locations, this report provides insight into how to effectively apply SNA to advance sustainable WASH services in low-resource settings. The analysis and recommendations are relevant to development practitioners seeking to improve the use of SNA and other systems tools in their work.

Consortium Learning from SNA

SWS conducted cross-case learning from application of network analysis around five research questions focused on the use and value of SNA in WASH programming. This report is organized according to the four key themes that emerged from the research across network cases in Ethiopia (four locations), Uganda (two locations), Kenya (one location), and Cambodia (one location): SNA design and implementation methods; key uses of SNA to support WASH activities; value, perceptions, and ownership of SNA; and SNA resource requirements and implications. Key takeaways from each theme are described in turn below.

There is no single way to conduct SNA that produces the most valuable results, but important considerations should be taken into account based on the context and the intended use of the analysis. SWS applied SNA to a variety of types of networks and implemented the approach using a variety of methods. Key considerations that varied across networks included SNA objectives, definition of the network (such as who is included and who is excluded), data collection methods, and relationship types to research (such as information sharing, skills transfer, collaboration, and problem solving).

There are a variety of potential purposes for the use of SNA in WASH. While each network had more specific objectives for their SNA studies, LINC researchers identified three primary purposes. For activity design, the SNAs informed program strategy, interventions, approaches, and partnership.

For monitoring, evaluation, and learning, SWS conducted SNAs at least twice to measure changes in network cohesion and shifting power dynamics over time. For stakeholder understanding of the system, SWS used SNAs as an intervention of its own, to spark discussions and action with network members.

Both program stakeholders and field staff expressed the value of SNA and offered constructive critiques. In all four countries, SWS teams held participatory workshops with stakeholders to better understand, validate, and act upon the results. Stakeholders generally found the participatory workshops useful, indicating that SNA feedback helped to encourage discussion on issues and challenges. Because SNA was a new tool for all SWS teams, their perspectives on the tool and its usefulness were insightful. They reported that the more SNA can be integrated into implementation, and the more participatory the process, the more effective it is likely to be. At the same time, engagement in SNA implementation required considerable time and resources on the part of SWS teams, limiting time for other activities.

SNA resource requirements vary by context and need but are manageable. The SWS SNAs generally require a relatively high resource commitment, based on the methodology, data collected, and validation workshops. In comparing the levels of effort (LOE) that SWS staff and consultants invested in each location, it is clear they used a wide range of LOE. Drivers of LOE requirements included the network size, data collection methodology, frequency of repeated analyses, and the stakeholder validation efforts.

Key Recommendations for SNA in WASH Programs

Through the process of comparing different approaches to applying SNA in SWS, and with direct input from the field teams implementing WASH programming, researchers identified several key recommendations for using SNA for WASH, summarized here.

Choose the right analysis tool for your WASH program's needs. A variety of traditional and systems tools other than SNA exist to help understand local context and to design appropriate intervention strategies. SNA is the right tool to choose when the relationships and interactions among program stakeholders are important for achieving your programmatic goals. This is almost always the case when any type of collective action or collaborative process is crucial to success.

Be clear on the purpose of SNA in your WASH program and articulate that purpose to implementation teams, partners, and stakeholders. Many of the design and implementation decisions that need to be made for effective SNA are dependent on a clear purpose. This includes defining the primary audience for your SNA, as well as the reason for why understanding relationships will help in achieving your programmatic goals.

Align the design of your SNA to the purpose you've identified and to your programmatic approach. Specific design decisions should flow directly from the SNA purpose. For example, your network boundary should align with whether you are working with an existing coalition, forming a new coalition, or working within the structure of relationships among stakeholders in an informal network. Additionally, if your key target audience is local stakeholders, focus more on the qualitative

understanding of the network and visual presentation of findings, rather than on quantitative metrics and technical reports.

Engage the implementation team directly in the SNA research, analysis, and validation.

This requires training up front and a time commitment from the team in addition to their other work. However, those investments vastly improve the value of the SNA and more concretely integrate the design and use into the program.

Beware of information overload and research fatigue. Especially at the start and end of a program, there is often a rush to conduct studies and collect data in a short period of time. This can lead to high demands on staff and stakeholder time, too much information (data and findings) for staff and stakeholders to use, and fatigue that can turn stakeholders away from participation in the program.

Take into account ethical and reputational considerations for data collection, use, and sharing. Network data can include sensitive information on stakeholders and their relationships, and network findings can offend stakeholders that are not as influential in a network as they thought. Mitigation actions could include providing a preliminary presentation of results to specific actors, presenting results in smaller groups rather than plenary sessions, and anonymizing actor names (e.g., designating only organization type).

Overall, SNA has proven to be a valuable tool for WASH programs. The complexity of providing sustainable WASH services requires engagement of a variety of stakeholders and significant collaboration among those actors. While many considerations need to be taken into account, experience under SWS highlights the tool's value for designing a program, measuring change, supporting necessary adaptation, and improving stakeholder understanding of the system. SNA may also be most effective when complemented by other tools and analyses. Although SNA can help to describe the network in its current state and as it changes over time, it cannot tell you why the network is structured that way, and other sources of information and contextual understanding are very useful to properly interpret its meaning.

Introduction

The Challenge of Sustainable WASH Services

Over past decades, development partners and governments have made significant investments in water, sanitation, and hygiene (WASH) systems in low- and middle-income countries. Despite this effort, sustainable service delivery remains out of reach for many communities and individuals around the world, especially vulnerable and hard-to-reach populations. The development community increasingly recognizes the challenges facing traditional WASH approaches that focus primarily on increasing access to infrastructure and sometimes fail to address the maintenance and sustainability of services. Such approaches require a more intensive understanding of stakeholders, their relationships, and other factors relevant to WASH systems.

Effectively facilitating relationships and interactions between WASH actors is critically important for improving and sustaining WASH services. WASH systems involve a wide range of actors — government agencies, private sector, NGOs, donors, communities, and users — and the quality of their relationships and connections matter. The flow of information and resources through the network, the extent to which stakeholders exchange information, and their ability to make decisions and coordinate action are all critical to the effectiveness of WASH networks.

Conversely, many failures in service delivery and maintenance are due to breakdowns in relationships and coordination. WASH services are affected by numerous governmental agencies, which may lack engagement and feedback channels with their constituents and may face bureaucratic challenges to coordinating among themselves. Donor efforts to initiate service improvements are often not sustained due to a lack of adequate linkages between local systems and actors. Similarly, when WASH service providers and users are not adequately connected to support agencies, they are challenged to address problems when interruptions occur.

Social Network Analysis

Social network analysis (SNA) is a powerful tool for analyzing relationships. SNA offers a way to think about social systems that focuses on the *relationships* among actors in a system: public institutions, NGOs, private enterprises, associations, and others. SNA can help to understand the structural characteristics of a network: who the central actors are, how tightly interconnected they are, and what subgroups or clusters exist. All this information can elicit insights about strengths and weaknesses in communication, flows of resources, power structures, coordination, and overall network functionality.

WASH programming, with its nature of distributed decision-making across a network of actors with varying levels of agency, can be complex. For example, while building or adapting WASH facilities may require technical, financial, and coordination complexities, changing social behavior is considerably more complex, involving established norms, habits, and sometimes conflicting institutional roles and interests. In this respect, SNA's focus on relationships is highly relevant to WASH systems. Finding solutions that account for the complexity of WASH challenges requires effective sharing and collaboration between

stakeholders. Understanding the actors, their roles, and their relationships through SNA and other systems tools can improve the effectiveness and sustainability of solutions.

Sustainable WASH Systems Learning Partnership

A consortium of partners under the overall leadership of the University of Colorado Boulder (UCB) implemented the Sustainable WASH Systems Learning Partnership (SWS) through multiple activities in four countries — Ethiopia, Kenya, Uganda, and Cambodia. SWS applied SNA together with other systems tools and approaches in each location from 2018 through 2021. In total, SWS completed 19 SNAs (see Table 1), providing an opportunity to deepen the project’s understanding of the benefits and challenges in applying SNA to WASH systems and to better understand the tool itself.

Table 1. SWS Locations, WASH Systems, and SNAs

Country	Locations	SNAs Conducted
Ethiopia	Small town sanitation: Debre Birhan Town Woliso Town Rural water supply: South Ari District Mile District	Baseline, midterm, endline (12 total)
Uganda	Rural water supply: Kabarole District Kamuli District	Baseline, endline (4 total)
Kenya	Rural water supply: Kitui District	Baseline, endline (2 total)
Cambodia	Rural sanitation and hygiene: National level	Baseline (1 total)

This Report

This report includes a summary of how SWS used SNA across the four countries, including how the partnership made decisions, how it adapted plans over time, and how local partners and stakeholders received SNA. LINC researchers generated findings through an iterative process during the implementation of SWS, including a review of program documentation and reports, regular reflections at team meetings, interviews with SWS team members, and feedback from local stakeholders on SNA tools and processes. SWS also conducted an analysis of the use and value of SNA in SWS implementation programming. The report is organized according to four key themes that emerged from the research:

1. SNA Design and Implementation Methods
2. Key Uses of SNA to Support WASH Activities
3. Value, Perceptions, and Ownership of SNA

4. SNA Resource Requirements and Implications

A final summary section synthesizes the learning across the four themes to provide recommendations for applying SNA to WASH programming.

SNA Design and Implementation Methods

This section compares SNA designs and methodologies employed in the four SWS countries, examining the definition and composition of the networks and the considerations and decisions made that affected the findings and analysis.

Networks Examined

A brief description of each network is described below. In all locations, baseline SNAs took place in the early stages of SWS, in 2017 or 2018, though SWS conducted baseline SNAs in Ethiopia before forming the four learning alliances. All teams originally planned to have at least one follow-up SNA to monitor changes in network dynamics over time. In Cambodia, however, SWS activities ended in 2018 due to external factors, so SWS did not complete the planned endline analysis.

Ethiopia (IRC, Tetra Tech, LINC): In Ethiopia, SWS conducted activities in four locations: two on rural water systems in the *woredas* (districts) of South Ari and Mile, and two on urban sanitation systems in the small towns of Woliso and Debre Birhan. In each location, SWS teams mobilized WASH stakeholders to form and facilitate learning alliances, locally led platforms of key stakeholders, designed to strengthen collaboration and share knowledge to improve service efficiency, effectiveness, and sustainability. Learning alliance members included local representatives of public agencies, NGOs, academic institutions, and private enterprises involved in WASH service provision. SWS conducted three SNAs in each location in Ethiopia: at baseline, midterm, and endline of the SWS activity. Baseline SNAs in all four locations were conducted concurrently with mobilization of the learning alliances, so the baseline roster included both expected and potential learning alliance members. LINC applied a “roster-based, whole-of-network” approach at all timepoints, whereby it surveyed 100 percent of stakeholders that the SWS team identified (ranging from 11–23 network members in the four locations).

Kabarole, Uganda (IRC): IRC had an extended history in Kabarole, Uganda, supporting WASH development for more than 10 years. SWS supported and facilitated the Kabarole District WASH Task Team (DWTT), formed in 2017 to improve water service sustainability. For the SNA, the team expanded the network analyzed beyond the DWTT to include water supply stakeholders at regional, district, sub-county, and parish levels, plus users and community members. The team identified a roster of 54 actors, of which they surveyed 49 (91 percent) in both baseline and endline periods, with reported connections to the remaining five also recorded. Procedurally, the enumerators collecting network data asked each interviewee to draw a map illustrating his or her connections to other stakeholders in the roster. SWS then combined these “ego-centric” maps to develop the overall network map.

Kamuli, Uganda (Whave Solutions): In Kamuli, Uganda, Whave Solutions, a nonprofit social enterprise providing water maintenance services, had worked in the district supporting rural water systems for several years prior to the start of SWS. Engagement with local government and other stakeholders has been central to the establishment and scaling of Whave’s service model in Kamuli. The

SNA helped to identify network gaps and opportunities for strategic intervention to strengthen network ties among actors in Kamuli District, as well as to measure change in the network over the period of SWS support. The network roster included actors relevant to water supply and maintenance in the district, including community representatives from two sub-counties. Like in Kabarole, Whave developed a roster of 51 actors, of which it surveyed 46 (90 percent) in both baseline and endline periods, with participants allowed to name the actors not reached. Participants similarly generated ego-centric network maps, placing those with whom they have relationships in concentric rings by frequency of interaction; colored lines were drawn to indicate type of connection.

Kitui, Kenya (University of Oxford and FundiFix): In Kitui, Kenya, SWS addresses sustainable water service delivery at the county level, to which water service oversight in Kenya is devolved. The network included stakeholders already mobilized and cooperating under an existing county-level group who regularly convene via a WASH forum to improve water sector planning and coordination. Through SWS, the University of Oxford and FundiFix supported the forum to document, understand, and share information relevant to sustainable water service delivery. The WASH forum is comprised of county and national government line ministries and agencies, NGOs, development partners, private sector, informal water service providers, and academic or research institutions. SNA participants included forum members plus broader stakeholders engaged in county water services. The SNAs initially surveyed the 25 stakeholders in the WASH forum at baseline, then allowed them to identify additional actors not included in the forum, ultimately resulting in a network of 75 actors (an additional 50 were named from outside the forum). This approach is termed a “limited snowball.” In a true snowball, those named actors would all subsequently be interviewed and asked to identify additional actors, iterating the process until no new actors are named.

Cambodia (WaterSHED and LINC): In Cambodia, the local NGO WaterSHED led an effort to support key stakeholders in rural sanitation and hygiene (RuSH) to achieve ambitious goals established in the Government of Cambodia’s National Strategy for Rural Water Supply, Sanitation, and Hygiene 2011–2025. WaterSHED, together with LINC, undertook an effort to facilitate a locally led, locally owned systems approach to engage national RuSH stakeholders in a Collective Impact process. WaterSHED initially identified SNA participants from World Bank surveys from 2013 and 2016, plus additional participants from recent RuSH sector meetings, attendance lists, and recommendations, totaling 113 actors. Of these, WaterSHED interviewed 99 (88 percent) at baseline using a tablet-based questionnaire. WaterSHED then selected 88 to be included in the SNA according to criteria gauging their relevance on a national level: presence in Phnom Penh and commitment to RuSH based on mission, budget, or staffing levels. In Cambodia, a systems mapping process complemented the SNA to identify the key enabling and inhibiting factors for achieving RuSH goals in the National Strategy.

SNA Design Considerations

This section details SNA characteristics across the SWS activities and some of the key considerations that drove SNA designs. As with all SNAs, a variety of design decisions can be made depending on the context, purpose, and scope of the specific study. Table 2 summarizes the SWS network analyses and their key methodology characteristics.

Table 2. SNA Considerations and Parameters in SWS

	Ethiopia (IRC, Tetra Tech, LINC)	Kabarole, Uganda (IRC)	Kamuli, Uganda (Whave Solutions)	Kitui Kenya (Oxford, Fundifix)	Cambodia (WaterSHED, LINC)
Purpose	Design, monitoring, facilitation	Design, monitoring, facilitation	Design, monitoring, facilitation	Design, monitoring, facilitation	Design
WASH Focus	Small town sanitation, rural water supply	Rural water supply	Rural water supply	Rural water supply	Rural sanitation and hygiene
Stakeholders or Participants	Learning alliance (new) and select stakeholders	Learning alliance (existing**) and related stakeholders	Rural water supply service providers, authorities, and users	WASH forum (existing) and related stakeholders	National-level RuSH stakeholders
Location	Small town sanitation: Debre Birhan Town Woliso Town Rural water supply: South Ari District Mile District	Kabarole District	Kamuli District	Kitui County	National level
SNA Timing	Baseline, midterm, endline	Baseline, endline	Baseline, endline	Baseline, endline	Baseline
Data Collection	Roster (100 percent response rate)	Roster with sample	Roster with sample	Roster with open-ended response (limited snowball at baseline)	Roster (88 percent response rate)
Survey Methodology	Tablet-based interview	Individual network mapping exercise	Individual network mapping exercise	Individual network mapping exercise	Tablet-based interview
Full Network Size*	Debre Birhan: 16–21 Woliso: 14–19 South Ari: 21–23 Mile: 11–21	54	51	75	88
Actors Interviewed	100 percent of full network	49	46	Baseline: 28 Endline: 26	99
Relationship Types Analyzed	Information sharing, problem solving, direct coordination	Information, skills, authority, resources	Information, skills, authority, resources	Information, skills, authority, resources	Information, involvement, resources, communications, influence
Data Collection Enumerators	External enumerators, sometimes accompanied by SWS staff	Lead consultant with external enumerators	Baseline: SWS team Endline: Enumerators supported by SWS staff	SWS staff and logistical enumerator	External enumerators
Lead Data Analyst	LINC	Consultant***	Consultant***	Consultant***	LINC

Notes:

* In Ethiopia, network size and rosters varied from baseline to midterm to endline, because some stakeholders surveyed in baseline were ultimately not included in the learning alliance, and other members such as NGO projects joined or left as projects started up or ended.

** After baseline, during the course of the activity, the learning alliance became the DWTT.

*** SWS engaged the same consultant to conduct all the SNAs in Uganda and Kenya.

SNA Objectives: Table 3 summarizes the specific objectives of the SNAs in each of the SWS locations.

Table 3. SNA Objectives by Country

Location	SNA Objectives
Ethiopia	<ul style="list-style-type: none"> • Verify stakeholders to invite to join the learning alliances (baseline). • Understand the nature and effectiveness of relationships among stakeholders. • Identify strengths and build opportunities for WASH systems based on cooperation. • Compare the state of the networks over SWS's period of performance.
Kabarole, Uganda	<ul style="list-style-type: none"> • Assess development of the DWTT and effectiveness as a learning alliance toward SDG 6. • Assess approach, efficacy, and sustainability of the learning alliance platform as a vehicle for sector learning. • Assess effectiveness of DWTT to facilitate actors and connections to improve rural water supply.
Kamuli, Uganda	<ul style="list-style-type: none"> • Examine how networks and factors affecting rural water service evolved over the 2-year SWS period.
Kitui, Kenya	<ul style="list-style-type: none"> • Assess how the network changed over the 2-year period. • Examine the extent to which different stakeholder groups became stronger or more influential. • Assess the extent to which actors increased coordination and interaction.
Cambodia	<ul style="list-style-type: none"> • Better align RuSH stakeholder activities and support collective action in RuSH at the national level.

Network Definitions: In SNA, system boundaries are often defined to include those actors *directly* contributing to the network or results, though they can include actors further removed, depending on the SNA objectives. Boundaries may also depend on more practical factors, such as time and resource limitations, overall network size, and survey methodology. As seen in Table 2, network geographic focus varied from local districts through counties and up to the national level, depending on the programmatic focus. Network sizes also ranged from as few as 11 members (Mile, Ethiopia endline SNA) to 99 members (the national-level network in Cambodia). In Uganda, the team included all communities (parishes) from two sampled sub-counties in the stakeholder roster, with surveys conducted with water committee representatives from the respective communities. In Kenya, teams surveyed the initial roster of 25 actors, allowing them to provide open-ended responses to include other actors (at baseline), ultimately resulting in a network size of 75. To the extent possible, teams attempted to maintain roster consistency between the baseline and endline SNAs, although in some cases actors joined or withdrew from the network, such as newly formed enterprises and NGOs starting up or closing out their local WASH activities.

SNA Iterations: All teams planned both baseline and endline SNA iterations, though, as noted, Cambodia only completed a baseline SNA. In Ethiopia, the teams also incorporated midterm SNAs in all four sites. The Ethiopia activity also conducted the baseline SNAs earlier in the SWS implementation process than other locations, facilitating its use in design and allowing time between subsequent SNA

iterations. Availability of resources and the expected pace of network change also played a role in the number and timing of SNAs.

Data Collection: All the SNAs collected primary data in person via individual interviews and surveys. For large networks where personal interviews are not realistic, a sample may be applied, as in Uganda. An alternative means of data collection may also be applied, such as a web-based survey; however, SWS did not employ this method to ensure inclusion of actors with limited internet access. SNAs that utilize a less-than-complete roster will inherently miss relationships named from those missed actors; in such cases, the SNA can still identify network core actors and their relative prominence, but it is important to be aware of potential limitations. To collect data, Ethiopia and Cambodia SNAs used external enumerators, whereas teams in Uganda and Kenya relied at least partially on their program staff for enumeration. In Uganda and Kenya, SWS surveyed actors using a visual network mapping exercise (see photo at right) in which Post-it notes and markers graphically illustrate relationships and indicate type and frequency. In Ethiopia and Cambodia, SWS interviewed actors via a tablet-based survey, where respondents indicated relationships from a separate, printed list of other actors, with responses immediately recorded on the tablet and uploaded later when enumerators had internet access. Both methods can be used to collect the same information on actors and their relationships, with the trade-off of accessibility to respondents versus ease of data entry for analysis and time required for data entry. In all locations, other data collection efforts accompanied the SNA, including a qualitative analysis of factors contributing to WASH sustainability.



*SNA mapping exercise in Uganda.
Photo credit: Duncan McNicholl.*

Relationship Types: SNAs can examine any type of relationship or interaction but are commonly used to explore how information, resources, and skills flow through the network and who collaborates with whom. SWS selected relationship types based on the theory of change for local interventions, as well as advice from SNA experts. Table 4 provides a summary of the relationship types. In Uganda, Kenya, and Cambodia, enumerators did not ask respondents to distinguish between “directionality” of the relationship (i.e., “from” and “to” in the relationship). In Ethiopia, the baseline and midterm SNAs collected directionality data, but the endline survey was simplified, eliminating the issue of directionality. (It had not been sufficiently used in previous analyses to justify the additional time to collect and analyze; use and need should be considered in design of studies up front.) SNA analysts, field teams, and stakeholders found additional attribute information for relationships to be useful for analysis. For example, in all locations, SWS asked respondents about the frequency of information sharing in those types of relationships. Analysis of that data typically included identifying network actors who were excluded from frequent communication. In Kabarole, Uganda, despite the presence of relationships between communities and other actors at regional, district, and sub-county levels, many communities appeared to be isolated from frequent communication.

Table 4. SNA Relationships Examined and Survey Questions

Country	Relationship Types and Description
Ethiopia	<p>Information Sharing: Sharing of information on water or sanitation within the past 6 months, not including learning alliance meetings or instances where information was shared with a broad group. For indicated information sharing relationships, respondents were asked to provide frequency of communication: more or less than once per month.</p> <p>Direct Coordination: Coordinating directly within the past 6 months, including joint activities, sharing responsibilities, synergistic activities, evaluating progress, or similar relationships. For indicated coordination relationships, respondents were asked to provide type of coordination activities: service provision, maintenance, and rehabilitation; monitoring; capacity building; community engagement.</p> <p>Problem Solving: Requests to or from another actor to provide assistance. For indicated problem-solving relationships, respondents were asked to provide outcome: (1) support requested but not provided; (2) support provided but problem not resolved; (3) support provided and problem resolved; (4) support ongoing.</p>
Uganda and Kenya	<p>Information Sharing: Sharing of information related to new services or regulations. For indicated information sharing relationships, respondents were asked to provide the frequency of interaction.</p> <p>Skills and Support: Technical support provided or received. For indicated skills and support relationships, respondents were asked to provide the frequency of interaction.</p> <p>Resources: Type and value of resource flow, including financial, human, and/or material. For indicated resource relationships, respondents were asked to provide the frequency of interaction.</p> <p>Authority or Influence: Influence and/or authority over the interests of others and/or compliance enforcement. For indicated authority or influence relationships, respondents were asked to provide the frequency of interaction.</p>
Cambodia	<p>Formal versus Informal: Respondent assessment of whether the relationship is formal or informal.</p> <p>Information Sharing: Degree of information sharing, plus frequency and changes over the previous year, plus quality of information sharing ranked on a scale of 1–5.</p> <p>Contribution to RuSH: For each organization named, perception of their contribution to RuSH sector according to level of involvement, resource contributions, reliability, openness to discussion, fairness toward others, commitment, and influence.</p>

Stakeholder (Node) Attributes: Table 5 presents a summary of the stakeholder attribute data collected in each of the SNAs. Stakeholder attributes are demographic and other basic characteristics of each stakeholder that can be used for the analysis of network dynamics. Stakeholder attributes should be considered judiciously, as the analysis expands exponentially with each addition of a new attribute;

attributes might, however, also be useful for other purposes. As seen in Table 5, the number of actor attributes collected varied significantly among the SWS activities.

Table 5. Stakeholder (Node) Attributes Collected

Ethiopia	Kitui, Kenya	Kamuli, Uganda	Kabarole, Uganda	Cambodia
<ul style="list-style-type: none"> • Organization type • Geographic coverage • WASH sector • WASH functions and services 	<ul style="list-style-type: none"> • Organization type 	<ul style="list-style-type: none"> • Organization type • Geographic coverage 	<ul style="list-style-type: none"> • Organization type 	<ul style="list-style-type: none"> • Organization type • Geographic coverage • WASH sector • WASH activities • Target populations • Funding sources • Year established • Gender of director (M/F) • Faith based (Y/N)

SNA Implementation Considerations

This section highlights observations and comparisons of the implementation methods to applying SNA across SWS activities.

SNA Integration into Field Activities: SWS generally embedded SNA within the implementation of field activities. Compared to a standalone research activity, this practice aimed to support the SWS teams' and WASH stakeholders' design, execution, and utilization of SNA. The SWS project teams' relationships with local stakeholders proved invaluable in obtaining access and agreement to participate. Because sharing relationship data can be (and in some cases proved to be) sensitive, SWS teams' previous experience with participants helped to instill trust in the process and objectivity in analyzing the results. These factors led to the high response rates — nearly 100 percent of targeted respondents for all surveys — and complete, high-quality data that proved essential to analyzing the networks.

Engaging Experts: For all the SWS teams, SNA was a new tool. As a result, the teams engaged experts for the design and implementation of the SNAs, drawing on the experience of consortium partners and consultants. While the teams considered the technical assistance useful and valuable, liaising with the external actors required additional time and coordination. At times, these demands proved challenging, particularly in coordinating the numerous international and local experts and consultants in parallel with their duties in facilitating their project implementation activities. The teams that relied primarily on their own internal resources had generally more positive experiences with respect to learning and building their own capacity, executing a greater leadership role, and obtaining useful

feedback during validation workshops. In Ethiopia, SWS teams used an external enumerator and reported spending considerable time and coordination on scheduling and coordinating surveys.

Complementary Tools and Analysis: SNA is typically not intended as a standalone tool in development programs; although SNA can help to describe the network in its current state, other sources of information and contextual understanding are often required to properly interpret its meaning. To draw valid conclusions about network structure and drive program design issues, other data and tools can complement SNA. SWS field teams typically integrated SNA with other tools in each location, including factor analysis, systems mapping, stakeholder and key informant interviews, building block analysis, and/or political economy analysis. This integration helped contextualize and interpret findings and results. However, the volume of data and findings reported through the different learning initiatives is challenging to examine as a whole, considering the different analysis and reporting time frames of the various partners. Multiple studies completed simultaneously increased the teams' time commitment.

Right-Size Data Collection: Often, SWS collected more data than it could use in analyses. In part, this reflects the research nature of the global learning project, which perhaps incorporated more rigorous analysis than might otherwise be the case. This also reflects the nature of research studies and data collection in general: at the outset, it is difficult to anticipate new and useful findings, so astute researchers tend to collect readily available and potentially useful data. In some cases, SWS teams simplified their SNAs following the baseline, eliminating some of the less useful data and combining certain relationship attributes (e.g., directionality). Together with the feedback of the SWS teams, this highlights the need to align research design with its intended use and to right-size data collection.

Validation and Review with Stakeholders: Following data collection and analysis, all SWS teams reported having conducted some form of validation and review process with the stakeholders. SWS teams and local participants reported that these workshops were generally useful to better understand network dynamics and how they impact sustainable WASH services, as well as to generate momentum and ground-truth action. SNA results also served as a good starting point for valuable conversations about flow of information, coordination of activities, and group cohesion. While both SWS teams and local actors valued stakeholder engagement, the process demanded considerable time to plan, prepare, and implement, particularly considering other ongoing WASH and network-strengthening initiatives.

COVID-19 Impact and Adaptations

COVID-19 Impact on SNAs: SWS had planned to conduct all its endlines in 2020 when the COVID-19 pandemic emerged. Logistically, the SNAs themselves had relatively minimal disruptions, aside from some specific cases of travel restrictions and lockdowns that delayed data collection. Fortunately, because COVID-19 only impacted the endline SNAs, many of the respondents already had familiarity with the approach, making challenges somewhat easier to navigate.

COVID-19 Impact on Coordination: The larger effect of the pandemic's restrictions dealt with the coordination platforms themselves and the inability of stakeholders to gather and participate in their regularly scheduled meetings during much of 2020. Clearly, this impacted collaboration and relationships, together with their scope, purpose, and reported frequency. Examining the data and comparing them with the qualitative observations of SWS teams made all these issues clear and evident. In some of the locations in Ethiopia, the numbers of network connections, density, and cohesion metrics decreased in the endline SNA from the midterm. The SWS Ethiopia teams pointed out that the observed decreases in linkages in the endline did not reflect the true nature of the health of the networks, but rather the realities faced by the stakeholders attempting to perform their duties and work toward their common objectives.

Positive Outcomes: At the same time, some positive outcomes occurred during the pandemic. In Woliso, Ethiopia, the learning alliance added COVID-19 prevention and mitigation topics to its discussions and agenda, leveraging the platform to respond to emerging issues and prepare stakeholders to plan for emergencies and contingencies.

Key Uses of SNA to Strengthen WASH Systems

This section describes the primary ways that SWS field teams applied and used SNA to support their work. In analyzing and comparing the stated objectives for SNA in each context (see Table 3), and the use of SNA across SWS locations, the research team identified three common purposes for SNA application in SWS: *Activity Design; Monitoring, Evaluation, and Learning; and Stakeholder Understanding.*

Table 6 provides a summary of the three common purposes and examples of specific SNA applications under SWS for each purpose. Descriptions of applications are then detailed in following sections.

Table 6. SNA Applications in WASH Programs

Purpose	Specific Applications
<p>Activity Design: Gain Better Understanding of WASH Systems to Plan Strategies and Interventions</p>	<p>Identify stakeholders and relationships that are likely to influence the project.</p> <p>Provide insight to plan strategies and activities.</p> <p>Assess networks and collaboration structures to generate discussion and solutions toward sustainable, appropriate WASH solutions and how they currently (and should) function.</p> <p>Assess the extent to which planning and problem solving for WASH services is inclusive and participatory for relevant stakeholders and users.</p> <p>Assess actual patterns and gaps in communication and collaboration among WASH actors, which are often found to be different from formal WASH structures.</p> <p>Determine how resources flow in WASH networks, including technical assistance, capacity development, maintenance, and investment.</p> <p>Assess the power structures that affect how decisions are made about WASH services to improve the efficiency and participation of non-core stakeholders.</p>
<p>Monitoring, Evaluation, and Learning: Measure Change in Network Dynamics and Stakeholder Position over Time</p>	<p>Track changes in the structure and nature of relationships and in the network position of key actors.</p> <p>Incorporate insights into performance evaluations, specifically indicators that examine, rely on, or impact stakeholder relationships.</p> <p>Help troubleshoot challenges, identify root causes of performance gaps, and support facilitative interventions to strengthen the network and improve impact.</p> <p>Provide a more holistic perspective of the project’s impact on WASH systems.</p> <p>Adapt interventions based on the evolving network to increase collective sharing and action among WASH stakeholders.</p>

<p>Stakeholder Understanding: Inform Stakeholders about System Dynamics to Catalyze Network Improvement from Within</p>	<p>Support local stakeholders to make data-driven decisions.</p> <p>Increase engagement of water users, communities, and other frontline WASH stakeholders, including expanded opportunities for WASH users and communities to influence systems and stakeholders.</p> <p>Increase stakeholder understanding on how WASH actors engage with the broader development system and other actors.</p> <p>Transition from a technical, compartmentalized mindset to a systems mindset that recognizes interdependence, complexity, adaptation, and interactions.</p> <p>Strengthen collaboration among WASH actors to address sustainable service delivery and momentum to achieve more together.</p> <p>Inform exit strategies and transition plans to fill sustainability gaps that currently rely on international donors, projects, and NGOs.</p>
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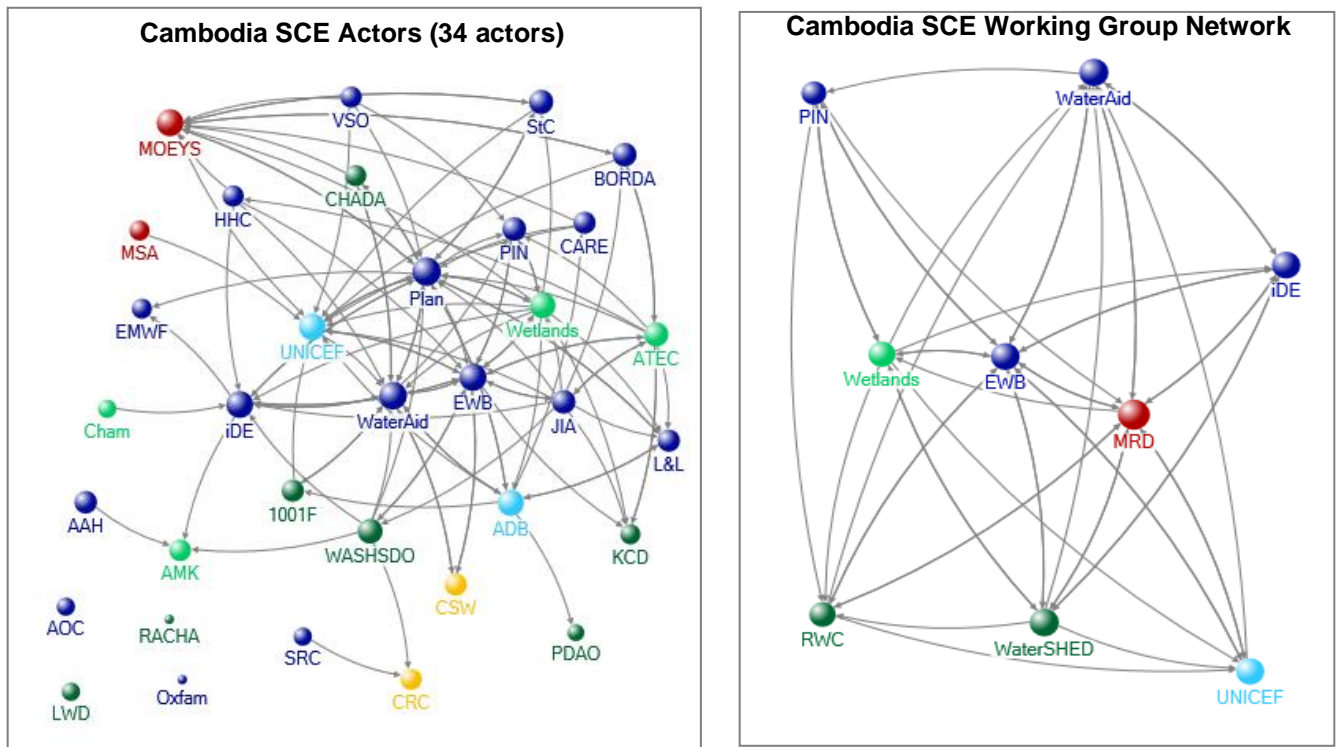
Applications of SNA for Activity Design

SNA was applied as a baseline instrument to better understand the structure of networks and to use that information to inform program strategy, interventions, approaches, and partnership. The SNAs aimed to help the SWS teams identify collaboration structures, collaboration gaps, and target and shape interventions. These applications are described in detail below.

Identify Collaboration Structures: One of the goals of the SWS SNAs was to identify existing structures of collaboration to leverage. The baseline SNAs provided project teams with findings and data to be used as discussion points during subsequent meetings; allowed coalition members to validate, dispute, or otherwise discuss cooperation and ways to improve; and defined the role of SWS to facilitate interventions. In some cases, local coalitions drew upon existing strategies and plans to develop concrete activities and areas of collaboration.

- Stakeholder Identification:** In Kitui, Kenya, the baseline SNA identified 50 additional stakeholders not included in the initial pool of 25, informing the WASH forum and allowing SWS to engage the new actors. The team highlighted the potential inclusion of commonly overlooked stakeholders, such as media, security, and gender and rights organizations.
- Coordination Sub-Groups:** In Cambodia, the baseline SNA showed several thematic sub-groups both well connected among one another and to the overall network. Figure 1 shows network maps comparing relationships among all actors who indicated they work on sanitation in challenging environments compared to the denser relationships among the actors in the Sanitation in Challenging Environments (SCE) working group. Combined with qualitative analysis, SWS identified these sub-groups as strong models for coordination to advance broader RuSH network goals. In addition, in Kitui, Kenya, the SNA cluster analysis identified five multi-stakeholder sub-groups that had high levels of information sharing among themselves and were connected by “bridging” organizations. Through facilitated discussion during feedback, the network charted pathways to leverage these strengths within the network going forward.

Figure 1. Network Maps of SCE Actors (Network Members Working on SCE) and of the SCE Working Group

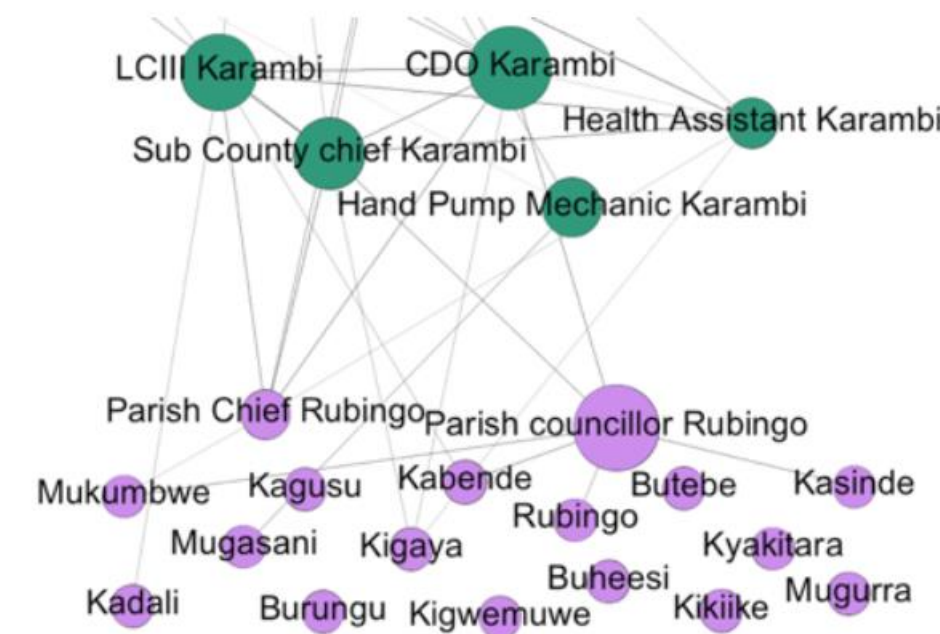


- Core/Periphery:** In Ethiopia, multiple networks showed a strong core/periphery structure, with some central actors, primarily government, engaging with a wider set of government and non-government actors on WASH-related issues. Often, facilitators encouraged these members to serve on steering committees and to engage with a wider set of peripheral network members to address participation and sustainability issues within the network.

Identify Collaboration Gaps: SNAs also helped to identify collaboration gaps to improve upon in activity design.

- Stronger Community Connections:** In Kabarole, Uganda, the SNA identified a disconnect between district-level stakeholders and user communities, and thus an opportunity to bridge the gap. Seeing this represented on a visual map following the baseline SNA (see Figure 2) led to prioritizing the issue. As a result, the learning alliance expanded its membership to include representatives from lower administrative levels and agreed to improve community engagement and communications going forward. Recommendations offered in the endline SNA include continuing to monitor gaps between District Master Plan intent and community engagement and to coordinate to ensure that progress made at the district level translates into effective improvements in sub-county and community service improvements and sustainability.

Figure 2. In Kabarole, Uganda, Many Communities in Karambi Sub-County Do Not Have Relationships with One Another or to Sub-County Actors



- **Political and Technical Coordination:** In Kamuli, Uganda, the SNA examined the relationship between water user committees and sub-county officials. This uncovered a lack of relationship between political and technical actors and generated a desire among partners to strengthen this to develop solutions for rural water maintenance.
- **Role Clarification:** The SNAs also uncovered new questions and provided an avenue to explore additional issues. In Kitui, Kenya, in responding to the question of why stakeholders shifted their priority activities between the baseline and endline, the stakeholders noted a lack of clarity on roles and responsibilities, especially among government actors, because county staff are oriented toward outdated management concepts. Thus, roles and responsibilities needed to be updated.

Target and Shape Interventions: Understanding network structure also aided SWS teams to target and shape their intervention strategy.

- **Strategies Informed:** In Kabarole, Uganda, the SNA helped to identify the central stakeholders to the network, which included both traditional political leaders and other actors, allowing the SWS team to facilitate network discussions on strategies to improve coordination and information sharing.
- **Stakeholder Identification and Outreach:** In Kitui, Kenya, the SNA showed a greater number of relevant WASH actors than the core stakeholders that the team originally anticipated and that the County WASH Coordination Office had a central position in this network. This finding helped to inform the SWS team’s strategy to support key members of the WASH forum

and to facilitate their involvement in reaching the broader network and less-included stakeholders.

- **Information Sharing and Coordination:** Also in Kitui, Kenya, the network cited a need to elevate actors to the same levels of understanding of water issues, beginning with issues hindering sustainability, so that they can further strengthen shared priorities. Network members also noted that while discussions and prioritization occurred regarding coordination in managing water supply schemes, they observed a lack of shared tools to guide stakeholders in actualizing them. SWS used this information to plan and improve SWS interventions and gauge future progress.
- **Action Planning:** In Woliso, Ethiopia, the learning alliance used SNA results to inform an action plan for community awareness campaigns on waste management, applying a network lens to illustrate the ideal network for executing the community campaigns. The process of visualizing a sub-network around a specific objective encouraged more thoughtful discussion on the importance of relationships in sanitation systems.

Applications of SNA for Monitoring, Evaluation, and Learning

SWS also used SNAs to monitor changes in networks. All teams planned to conduct SNAs at least twice over the project life cycle to understand how network characteristics and behaviors shifted over time. Many SWS interventions focused on increasing collaboration among WASH actors; as a result, they anticipated that the SNA would help them understand and verify whether expected improvements in network cohesion occurred. In 2019, SWS conducted midterm SNAs in Ethiopia for the four learning alliances, and in 2020–2021, SWS conducted endline SNAs for all networks in Ethiopia, Uganda, and Kenya. The ways in which SNA helped identify network cohesion and gaps are described in detail below.

Network Cohesion and Gaps: SNA allowed SWS field teams to identify changes in overall network cohesion over time, including ties throughout the network, gaps in interaction, reach of the network, and other cohesion measures. It is important to note that the SWS networks generally showed improving trends in network relationships, metrics, and cohesion, especially accounting for the effects of COVID-19 on the ability of stakeholders to meet (Cambodia excluded, as it did not conduct an endline SNA). This indicates that, despite the different locales and activities, all teams' approaches to facilitating improved WASH systems proved effective, as measured by the SNA and validated by the teams and stakeholders. This also highlights the potential value of SNA both as a monitoring tool and as a means to identify effective strategies to improve collaboration and cohesion.

- **Number of Linkages:** In Kitui, Kenya, the number of linkages between actors in the overall network increased by nearly four times between the baseline and endline (see Figure 3). Information sharing linkages accounted for the greatest number (117 baseline to 345 endline), with the largest proportional increases in areas of skills (37 to 212), resources (11 to 50), and then authority (58 to 218).

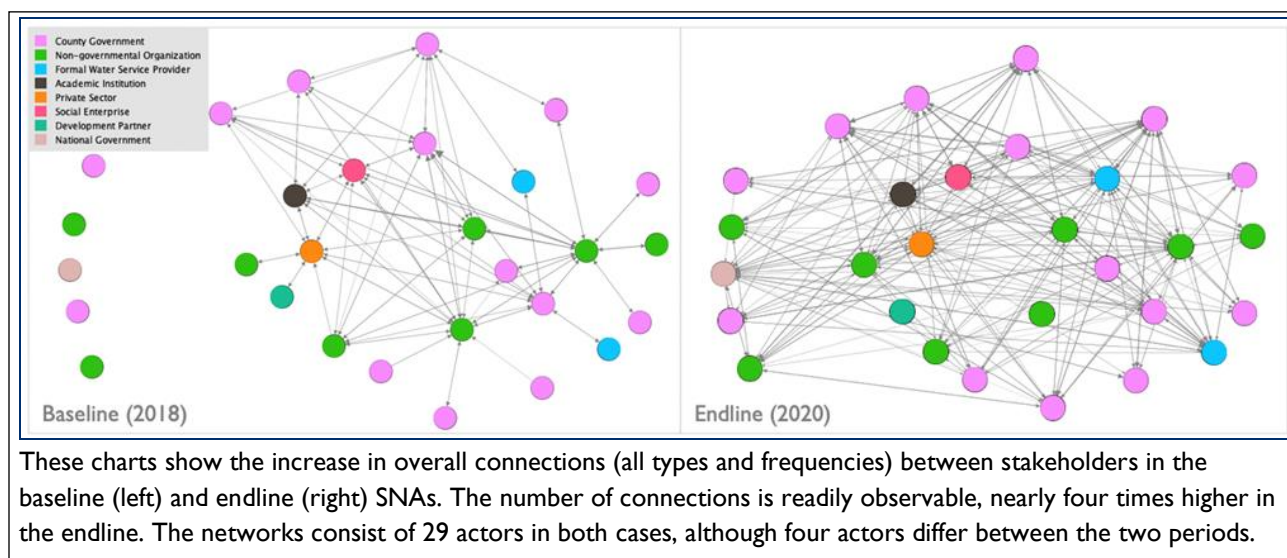


Figure 3. Strengthening WASH Networks in Kitui, Kenya (Whole of Network at Baseline and Endline)

- Progress Among Stakeholders:** In Debre Birhan, Ethiopia, the SNA indicated that the strength and cohesiveness of the network increased successively with each SNA and in all types of relationships (see Figure 4). In validating the results, the stakeholders and SWS team reported progress among the stakeholders in several areas, including increased participation of decision-makers, increased town sanitation budget, and increased dialogue across sanitation issues. The team attributed increasing trends in coordinating service provision in part to the allocation of financial resources from the municipality and the World Bank's Second Urban Water Supply and Sanitation Project, which also attributed to those actors' prominence in the network. Overall, the SNA showed significant network strengthening; the SWS team and network members' testimony supports this observation.

Table 7. Baseline, Midterm, and Endline SNA Results from Debre Birhan, Ethiopia

Metric	Baseline	Midterm	Change	End-Line	Change *
Overall Network					
Size: Current Members	16	19	+19%	21 **	+11%
Connections	96	208	+119%	205	0%
Information Sharing					
Connections	77	142	+82%	202	+42%
Density	28%	47%	+68%	48%	+2%
Average Degree	9.06	14.20	+57%	19.24	+35%
Average Distance	1.72	1.38	-20%	1.38	0%
Direct Coordination					

Connections	20	78	+290%	86	+10%
Density	22%	35%	+59%	20%	-43%
Average Degree	2.86	6.32	+121%	8.19	+30%
Average Distance	2.05	1.63	-20%	1.71	+5%
Problem Solving					
Connections	71	81	+14%	97	+20%
Density	26%	21%	-19%	23%	+10%
Average Degree	8.36	8.10	-3%	9.24	+14%
Average Distance	1.59	1.68	+6%	1.68	0%
* Percent Change from the Midterm.					
** Includes Communal Latrine Operator (Selassie Orthodox Church), who was surveyed but not officially a member.					

Actor Influence: SNA also allowed SWS field teams to observe changes in the centrality, influence, and connectedness of specific actors within each network.

- Prominence of Actors:** In Ethiopia, the midterm SNAs showed that certain public stakeholders with infrastructure mandates had become less prominent, while some working in other sectors gained in prominence. SWS interpreted this to reflect that the learning alliances may be addressing WASH with more multi-sectoral, inclusive, and long-term viewpoints. At the same time, the SNAs identified areas for further attention, including the need to involve non-governmental actors in WASH networks.
- Local Ownership:** In Kamuli, Uganda, in addition to understanding changes in connectivity, one SWS team hoped to observe a change in its own position in the network. The SNA in Kamuli included local SWS partner Whave; at the baseline, Whave appeared highly central in many relationship types, as expected. However, by transferring ownership of different capabilities to other local actors and fostering relationships among them, the team hoped to observe a decrease in the centrality of Whave in the network. The endline analysis found that several of the intended actors in fact all became more central to network information flows since the 2018 baseline. Whave, however, also remained highly central, suggesting that actors other than Whave that are directly involved in preventive maintenance services have become increasingly critical information brokers in the network.

Applications of SNA for Stakeholder Understanding

SNA can also be used as an intervention itself, helping actors to view themselves and their roles in their own networks and to spark discussion and action. In all four countries, SWS teams held participatory workshops with stakeholders to better understand, validate, and act upon the results. In most cases, SWS held the workshops alongside planning sessions and regularly scheduled meetings. This feedback on network dynamics provided to stakeholders in the workshops aimed to encourage local actors to adopt a more inclusive and collaborative approach. SWS found that SNA was beneficial for shifting to systems mindsets and influencing individual actor and group behaviors. These applications are described in detail below. The approach to these workshops and the outputs of the workshops varied in different

locations; the next section provides more information on the theme of value, perceptions, and ownership.

Shift to Systems Mindset: SWS teams emphasized that SNA is useful when working with local coalitions to shift from a technical, compartmentalized mindset to a systems mindset that recognizes complexity, adaptation, and interactions. In some cases, the network analyses served as visual aids for discussion, while in other settings the groups focused on discussion around more detailed analysis. Stakeholders reported that SNAs helped them consider how the structure and dynamics of their network relates to their objectives for sustainable WASH services.

- **Complexity-aware decision-making:** In Kitui, Kenya, the SWS team reported using the SNA results on an ongoing basis as a decision-making tool when deciding which actors were best suited to share a new technical resource through the network or which actors support certain new policy advocacy initiatives.
- **Collective perspective:** In Uganda and Kenya, where methodologies applied visual mapping exercises to collect data, users could observe their reported connections within the network maps during the validation workshops. Some teams noted that because the SNA was generated from the collective perspectives of stakeholders themselves, they perceived the results to demonstrate high validity and better represent the complete situation than individual stakeholders' perceptions. Local stakeholders found the SNA visual tools and maps to be compelling and useful.



*Participant at SNA workshop in Ethiopia mapping network relationships.
(Photo Credit: Megan McDermott)*

Individual Actor and Group Behaviors: Stakeholder understanding of the system, and of their network, can help encourage or catalyze behavior change outside of program interventions. It is important to note that while many of these changes will be positive, as stakeholders consider the increased understanding of the complexity of the problems faced, some may also create new impediments or constraints.

- **Centrality of government:** Government actors and agencies responsible for WASH systems are generally central to their networks. Similarly, donors and NGOs with funds to deliver WASH solutions are also typically central, although their departures following closures of their projects are noticeable, lowering network cohesion with their absence. Most WASH networks indicated a tendency of government actors to forge ties with other government actors more commonly than with those in other sectors. Over time, often with stakeholder will and targeted support from SWS, network dynamics changed as non-government actors often gained in prominence. For example, in Mile, Ethiopia, unemployed youth formed the Mile Woreda Maintenance and Spare Part Enterprise to supply spare parts for water supply and distribution in the region; SWS supported capacity building, dialogue, and minor construction for the

enterprise, which subsequently appeared as a core actor in problem-solving relationships in the endline SNA.

- **Skill-sharing relationships:** In Kitui, Kenya, a comparison between baseline and endline results indicated an increase of county government actors' skill-sharing roles, potentially indicating the network's growing investment to strengthen county government capacities in the network core. Discussing this shift with the forum members at the validation workshop identified factors that may have contributed to increased skill-sharing relationships, allowing actors to see which behaviors are improving WASH results: (1) adoption of online platforms, including organizational WhatsApp groups for knowledge and information exchange; (2) increased internet access and usage among the county government and other WASH stakeholders; (3) improved information flow within the county government structures, with regular meetings and workshops held monthly and quarterly; (4) increased investment in training from both the county government and WASH stakeholders, especially for sub-county water offices (field officers of the county government) and water committees at community-managed schemes; and (5) trainings delivered through SWS in areas of smart reporting, resource mapping, data analysis and management, life cycle costing, and climate-proofing water supply infrastructure.
- **Women in WASH:** In Cambodia, SNA found female-run organizations significantly less connected and central to the network than male-run organizations. On average, female-run organizations reported 60 percent fewer connections than male-run organizations. The study also found female-run organizations much less likely to be an informational bridge in the RuSH network. Not all stakeholders agreed with this finding, and it led to an intense debate during and after the stakeholder validation workshop. However, the finding catalyzed a women-led initiative that had already been forming into establishing a Women in WASH community and related programs in Cambodia.

Value, Perceptions, and Ownership of SNA

All SWS teams incorporated some form of participatory methodology in the SNA process, and conducted workshops with stakeholders to present SNA findings for feedback, an important input to get the most value from SNA. This section first presents how feedback and validation methods differed across SWS locations and then summarizes the feedback received from stakeholders and SWS field teams on the value and process of SNA.

Feedback and Validation Methodologies

While SNA provides insights and observations about *how* a network is structured, it cannot explain *why* the network is structured that way. Network members reviewing the insights and observations are often the best sources of knowledge on why a network has a certain structure and can provide significant additional context to SNA findings. SWS teams in each location shared SNA findings with stakeholders, applying somewhat different methods for collecting feedback, validating findings, and discussing potential actions to take. The workshop sessions aimed to inform and spark action among participants, provide insight into the dynamics among members, and help to better understand methods of engagement. During the workshops, stakeholders reviewed the findings on their networks, offered

their own analysis and interpretations to validate (or dispute) the findings, asked questions, and provided feedback. A summary of the methodology used in each location is described below.

Ethiopia: For each SNA, LINC organized presentations with the SWS teams in Ethiopia, presenting the key findings and analyses outlined in each report. The presentations provided opportunities for the SWS teams to contextualize and validate (or dispute) the findings. For instance, the process often identified power dynamics and central actors previously suspected or known, as well as strongly held assumptions that the results called into question. LINC researchers updated the reports and added context based on the feedback and contributions from the SWS teams. LINC also provided SWS teams with the presentations to use to present the findings to the learning alliances at subsequent meetings. The SWS teams selected certain findings from the presentation and focused discussion around those.

Kabarole, Uganda: Following the baseline and endline SNAs, SWS shared and discussed the results with learning alliance (Kabarole DWTT) members during scheduled meetings. It presented and discussed concurrently the results of the SNA and of another systems study, the Iterative Factor Mapping and Learning study (IFML, which analyzes factors perceived by stakeholders to influence sustainable WASH service delivery). Participants agreed with most of the conclusions presented and, in some instances, explained why the network appeared as shown in the SNA.

Kamuli, Uganda: The SWS team organized a workshop with the survey interviewees to present the baseline SNA data; the stakeholders largely agreed and validated the findings. COVID-19 restrictions prevented the team from presenting endline findings at a validation workshop.

Kitui, Kenya: The SWS team invited a network subset of 15 participants from organizations that had participated in the SNA, ensuring representation of all types of groups (e.g., government, NGOs). The SWS team extended invitations based on organizations' consistent attendance in the quarterly WASH forum. The SWS team provided a brief on SWS, an overview of the SNA data collection, and detailed findings and results across the four relationship types (information, skills, authority, and resources). Participants split into groups to further discuss the findings, providing context for the findings and considering potential needs for the network to address. SWS presented the discussions from the workshop at a WASH forum meeting.

Cambodia: SWS complemented the SNA with the development of a systems map (a causal loop diagram) created through qualitative analysis of open-ended interview questions collected at the same time as the network data. LINC worked closely with WaterSHED to review important findings and to guide further analysis, with WaterSHED also engaging other RuSH stakeholders in reviewing certain findings where they felt another actor had more insight. After preparing an initial report with findings from both the SNA and the systems map, LINC and WaterSHED hosted a stakeholder workshop with more than 100 participants representing network actors. To share the data and findings and to collect feedback, world café-style stations on eight themes that emerged from the SNA and systems map allowed smaller groups of stakeholders to explore each theme with the facilitators in their preferred language (English or Khmer). SWS incorporated the feedback into the final baseline report.

Stakeholder Validation and Feedback

All SWVS teams incorporated some form of participatory methodology in the SNA process: all teams relied on direct surveys or interviews for data collection, and all teams held a feedback or validation workshop where they presented and discussed the findings with the participants. Stakeholders generally reacted positively to the participatory processes; they reflected that the SNA feedback and presentations helped to encourage discussion on known issues and challenges. Some of the key findings and feedback from the stakeholders are summarized below.

Validation and Action: Reviewing SNA results that resonated with stakeholders often catalyzed them to take action. For example, in Kabarole, Uganda, participants agreed with most of the SNA conclusions and explained why things appeared as such. Among the most revealing findings, as indicated in the Key Uses of SNA section, was the low interaction between stakeholders at district and sub-county levels with user communities; one participant wondered how the stakeholders can claim to serve the communities when they are so disconnected. Stakeholders identified the following actions to strengthen the linkages between these stakeholders and communities: (1) establish routine, community-centered monitoring involving the communities; (2) strengthen community structures like user groups; (3) repackage information to suit community understanding and participation; (4) conduct bottom-up planning and project design based on community needs; and (5) improve monitoring roles and feedback loops at the sub-county level and in community-centered organizations.

Structured discussions about the SNA findings also created opportunities for stakeholders to provide direct input to SWVS field teams on the type of programming support that could improve network cohesion. In Uganda and Kenya, where the coalition groups had been previously formed and participants knew one another already, the baseline validation workshops used the SNA findings to stimulate productive discussion with stakeholders on actions and interventions related to the findings. For example, Kitui forum members identified concrete ways to enhance coordination: establish communication channels from low to high administrative levels; establish proper governance structures to determine entry criteria for organizations; promote transparency and accountability between actors; and use coordination to align sector activities and interventions, recognizing that various donors' terms and conditions can hinder alignment.

Feedback on Network Influence: One recurring issue presenting some discomfort occurred when the SNA depicted certain actors as “peripheral” rather than “core,” or similar references to prominence in the network. Some actors interpreted such designations to imply that they were less important or influential. To alleviate this issue, many SWVS teams adapted their approach, for example by providing a preliminary presentation of results to specific actors, presenting results in smaller groups rather than plenary sessions, and anonymizing actor names, designating only organization type instead.

Feedback on Actor Roles and Priorities: Stakeholders often found the SNA results helpful in understanding actor roles and alignment of the group. In Kitui, Kenya, forum members identified numerous important observations from the analysis, including: the county government's lack of visibility as a major resource provider; the lack of visibility of the national government's role in the WASH sector; the major role NGOs play in capacity building; and the overall the high level of cooperation among partners. All water sector actors in the county cited sustainability as a common issue; although

priorities differ among actors, they agreed that interventions should target and incorporate measures toward sustainability.

Feedback from SWS Teams on SNA Process

Because SNA was a new tool for both SWS teams and stakeholders, SWS considered it important to obtain feedback on its usefulness and value as a tool, as well as determine their sense of ownership over the process and results. Following the endline SNAs, LINC researchers requested feedback on the overall process and utility of SNA from SWS field team members. Their thoughts, which echo many of the other findings and recommendations here, are summarized below.

SNA Benefits and Limitations: All teams found significant benefits to conducting SNAs and noted limitations related to their particular experiences. In Kitui, Kenya, the SWS team found SNA to be a valuable exercise to map relationships to understand sector dynamics at the outset, and the endline effectively demonstrated shifts in network dynamics. During validation meetings, the team linked SNA with the qualitative interviews to elicit discussion on actor priorities, challenges, and sustainability. In Karabole, Uganda, a team member seconded the notion, noting that qualitative questions help tell the story behind the connections. In Ethiopia, a team member added that the SNA served as a very useful start to productive discussions with stakeholders.

Limitations were also noted. In Kitui, SWS staff stated that as a snapshot for a specific point in time, certain key aspects of networks can still be missed, such as the impact of soon-ending donor programs. In Kabarole, a team member noted that it would have been beneficial to more closely examine whether mandated institutions are exercising their authority effectively; they felt that the SNA could have provided this answer.

Integration of SNA into Activities: As a general reflection, SWS teams reported that the more the SNA is integrated into implementation, and the more participatory the process, the more effective it is likely to be. That said, teams acknowledged the tradeoffs of more integration on their time commitment.

SWS teams whose staff collected data directly (such as in Uganda and Kenya) report having been more involved throughout the process, although it consumed more of their time. The Ethiopia SWS teams recommended that SNA training be provided to the field teams to improve participation. In Uganda and Kenya, where SWS team members received some training, staff saw the benefit and took on more responsibilities in the data collection and analysis.

In every location, an outside SNA expert led or supported the design and implementation of the studies. However, teams reported differing levels of interaction, coordination, and collaboration between staff and the external consultants. In retrospect, teams generally agreed that more integration, more knowledge transfer, and more staff participation would be worth the trade-off of additional time. Staff's lack of participation led to less understanding of the full set of findings, which translated to less stakeholder understanding as well.

Audience of the SNAs: Several teams noted a lack of clarity in identifying the target audience for the SNAs and their findings. With the ambiguity of the audience, some teams felt that the reports, validation

workshops, and opportunities for integration suffered. In Ethiopia, team members felt that the purpose of the SNA appeared to be focused on “evaluation” of the networks over time, rather than for the other purposes of planning or design and stakeholder understanding. Their perceived low level of participation reinforced this belief. One team member noted that SNA can be valuable to start a collective, action-oriented discussion with a group; however, they said this opportunity had not been fully applied in their context. In Uganda, staff expressed uncertainty about who the tool intended to support and suggested being clear and honest from the start. They suggested that if it is meant to support project teams and stakeholders, it requires more time and support for digesting the results and taking action. If it is meant for monitoring change, focus on the changes that are desired and set expectations with staff and stakeholders. Kenya more clearly defined the target audience up front (the staff and stakeholders), and as a result, participants viewed the experience and integration of SNA in programming more favorably.

SNA Reporting Process: Related to concerns about the audience for SNAs, SWS teams provided numerous comments regarding reporting and its usefulness. Some found the SNA reports too long or too technical, and teams had difficulty analyzing and internalizing them, limiting the team’s ability to share the results with the stakeholders and limiting the stakeholders’ ability to accept and use the results. Others found brief PowerPoint slide decks much more useful. Respondents also found visual results more useful for feedback and validation; the quantitative metrics that SNA produces went virtually unused in stakeholder validation and feedback discussions. While some team members expressed concerns that the tool itself is complex, making it difficult to engage stakeholders more completely, the same people also noted that stakeholders used the findings to start valuable discussions and identify opportunities for improvement.

Priorities and Time Constraints: Stakeholder engagement, feedback, and validation required more time and attention than expected on the part of SWS teams to finalize the tools and methodologies. SWS teams, especially those covering remote areas, had limited time with stakeholders for their planned WASH activities overall, and found it challenging to determine how to fit SNA data collection and validation into this limited availability. In Kenya, staff suggested that due to the time and cost implications, subsequent SNA studies (beyond baseline) should be shortened and adapted to suit more specific needs.

SNA and Stakeholder Turnover: All teams experienced some turnover of individuals and entities that had been interviewed to collect network data. This challenge applied to midterm and endline data collection in general and surfaced as a potential constraint on the networks themselves. Related to turnover, but more widely applied to stakeholder data collection, in Ethiopia and Uganda, teams noted that it can be difficult to identify the best individual representative of an actor organization to participate in an interview. They suggested targeting the most senior person in the organization with knowledge of operations to ensure accurate information and thoroughly explaining to stakeholders the reasons for conducting the SNA. Note, however, the potential trade off of gender or other biases that may result from targeting senior leadership of organizations to be respondents.

SNA Resource Requirements and Implications

Resource Considerations

Factors Affecting Resource Requirements: An important question for those considering SNA in a WASH program is how to plan and budget for the activity. Because SNAs can vary significantly in their size, scope, and complexity, the respective resource requirements will likewise vary. SNAs can range from as simple as a brief set of questions about relationships during a meeting or discussion to a significantly more complex and large-scale effort. Some of the factors affecting resource requirements include:

- **Purpose:** Research questions should be considered carefully to define and limit the scope to balance objectives and resources.
- **Network Size and Boundaries:** The larger a network, the more time and resources are often required to collect data and present them back to stakeholders. The analysis, however, is not necessarily more resource intensive for a larger network. Most SNA software can efficiently manage networks with thousands of actors, although the more actors there are, the greater the chances of data error and other special cases that require cleaning. The extent to which network members can be identified in advance of data collection also significantly impacts resources. A roster-based approach is generally less resource intensive than a snowball approach, which requires multiple iterations to capture all actors. The purpose influences many of the size and boundary considerations.
- **Data Collection Methodology:** In some cases, SNA data might be available through secondary sources, therefore, reducing the burden of conducting a survey or interview for primary data collection. SWS did not use any existing datasets; it collected all data through first-hand interviews with stakeholders, as SWS implementers sought to maximize response rates and data consistency. SNA data collection can also be combined with other research and project activities, as SWS did in combination with qualitative survey questions. Integrating SNA with other activities helps to realize cost and resource savings due to efficiencies in time, human resources, and travel. It is important to note, however, that combining many research activities can result in surveys that are long and cause respondent fatigue. SWS, at both baseline and endline, conducted many studies over a short period of time.
- **Enumeration and Analysis:** In-person enumeration is more resource intensive than web-based or remote enumeration but generally improves quality of results. Use of technology like tablets eases data collection and input, while visual mapping techniques often require additional time to collect, verify, and input data but can be more accessible to respondents and other stakeholders. It is noteworthy that even during the COVID-19 pandemic, SWS collected data through in-person interviews in all locations. Program staff or external enumerators or analysts, or some combination, can conduct data collection and analysis. SWS used different methods (see Table 2), but all cases required an investment of time, training, and other resources. SWS teams with more direct involvement reported benefitting from increased understanding of the SNA tool and findings and from opportunities to strengthen relationships with stakeholders. The SWS teams that relied on external enumerators often made that decision to reduce their own time commitment, but later reported some challenges with respect to scheduling and

communication with stakeholders, as well as with their own involvement in the overall SNA process.

Table 7 illustrates the impact these factors and other key decisions have with respect to SNA complexity and resource commitment. A low-resource study may require only 1–2 weeks and a single specialist to design and complete the analysis, while a high-resource study may require several months for each iteration to design or update the research plan, collect data, conduct analysis, and report to stakeholders. In Table 7, the yellow-highlighted cells correspond to the general level of resources for the SWS SNAs (recognizing relative differences between them). All SWS SNAs generally correspond to higher levels of analysis and resource requirements; this is logical, because SWS intended the SNAs both to support implementation and to serve as a global learning initiative on SNA application. A more-specific comparison of resources invested for SNA in each SWS location is provided in the next subsection.

Table 8. Key SNA Decisions and Impact on Resource Requirements

Key SNA Decisions	Resource Level Commitment		
	Low	Medium	High
Purpose	<ul style="list-style-type: none"> • Basic understanding of network relationships to inform project design parameters or foster networking. • Not a significant need for landscape analysis or stakeholder engagement to make decisions. 	<ul style="list-style-type: none"> • Basic understanding of network relationships to inform project design parameters and/or to spark discussion with network stakeholders. • Calculation of a small number of metrics to be compared over time. 	<ul style="list-style-type: none"> • Longer term monitoring and evaluation (M&E) or commensurate purpose aimed at quantitatively assessing and tracking network dynamics in cooperation with system stakeholders. • Adaptive network facilitation based on regular updates to the network data.
Network Size and Boundaries	<ul style="list-style-type: none"> • Limited to core set of actors with direct influence over system. • Boundary definition easy to use to determine actors to include in study. • All network members identified in advance, with available contact information. • Relatively small network (10–30 members). 	<ul style="list-style-type: none"> • All actors directly contributing to and/or utilizing or affecting the system being studied. • Boundary definition more flexible to identify actors within the network and actors to exclude. • Closed roster of network members, requiring some identification of contact information. • Network range of roughly 30–100 members. This is a more important distinction for resource-intensive data collection methods. 	<ul style="list-style-type: none"> • All actors directly contributing to and/or utilizing or affecting the system, plus select other peripheral or indirect stakeholders. • Boundary definition with nuanced decisions of who to include and who to exclude from the study. • Snowball or limited snowball approach to expand network membership based on relationships named by respondents. • Over 100 to several hundred or more members.
Data Collection Methodology	<ul style="list-style-type: none"> • Use of existing network or relationship data that do not require significant data cleaning. • Simple questionnaire or mapping exercise delivered at existing workshop or another forum. Need not demand internet connectivity. • SNA data collection through online survey (with clear, understandable questions). 	<ul style="list-style-type: none"> • In-person surveys using technology that eases collection and input and that does not require significant scheduling with respondents in advance. • Telephone surveys that still require scheduling and enumerator time. 	<ul style="list-style-type: none"> • In-person surveys, especially those conducted in remote areas; in this case, consider logistics to improve data collection efficiency. • Consideration of local enumerators versus project team. • Surveys requiring a high response rate necessitating significant scheduling efforts and/or phone reminders.
Timing or Frequency	<ul style="list-style-type: none"> • SNA delivered as part of existing or previously organized workshop or another forum. • Could be built into the existing M&E data collection system. • Generally, a small one-off analysis or small effort added to other regular data collection. 	<ul style="list-style-type: none"> • Often, a single SNA at strategic point in project life cycle to inform key aspects of implementation and serve as network building and/or other higher-level support for project activities. • Generally, a one-off, more-intensive analysis requiring more data collection. 	<ul style="list-style-type: none"> • Typically, two or more SNA iterations conducted over life of project (e.g., baseline and endline). • Used as M&E tool, quantitatively assesses changes in network, cohesion, and relationships between actors.

Key SNA Decisions	Resource Level Commitment		
	Low	Medium	High
Relationship Types	<ul style="list-style-type: none"> Basic question of whether or not a general working relationship exists, as long as the meaning of the relationship is clear to respondents. 	<ul style="list-style-type: none"> Multiple types of relationships, but easy for respondents to understand and respond. 	<ul style="list-style-type: none"> Multiple types of relationships, with other follow-up question(s) on relationship attributes (e.g., frequency, type of coordination activity).
Validation Measures	<ul style="list-style-type: none"> Near-real-time feedback of network survey results delivered at existing workshop or another forum. Specific validation questions asked of participants. 	<ul style="list-style-type: none"> Single separate meeting held to report on findings and receive feedback from network respondents following analysis. Often used as network-building exercise. 	<ul style="list-style-type: none"> Multiple iterations of analysis, validation, and revision conducted with network members. Separate meetings held with different network members to collect feedback. Network members and project teams have participatory roles and feedback mechanisms into SNA findings.

Comparative Resource Requirements for SWS SNAs

In SWS, SNA utilized different methodologies, network sizes, and data collection approaches, allowing researchers to generate a rough comparison of levels of effort (LOE), in days, required. Table 8 provides a summary of LOE (local, international, and total) for each of the SNAs. It is noted that SWS partners and consultants did not record their time and expenses explicitly against the SNA activities or the phase of the SNA, and they collected most of the resource requirement data in June 2021 for recent and historical LOE used. Therefore, team members reported and estimated much of the resource data below as best approximations in reviewing their time and activities devoted to SNA. Additionally, because the same staff conducted all four Ethiopia SNAs at the same time, figures are an average per location (total LOE for Ethiopia divided by 4). Detailed tables showing LOE by position (SWS field team, enumerator, analyst, HQ management), phase of SNA (planning, data collection, analysis, validation), and iteration of SNA (baseline, midterm, endline) are presented in Annex I for each SWS location. For those interested in these data, it is recommended to review the notes and comments together with the detailed estimates provided in the annex.

Table 8 summarizes the estimated LOE for each SWS location. Because teams estimated the LOE retrospectively, rounded ranges are provided for each entry. Figures are provided for local LOE, which includes SWS field teams and local enumerators and assistants; international LOE, including international SNA analysts, headquarters program support, and UCB input and analysis; and overall LOE totaling local plus international. Given differences in travel costs in each context, associated non-labor expenses are not reported.

Table 9. SNA Comparative LOE and Costs

Location	SNA	LOE (Days)		
		Local	International	Total
Ethiopia (average per location across four locations in Ethiopia)	Baseline	20–25	12–15	30–35
	Midterm	20–25	10–12	30–35
	Endline	18–20	15–18	30–35
Kabarole, Uganda	Baseline	35–40	25–30	60–65
	Endline	25–30	10–12	35–40
Kamuli, Uganda	Baseline	40–45	15–18	55–60

Location	SNA	LOE (Days)		
		Local	International	Total
Kitui, Kenya	Endline	60–65	10–12	70–75
	Baseline	55–60	25–30	85–90
	Endline	40–45	12–15	55–60
Cambodia	Baseline	120–130	45–50	165–175

The estimated ranges are meant to give an indication of the variability of resources applied in different cases in SWS, as well as an idea of the overall LOE used to complete a network analysis. As shown in the table, total LOE ranged from about 35 days per SNA (average across four locations) in Ethiopia and Kabarole to about 50–60 days in the other African SNAs. In Ethiopia, where SWS conducted four different SNAs simultaneously, SWS experienced economies of scale in labor, time, and resources. Cambodia reported considerably higher LOE for several reasons, most notably that it undertook a national-level analysis and included the greatest number of actors, requiring significant time for data collection and a larger facilitation team for two stakeholder workshops with more than 100 attendees each. The full reported LOE by phase of network analysis (planning, data collection, analysis, and validation) is included in Annex I.

Based on the 19 SNA applications, a program could plan, implement, and refine a network analysis for a network of approximately 25 members using in-person data collection with approximately 30 days of local staff or enumerator time, 15 days of an experienced analyst’s time, and 5 days of other management support. Those totals could be reduced when implementing SNA for multiple networks in the same area with economies of scale. Additionally, LOE decreases when the SNA is repeated later in the program.

While available resources alone should not dictate SNA design, it is often a constraint in the competition for project resources. As mentioned above and shown in Table 7, several SNA design decisions have trade-offs between cost and results, and programs will have to make those decisions based on their available resources, the intended use of the SNA, and the local context. One note regarding these LOE trade-offs is that, as reported in the Value, Perceptions, and Ownership section, teams that initially designed their SNAs with less staff involvement in the process later stated that they wished they had been more involved and had better integrated the SNA into their programming.

Recommendations for Applying SNA to WASH Programming

Comparing and contrasting the different methodologies and findings in the SWS countries provided valuable insight for the future application of SNA in WASH systems strengthening programs. These insights also fit well with the advice and feedback that SWS teams, partners, and stakeholders offered to improve the process and application of SNA going forward.

Choose the right analysis tool for your WASH program’s needs. A variety of traditional and systems analysis tools other than SNA exist to help better understand local context and to design appropriate intervention strategies. Rather than choosing SNA as a tool first and determining its value to the specific program afterward, practitioners should start by identifying the goals for their program and

how a systems approach will help them achieve their goals more effectively and sustainably. Then, when designing the analytic framework and implementation strategy for their program, they can select the tools that best meet their needs and context, including the need to understand stakeholders and their relationships. This will help to be realistic about what SNA can do in a WASH program, what it cannot do, and what its role is in relation to other research and implementation efforts. SNA is the right tool to choose when the relationships and interactions among program stakeholders (including “spoilers” who may be working against your program) are important to achieving your programmatic goals. This is almost always the case when any type of collective action or collaborative process is crucial to success.

Be clear on the purpose of SNA in your WASH program and articulate that purpose to implementation teams, partners, and stakeholders. Many of the design and implementation decisions that need to be made for an effective SNA are dependent on a clear purpose. Additionally, stakeholders and implementation teams need to have a clear understanding of the purpose and audience to maximize engagement, application, and learning. It is difficult to balance the interest in providing valuable information to multiple audiences, such as local WASH stakeholders, the field implementation team, and the global WASH audience interested in learning from the experience. Additionally, even after defining the primary purposes of the SNA (such as activity design, monitoring and evaluation, or stakeholder understanding), it is necessary to recognize the different contexts and overall program approach. Effective SNA design varies depending on whether the approach involves working with an existing coalition (as in Kitui and Kabarole), supporting new coalitions to form (as in Ethiopia and Cambodia), or working with an informal network of stakeholders (as in Kamuli).

Align the design of your SNA to the purpose you’ve identified and your programmatic approach. Specific design decisions should flow directly from the SNA purpose. For example, your network boundary should align with whether you are working with an existing coalition, forming a new coalition, or working within the structure of relationships among stakeholders in an informal network. Additionally, if your key target audience is local stakeholders, focus more on the data needs for a qualitative understanding of the network and visually evident findings. Whereas it might be more appropriate to plan to collect data that will support more quantitative analysis and technical reports, if your target audience is WASH implementers designing interventions or external stakeholders evaluating results.

The timing of SNAs within your program timeline also needs to be aligned with the purpose. In particular, the timing of a baseline study can vary by purpose. The baseline can be used to support the formation of a new coalition if the SNA is conducted before its formation, or it can be used to support the design of a technical approach in a new context if the SNA is conducted to understand existing relationships and champions before entering. In that case, the baseline should not use a closed roster and should instead capture an understanding of how even unknown actors might be connected to the network. However, those types of baseline studies are less valuable to compare to later iterations if measuring change over time. In that case, it would be better to wait until a new coalition is formed before conducting the baseline. In Ethiopia, where learning alliances were being newly formed, SWVS team members felt that the baseline SNA process would have been more meaningful had it been conducted after the learning alliance concept had been further developed.

It is also important to balance resource requirements with value. SNA research questions and data collection should be limited to meet the needs of the program, aligned with the purpose. For example, if the primary purpose of the SNA is to support local coalitions, low-resource methods can be used, such as a group mapping and discussion exercise at a coalition meeting. At the same time, it is important to budget appropriately. Underinvestment is a self-fulfilling prophecy that results in less-valuable results.

Engage the implementation team directly in the SNA research, analysis, and validation.

This requires training up front and requires a time commitment from the team in addition to its other work and is therefore sometimes not undertaken. However, those investments vastly improve the value of the SNA for engaging stakeholders, improving understanding and use of findings, and inducing action, and more concretely integrate the design and use into the program. Note that if the sole purpose is monitoring change in the network over time, this may not be as important. SWS teams directly involved in the research reported benefitting from increased understanding of the SNA tool and findings and from opportunities to strengthen relationships with stakeholders.

Beware of information overload and research fatigue. Especially at the start and end of a program, there is often a rush to conduct studies and collect data in a short period of time. This can lead to high demands on staff and stakeholder time, too much information (data and findings) for staff and stakeholders to use, and fatigue that turns some stakeholders away from participating in the program. Speaking more broadly than SNA, some SWS team members in Ethiopia and Uganda commented on the overall number of analyses and tools employed on SWS. In addition to facilitating the numerous surveys and following the various analyses, SWS teams also organized stakeholder feedback for the different studies; all of this drew on meeting time that might have been used differently.

Consider ethical and reputational considerations for data collection, use, and sharing.

Network data can include sensitive information on stakeholders and their relationships, and network findings can offend stakeholders who are not as influential in a network as they thought. Additionally, it is difficult (but not impossible) to keep network analysis responses anonymous due to the way network data are analyzed and presented. In several instances, SWS teams encountered challenges due to the sensitivity of the SNA findings. This included cases where entities, mainly public agencies with formal WASH responsibilities, did not appear centrally in WASH networks, thereby reflecting poorly on the institution. In some networks, participants expressed surprise at seeing their names on the SNA maps and the direct results of their responses (i.e., with whom they stated connections). Some locations anonymized the maps for their validation workshops.

Overall, SNA has proven to be a valuable tool for WASH programs. The complexity of developing *sustainable* WASH services requires engagement of a variety of stakeholders and significant collaboration among those actors. While many considerations need to be taken into account and trade-offs made for resources within WASH programs, the experience under SWS highlights the tool's value for program design, measuring change, supporting necessary adaptation, and improving stakeholder understanding of the system. The experience has also provided concrete recommendations for applying SNA effectively in future programming.

Annex I. Reported Levels of Effort and Expenses for SNAs

During this multi-case research, SWS staff and consultants provided their best estimates of LOE and other local costs such as their teams' local travel and venues used to conduct each SNA. They provided LOE estimates based on phase of work (planning, data collection, analysis, and validation) and separated by role (local field program staff, external enumerators, experienced network analysts, and other international support such as headquarters management support). It is important to note that the figures provided are only estimates and were provided after conducting the SNA, in some cases more than 3 years afterward. However, we are presenting the complete set of estimates here to provide both an idea of the variability of resources used to conduct an SNA and a general idea of what it might require for other WASH programs around the world.

Ethiopia				
SNA Comparative LOE and Costs*				
SNA Phase	LOE Contribution	Baseline (days)	Midterm (days)	Endline (days)
Planning and Preparation	SWS team	2	2	3.25
	External enumerators	0.5	0.5	0.25
	SNA analyst	3	2	2
	Other international***	0.75	---	0.5
Data Collection and Enumeration	SWS team	3	3	2
	External enumerators	12	12	9
	SNA analyst	1	1	0.5
SNA Analysis	SWS team**	2.5	1	1
	SNA analyst	7	8	11
	Other international***	0.25	---	1.50
Feedback and Validation	SWS team	1	2	3.25 (6.5/2)
	SNA analyst	0.5	1	---
Other Expenses*	Travel	\$1,590	\$1,500	\$1,500
	Consumables	\$40	\$40	\$40
TOTAL	Local LOE	21	20.5	18.75
	International LOE	12.5	12	15.50
	Expenses	\$1,630	\$1,540	\$1,540

* Total LOE and other expenses (for all Ethiopia) were divided by 2 (corresponding to two locations in the table), where applicable, to derive LOE and expenses per SNA.
 ** Includes PowerPoint reporting by LINC to SWS teams.
 *** Includes partner headquarters support plus UCB.

Kabarole, Uganda SNA Comparative LOE and Costs			
SNA Phase	LOE Contribution	Baseline (days)	Endline (days)
Planning and Preparation	SWS field staff	4	3
	External data collectors*	4	3
	SNA analyst	3	1
	Other international**	2	---
Data Collection	SWS field staff	5	4
	External data collectors*	20	12
	SNA analyst	5	---
Analysis and Reporting	SWS field staff	2	2
	SNA analyst	15	9
	Other international**	1.5	1.75
Stakeholder Feedback and Validation	SWS field staff	1	1
TOTAL	Local LOE	36 days	25 days
	International LOE	26.5 days	11.75 days
	Expenses***	Not specified	Not specified

* SWS team was supported by four external data collectors at baseline and three at endline.

** Includes partner headquarters support plus UCB.

*** Most meetings used the program office, but other expenses included basic meeting costs, local transportation, routine supplies, and printing costs. No estimate provided.

Kamuli, Uganda SNA Comparative LOE and Costs			
SNA Phase	LOE Contribution	Baseline (days)	Endline (days)
Planning and Preparation	SWS field staff	5	5
	External enumerators*	---	6 (6 x 1)
	SNA analyst	2	1
Data Collection	SWS field staff	10	1
	External enumerators*	---	24 (6x4)
	SNA analyst	5	1
Analysis and Reporting	SWS field staff	20	5
	SNA analyst	8	8
	Other international**	0.5	0.5
Stakeholder Feedback and Validation	SWS field staff	10	20
Other Expenses	Travel	\$30***	\$30***
	Consumables	Not provided	Not provided
TOTAL	Local LOE	45 days	61 days

	International LOE	15.5 days	10.5 days
	Expenses***	Not provided	Not provided
<p>* Six enumerators were engaged at \$28/day per enumerator, inclusive of fees and expenses.</p> <p>** Includes UCB only; no other international reported.</p> <p>*** SWS team indicated that travel costs for Whave staff came to a total of approximately \$30. Other costs, such as the travel for enumerators, meeting costs, etc., were not specified.</p>			

Kitui, Kenya			
SNA Comparative LOE and Costs*			
SNA Phase	LOE Contribution	Baseline (days)	Endline (days)
Planning and Preparation	SWS field staff	5	5
	SNA analyst	3	---
	Other international**	3	0.75
Data Collection	SWS field staff	16	14
	External assistants	16	14
	Other international**	9.5	---
Analysis and Reporting	SWS field staff	20	5
	SNA analyst	7	10
	Other international**	4.25	3.5
Stakeholder Feedback and Validation	SWS field staff	2	2
	External assistants	1	1
	SNA analyst	---	---
	Other international**	0.25	0.25
Other Expenses	Travel (in-country)	\$3,000	\$3,000
	Workshops	\$2,500	\$2,500
	Consumables	\$150	\$150
TOTAL	Local LOE	60 days	41 days
	International LOE	27 days	14.5 days
	Expenses	\$5,650	\$5,650
<p>* Oxford stated that the total cost including staff and consultant time for both baseline and endline SNAs was \$27,500, or roughly \$14,000 per SNA.</p> <p>** Includes partner headquarters support plus UCB (including participation in data collection).</p>			

Cambodia		
SNA Comparative LOE and Costs		
SNA Phase	LOE Contribution	Baseline (days)
Planning and Preparation	SWS field staff	11.7
	SNA analyst	8.3
	Other international	6.7
Data Collection	SWS field staff	40
	External enumerators	36.3
	SNA analyst	5
	Other international	5
Analysis and Reporting	SWS field staff	20
	SNA analyst	10
	Other international	3.3
Stakeholder Feedback and Validation	SWS field staff	15
	SNA analyst	4
	Other international	3.3
Other Expenses	Travel	\$733
	Venues/interpretation	\$1,100
	Other expenses	\$1,133
TOTAL	Local LOE	123 days
	International LOE	45.7 days
	Expenses	\$2,967